DISSERTATION

MANAGEMENT OF STORM DRAINAGE AND FLOOD CONTROL IN NEW DEVELOPMENTS IN INDONESIA

Submitted by:

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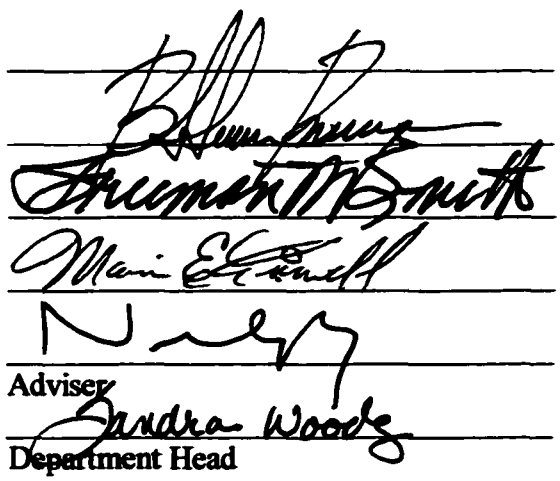
WE HEREBY RECOMMEND THAT THE DISERTATION PREPARED UNDER OUR SUPERVISION BY HARY AGUS RAHARDJO ENTITLED MANAGEMENT OF STORM DRAINAGE AND FLOOD CONTROL IN NEW DEVELOPMENTS IN INDONESIA BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

Committee on Graduate Work



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ABSTRACT

MANAGEMENT OF STORM DRAINAGE AND FLOOD CONTROL IN NEW DEVELOPMENTS IN INDONESIA

New residential developments in developing countries such as Indonesia generate adverse impacts and unsafe living conditions for various reasons, including vulnerability to flooding. The constraint faced by developing countries relates to absence of integrated land and water planning, lack of regulatory control, increasingly severe extreme events due to urbanization, lack of drainage system infrastructure, clogging by ad hoc structures and garbage, and lack of operation and maintenance systems.

Dealing with flood problems in newly constructed residential developments in Indonesia requires overall, integrated efforts. Problems are interrelated and form a vicious circle. Ongoing and unsolved drainage problems will make existing drainage worse. Flood problems will harm residents, and gradually influence local economic development. The lower economic status of society will hamper income of local government, which makes it unable to provide decent facilities for society. An unorganized community tends to lead lives according to individual preferences, with less attention to hygiene and decent environmental conditions, such as those related to storm drainage and flood control.

This study addresses the causes of flood problems in new residential developments by presenting a three–part management model with technical, institutional, and financial elements. The first objective of this study is to develop a comprehensive

concept for storm drainage and flood control systems in new residential districts in developing countries. The other objective is to use the broad concepts developed to create a management model for this situation. The model is tested by analyzing how it applies to Indonesia, but it is intended for application to other countries as well.

The implementation of the management model in Indonesia resulted in important findings. Local government is not well organized; rules, laws and regulation are not complete; and enforcement for penalties must be tightened. Poor planning and design require technical capability improvement among local agencies. An appropriate method of sources of funds for storm drainage and flood control should be developed.

Considering that many other developing countries have even higher population growth than to Indonesia, the need for residential development is also higher than Indonesia. Thus, the case study based on Indonesia could become a representative example for other developing countries.

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DEDICATION

To my dad, who passed away in May, 2001, and to my mom, who passed away in February, 2002, just only four days before my defense of this dissertation.

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CHAPTER 1

INTRODUCTION

In developing countries today, population growth and urbanization cause pressure on living conditions, both in older cities and in new developments. Residents experience unsafe living conditions for various reasons, including vulnerability to flooding. In older cities, flood vulnerability may have existed for many years, but even in new developments, residents may suffer from severe flooding which is caused by absence of integrated land and water planning, lack of regulatory control, increasingly severe extreme events due to urbanization and lack of drainage system infrastructure, clogging by ad hoc structures and garbage, and lack of operation and maintenance systems.

This study addresses the causes of flood problems in new residential developments in developing countries by presenting a three–part model for management of technical, institutional, and financial aspects. The model is tested by analyzing how it applies to a single country, Indonesia, but it is intended for application to other developing countries as well.

In developing countries, government control tends to be top-down, rather than bottom-up, and this introduces the dilemma that the problem of concern is local in nature, but solutions come from the top. Thus, institutional issues relating to local control are very important. Given this importance, the possibilities that a management system can be implemented in the absence of institutional reforms is slight, but incremental

improvements can go a long way toward improving quality of life, and the model can guide development of better systems as institutional reforms may occur in the future.

1.1. PURPOSE OF THE RESEARCH

The importance of good quality infrastructure, including storm drainage and flood control systems in new residential districts, is recognized in the Indonesian Broad Guidelines for the National Development (GBHN), which sets the goal of decent and healthy residential districts for Indonesians. Each aspect of infrastructure and land development enters into the equation of providing decent and healthy residential districts, and the main objective of this thesis is to explain comprehensively how storm drainage and flood control management can improve conditions in new residential districts of developing countries. The explanation, in the form of a management model, is intended for the parties who have responsibility to improve living conditions, which are government agencies, developers, and educators and professionals, such as architects, planners, engineers, lawyers, contractors, and construction managers. The management model is intended to serve as a policy and development guide for the planning and implementation of improved storm drainage and flood controls systems, in other words, to guide parties in different roles in establishing their parts of a new and improved comprehensive management system.

1.2. DRAINAGE AND FLOOD CONTROL PROBLEMS IN NEW RESIDENTIAL DEVELOPMENTS IN INDONESIA

The problems created by poor drainage systems occur in an interrelated matter as shown in the following diagram (Figure 1.1).

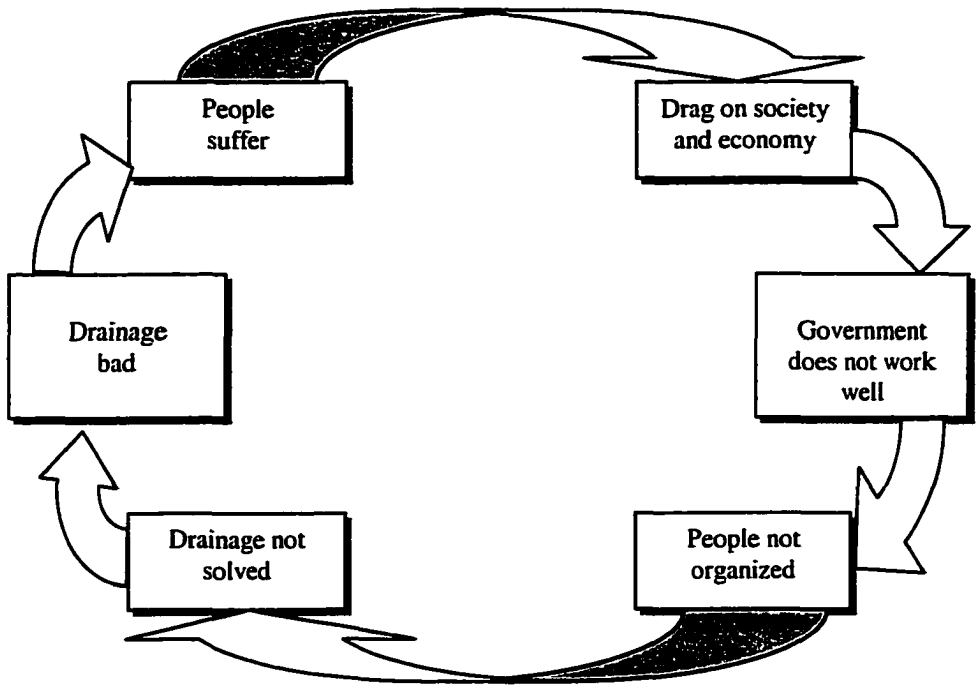


Figure 1.1. SDFC problems in new residential area

Ongoing and unsolved drainage problems will make existing drainage worse. Flood problems will occur during rainy seasons and harm residents. Their problems will gradually influence economic aspects, and lower economic status of society will hamper the local government's income, which makes local government unable to provide decent facilities for society. It is a vicious circle.

The problems are all interrelated. An unorganized community tends to lead lives according to individual preferences, and satisfies the needs of the individual, at the expense of the good of the community as a group. They pay less attention to hygiene and decent environmental conditions, such as those related to storm drainage and flood

control (SDFC). These circumstances cause drainage problem to remain unsolved and the interrelated problems continue in a continuous cycle.

The status of storm drainage and flood control facilities in new residential areas in developing countries, especially Indonesia, must be placed into context. In these countries strong housing demand results from population growth of cities and surrounding areas. For example, in Indonesia, annual population growth in Jakarta is 3.4% and Surabaya (the second largest city) grows at 2.8% per year (CBS, 1995). Population growth dominated by urbanization results from industrialization, which creates job vacancies in certain areas. Demand for housing consequently influences rapid development of new residential areas, both at small scales of about 50 hectares to huge areas of 3000 hectares that become new towns. Figure 1.2. illustrates this type of new residential development in Jakarta, where by October 1996, over 90,000 hectares outside the capital city region had received government approval for urban development (Kompas, 1996). Of this total, 13,300 hectares had been developed by 1997. Figure 1.2. shows that Lippo Cikarang, Kota Baru Cikarang, and Bumi Serpong Damai projects total more than 6,000 hectares, making nearly a new town (REI, 1998). This shows that new residential developments both at small and large scales are spread around the outskirts of cities such as Jakarta (i.e. Bekasi, Bogor and Tangerang).

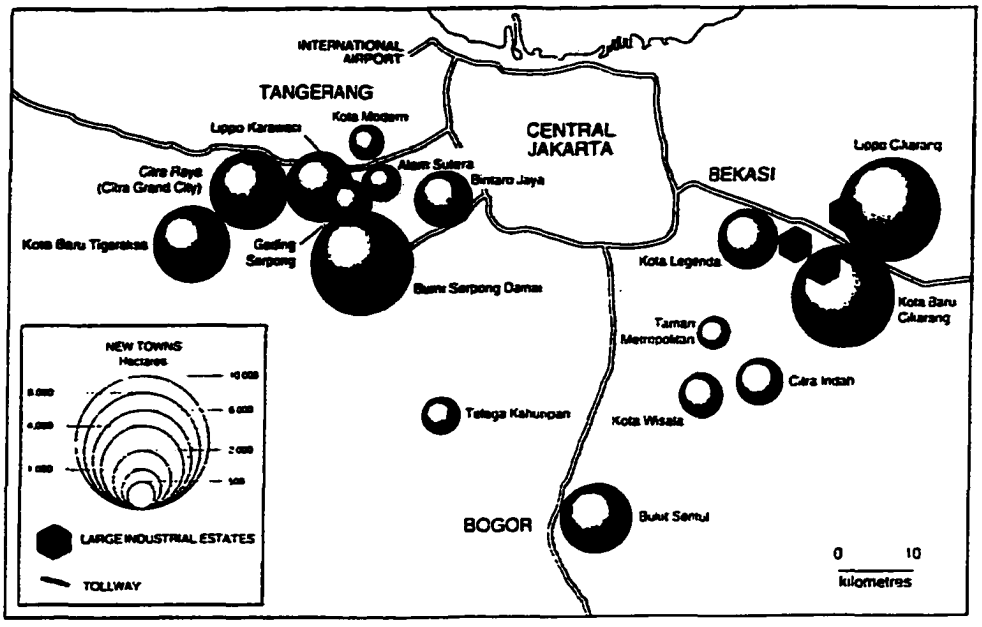


Figure 1.2. New residential district developments surrounding Jakarta

These developments face two obstacles. First, no specific agency in the Regency Government (local government) manages infrastructure development. Second, there is no management system that enables authorities to plan and control new residential development. In addition, local government lacks trained personnel to carry out management tasks. Thus, there is a great disparity of city management capabilities among large and small cities in developing countries.

Even in Jakarta, management of storm drainage and flood control is not adequate in some areas. As in other developing countries, effective action on flood problems is impaired by divided jurisdictions and lack of coordination among the water and land management authorities.

Other examples can be cited. Indonesia's second city of Surabaya has a 2000-hectare new town under construction as well as several adjacent semi-bundled projects of several hundred hectares (Kompas, 1996). In Thailand, large firms such as Bangkok Land

and Tanayong and House Land have built huge complexes around the city's outskirts. Even Ho Chi Minh City in Vietnam has a new town project of 2300 hectares. Saigon South is a joint venture between Taiwan interests and the People's Committee of Ho Chi Minh City (Dick and Rimmer, 1998).

To sell their product, developers naturally pay attention to project site plans. Most developers of large projects in Indonesia have hired planners, design consultants, managers and advisers, property specialists and architects from the US and occasionally also from Australia, Canada, Japan and Singapore. In Jakarta, for example, according to the REI (Indonesian Real Estate and Developers Association)'s annual report 1997, Lippo Karawaci hired experts from the US. Other Jakarta examples are Alam Sutera (SWA Group, California), Bumi Serpong Damai (John Portman and Asociates, US, Pacific Consultants International Japan), Bintaro Jaya (Development Design Group, Baltimore, US) and Cikarang Baru (Klages Carter Vail and Partners, US).

Regretfully, the consultants are only involved in the site planning and architectural aspects of building or limited to sales and marketing. They are not involved in planning infrastructure for the new residential area. The impact is evident in flood problems in the projects and resulting inconveniences to residents.

In these developments, the government role is important and includes assistance, permits and control, and implementation of new residential areas. The government authority most involved will be the Local Government.

Storm drainage management consists of control of storm runoff, onsite or in small streams, by means of programs that may include land use control, detention/retention of runoff, erosion control, and drainage. For large streams and rivers, storm drainage

management in the headwaters is a necessary supplement to programs of flood control and floodplain management. Flood control may be achieved in a number of ways. Both the storm drainage system (minor) and flood control system (major) need to be well managed to achieve it.

Development of new residential districts causes adverse impacts on drainage facilities and also increases environmental pressures that increase floods, accentuate channel erosion, and degrade the quality of streams with runoff pollution. Over time, peak flood flows may double or triple as an area changes from grassland and forest to suburban development. These increased flows cause flood damages, because early settlers built homes based upon their perceptions of the original flood situation.

New residential areas should be planned and organized from the beginning, and the developer's role is important. Studies are needed to define technical alternatives for drainage and flood control and also authority systems and institutional form, because developers will transfer infrastructure assets to the management institution upon completion of development.

1.3. STATEMENT OF RESEARCH PROBLEM

For purposes of the research, planning and managing storm drainage and flood control in new residential developments is organized into institutional, technical, and financial categories. See Figure 1.3.

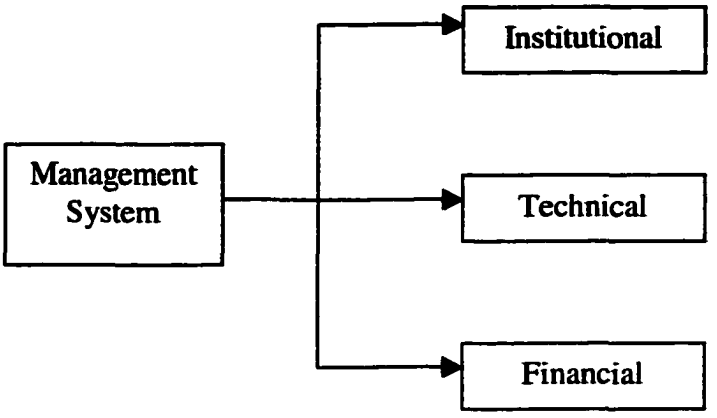


Figure 1.3. Management system categories

Planners and managers of SDFC systems often blend technical and managerial tasks to solve problems, and it is not always possible to separate them clearly. Technical aspects relate to actual design and planning of facilities and involve hydrologic and engineering procedures, which include rules, standards and codes. After planning, design, and construction, operation and maintenance are necessary to assure that the facilities work properly. So the technical aspect includes engineering planning and design, construction, operation and maintenance, and all issues related to compliance with rules, standards, and codes.

The institutional aspect mainly involves activities of government and developers and their roles influences the risk of flood problems because lack of clear lines of authority and unclear coordination will cause control of development in new residential districts to be inadequate. If policy for flood problems has not been established and responsibility for publishing it not assigned, there will be a policy vacuum. A clear arrangement is needed for authority, items to be controlled, mechanisms of control, and patterns of coordination.

The financial aspect cannot be separated from the technical and institutional aspects, as responsibility also requires assignment of financial obligations, including sources of funds.

1.4. RESEARCH OBJECTIVES

The research problem is approached at two levels: development of conceptual approaches to controlling storm drainage and flood control, and translating these into specific elements of a management model. These can be expressed as two specific objectives:

1. To develop a concept for comprehensive management of storm drainage and flood control systems in new residential districts. By "concept," is meant the formulation of broad outlines of the roles, responsibilities, methods, and other instruments that can be used to create a management model. The concept should result from studies of storm drainage and flood control system in the United States and Indonesia and outline the complexity and difficulty of the flood problems, and how situations can be handled effectively. The concept should lead to an inter-related management system to guide planning, construction, ownership, operation and maintenance of storm drainage and flood control systems to prevent the problems described.
2. To use the concepts developed to create a management model for storm drainage and flood control in new residential districts in developing countries. The management model will have technical, institutional, and financial parts. The technical part would include all planning, engineering, and operation and maintenance issues after considering obstacles and potential problems in existing systems. The institutional part would guide responsibilities and

authorities of the government and developers to control and manage the infrastructure and systems connected to it. The financial part would guide funding for initial development, operation and maintenance.

1.5. RESEARCH PLAN AND STUDY ORGANIZATION

The research is organized in four stages: 1) literature review; 2) development of framework; 3) development of management model; and 4) testing whether the model is feasible.

The literature review will report on actual practice and field experiences in the United States and opinions from experts in storm drainage and flood control, organized into the categories of the management system. In the second stage the conditions in Indonesia will be studied to guide the organization of the model according to the situation in that country, with reference to a specific case study in Bekasi. In the third stage the lessons from the literature and practice in the United States and from study of the conditions in Indonesia will be used to create the management model with technical, institutional and financial aspects.

Strictly speaking, testing of the model would require that it be implemented and the results assessed. However, as in much policy research, this cannot occur in the time frame of this research, so the "test" consists of a thorough analysis and presentation of a chapter on "implementation" (Chapter 5). In this chapter, important elements of the model will be studied to assess how well they will work in the Indonesian technical, social, political, and economic context. This plan to test the model is incomplete, but is the best that can be organized within the scope of this study.

Figure 1.4. illustrates the plan of research as it is organized within the document.

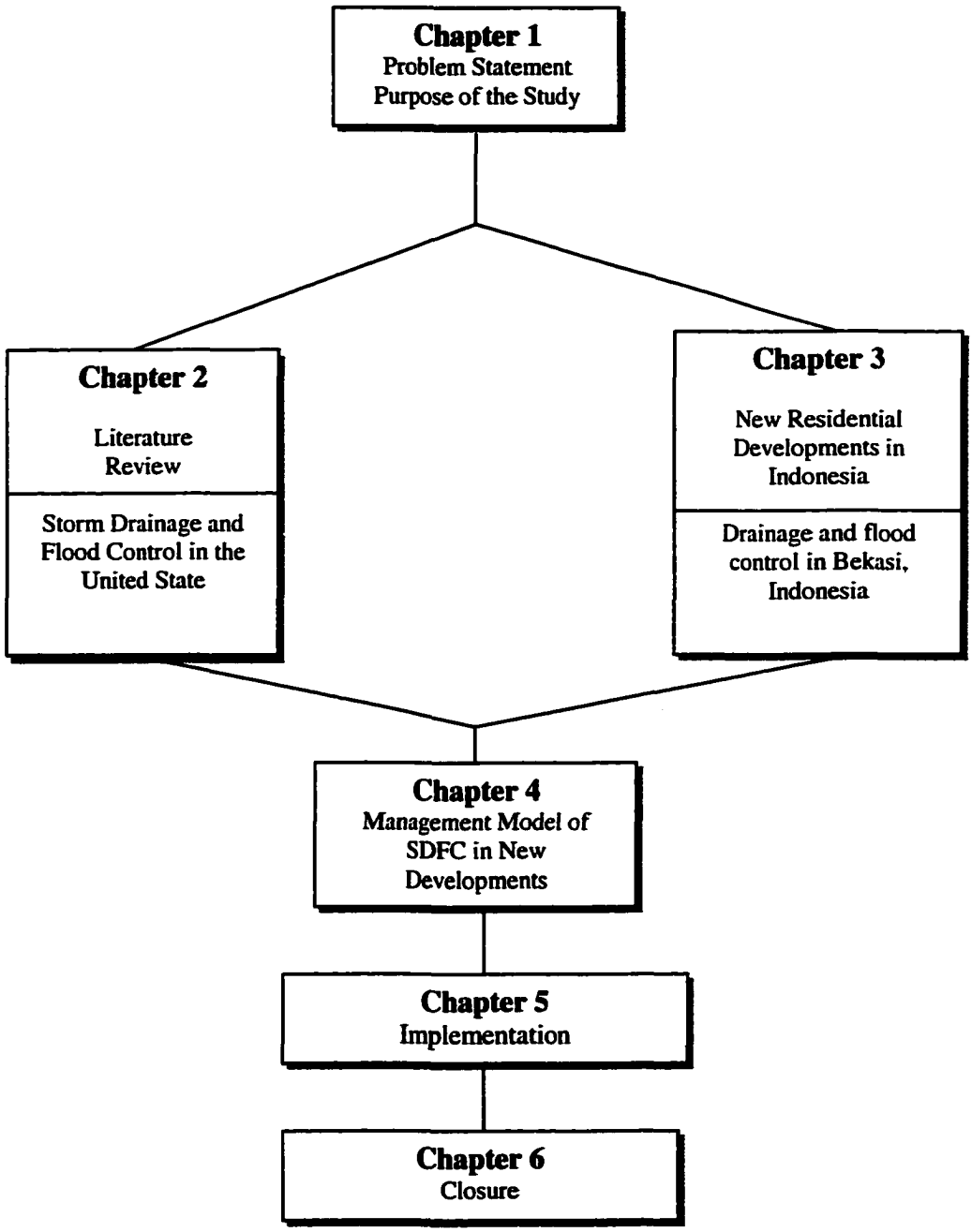


Figure 1.4. Study organization

1.6. RESEARCH BENEFIT AND EXPECTED OUTCOMES

The benefit of this study will be to present a detailed model of storm drainage and flood control management in developing countries, in this case Indonesia. The model will

provide a technical, institutional, and financial guidance to help policy makers design management systems to improve living conditions in rapidly–developing countries. The study can also be used as a reference to develop a better and more comprehensive and harmonious system among parties and institutions in infrastructure management. Recommendations about storm drainage and flood control systems will provide a framework for further study.

In summary, the expected results are:

1. A concept and management model for storm drainage and flood control for new residential districts in Indonesia and other developing countries will be presented.
2. Features of storm drainage systems developed for the US will be considered in the model, insofar as they apply to the technical, social, economic and government policy conditions in developing countries. In particular, institutional systems and regulations developed in the US will be used to guide institutional, authority and regulation systems.
3. The system will provide for harmonious integration of structural and non-structural features, based on local conditions.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

In this chapter, the technical, institutional, and financial aspects of stormwater and flood control are explored, as they apply in developed and developing countries. While basic technical issues are the same everywhere, institutional and financial aspects differ greatly from developed to developing countries. Also, appropriate technical strategies must be adapted, meaning those that will work in the context of developing countries. First, an overview of storm drainage and flood control management is presented. Then, the practice of SDFC in the United States is discussed. Finally, how this practice would change in developing countries is discussed.

2.2. STORM DRAINAGE AND FLOOD CONTROL MANAGEMENT

Storm drainage and flood control management is defined as the application of measures to provide security against problems from excessive stormwaters. Management itself is the process of planning, organizing, directing, and controlling activities that fulfill organizational objectives (Flippo and Munsinger, 1975), and for storm drainage and flood control, Grigg (1978) grouped these into technical, financial, and regulatory elements. Of course, institutional elements go beyond the regulatory component.

As we constantly refer to technical, institutional, and financial issues, Table 2.1. is provided to explain which aspects fall into each category.

Table 2.1. Three categories of management system

Institutional	Financial	Technical
Responsibilities for tasks	Where funds come from and who pays	Classification of SD and FC
Organization of agencies	Cost accounting for capital and operating funds	Types of facilities
Laws and regulations	Decisions on priorities for spending	Risk factors for design
How planning is done—policies and procedures planning		Planning for measures to combat problems
Management of codes and standards		Details of codes and standards
Enforcement of penalties		Functions of SDFC structures
Roles of parties		Design approaches
		Operations and maintenance procedures

2.2.1. Institutional Aspects

This section discusses institutional aspects of a management system for SDFC. The discussion includes responsibilities for tasks, organization of agencies, laws and regulation, policies, codes, standards and roles of parties.

2.2.1.1. Responsibilities for tasks

Cyre (1982) presented categories of tasks in storm water management, which might be used in a functional requirement analysis, as presented in Table 2.2.

Table 2.2. The typical categories of functions in stormwater management

Category	Functions
Administration	General Administration Secretarial/Clerical Program development and Planning Personnel Capital Outlay and Overhead
Finance	Financial Administration Accounting and Budgeting Revenue Management Financial Information Management
Planning	Basin Master Planning Development Area Planning Monitoring Studies
Design	General Design Project Management Operations Design Drafting
Operations	Operations Administration Routine Maintenance Remedial Maintenance Support Services Survey
Regulation/Enforcement	General Regulation/Enforcement Permit Administration Private Drainage System Regulation Floodplain Management

Sheaffer (1982) states that a drainage agency should: establish criteria for drainage and flood control planning and design, establish drainage plan, review and revise plans for drainage basin, coordinate individual development and drainage scheme with the plan, consider preventive and corrective approach for flood control.

2.2.1.2. Organization of agencies

Organizations involved in stormwater management are central government, regional government, local government and special districts. Local governments such as cities,

municipalities, townships and counties have the main responsibility for stormwater management. Regional and central governments can support and influence local government efforts (Tucker, 1983).

The central government has a planning, control and coordination function for all water resource management actions. The role of the central government can be exercised as follows (Hubert and Boyer, 1986):

- On a financial basis: grants given for SDFC study, research and work program, fines inflicted for no respect of the current legislation
- On a juridical basis: setting up legislative and regulatory literature, water police, legality control, global equipment endowments
- On a technical basis: enacting of technical norms and instructions, counseling with foremen, implementation of studies and realization of projects

2.2.1.3. Laws and regulation

It is essential that governmental entities, planners, and engineers work within a legal framework for a number of reasons: to avoid legal obstacles to implementation of plans and designs; to minimize potential liability; and to be alerted to opportunities that may be available.

Legal, financial, and policy for drainage and flood control have caught the attention of legislators. Poertner, (1974) suggests at least three premises for legislation:

1. To protect the health, welfare and safety of the public
2. To conserve excess stormwater runoff and make it available for beneficial use by the public, and

3. To determine and implement the best and most equitable stormwater runoff control facilities and programs so that those who benefit will pay in accordance with their potential benefit

Provisions for stormwater management are mostly made by local governments. Types of local legislation include:

1. Subdivision regulation ordinance
2. Zoning ordinance
3. Building code ordinance
4. Plumbing and sewer ordinances
5. Water pollution control ordinances
6. Food control ordinances, and
7. Drainage fee assessment ordinances

2.2.1.4. Policies and procedures planning

Management includes a number of elements and processes, including policy, planning, programs, rule making, and implementation. Elements of management are often hard to separate and terms are used interchangeably. However, some distinctions can be made between objectives, policies, rules, programs, budgets, and strategies, which are said to differ in complexity, level of abstraction, and in other respects.

The purpose of policy is to guide behavior or work, and thus it is the broadest management function. Policy can be defined as a predetermined, general course or guide established to provide direction for ensuring action. As such, it should be based upon a thorough analysis of enterprise objectives. After policy, planning is required.

Planning is the primary task and must occur before other managerial functions because it determines the nature of those functions. Planning makes things happen that would not otherwise occur. Henri Fayol's word prevoyance involves the two considerations of planning: (1) assessing the future, and (2) making provision for it. The most significant feature of the different types of plans is that they represent role prescriptions, which are formed to guide organization members in their work. All types have this in common. For present purposes there seems little point in differentiating further among them. Thus the policy planning rubric will be used to encompass not only policies but what is normally meant by such terms as objectives, procedures, rules, and the like, as well. For conceptual purposes, plans will be followed by coverage of the more typical, narrower standing plans: policies, rules, procedures and standard.

A rule is a very specific and detailed guide to action, which is set up to direct and restrict action in a fairly narrow manner.

For most policies, there would be an accompanying procedure to indicate how that policy should be carried out. A procedure is a series of steps or functions established for the accomplishment of some specific project or endeavor. A Standard can be defined as a model or criterion with which something can be compared. All plans are standard (Flippo and Munsinger, 1975).

Planning is the process of formulating objectives and developing strategies for achieving them. It involves establishing a strategy and identifying policies, procedures, and programs for implementing it. The possibility of planning errors also requires a constant inflow of information about such environmental forces. Control or feedback information indicates planning inadequacies and variations from plans. It provides a basis

for adjustments in organizational behavior and proper adaptation to environment changes (Albers, 1972).

Grigg (1983), mentioned the general planning framework for flood control as shown in Figure 2.1.

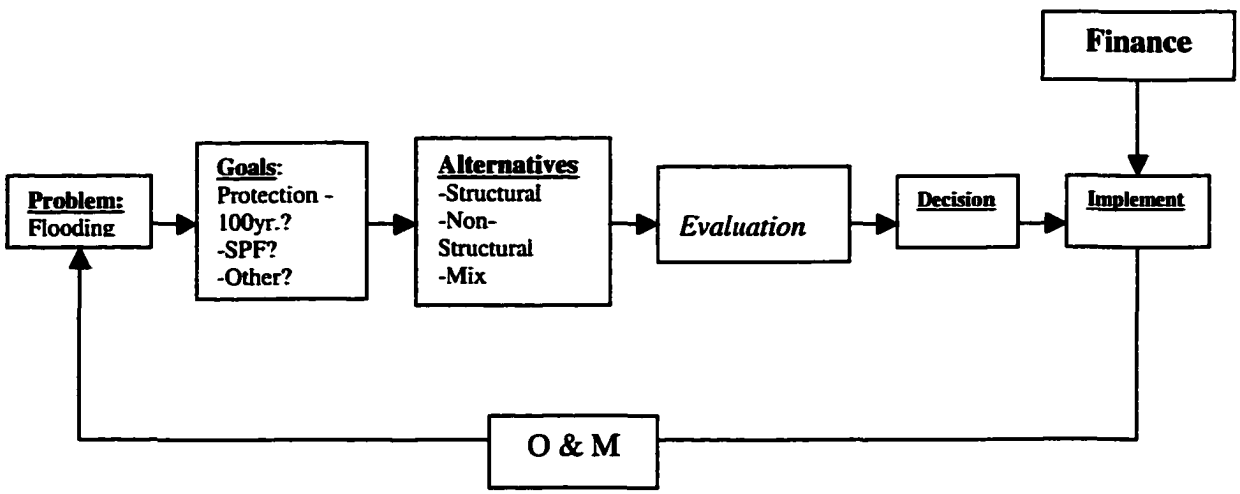


Figure 2.1. General planning framework for flood control

Each flood control plan was developed to attain three specific plan objectives.

1. Eliminate existing flood hazards to the extent practicable
2. Minimize the impacts of remaining flood hazards
3. Prevent the creation of additional flood hazards

A dam, levee, zoning ordinance, or flood warning system alone does not usually constitute a flood control plan. A flood control plan must achieve all three-plan objectives and normally requires several components to do so. A typical flood control plan would provide a combination of components such as a dam or levee to keep floodwaters away from an urban area, flood insurance and an emergency evacuation program to mitigate

damages not prevented by the dam or levee, and flood plain zoning regulations to prevent future construction in the residual flood plain.

2.2.1.5. Management of Codes and Standards

One of the most basic concepts in urban planning is the general plan (Korbitz, 1976). The general plan is not a regulatory ordinance, but a guide to be used when regulatory ordinances are drafted and administered.

Zoning is related to the general plan in that it effectuates the land use plan portion. Municipal regulations regarding the conversion of vacant unimproved land into building sites are known as land subdivision regulations. Regulation concerning the building design and construction is in the form of building codes. Design standards and criteria manuals are for storm drainage and flood control facilities (UDFC District, 1999).

2.2.1.6. Enforcement of penalties

An effective prevention mechanism based on design codes and standards will reduce substantially the need for abatement activities (Korbitz, 1976).

Enforcement of regulations pertaining to stormwater and flood control would include approval of construction, inspection, and either enforcement policies forcing compliance with regulations such as fines or other penalties, or incentives for implementation of SDFC such as drainage fee assessment. Two examples of effective enforcement policies are the use of subdivision regulations to hold back initial plat approval until SDFC facilities are included in the developer's plans and the use of drainage permit regulations to refuse connections to sewers until adequate drainage for runoff is provided. Inspection procedures should also be included to insure that what is on paper is the same as that which physically exists (Alley, 1974). The inspector usually

determines on the spot whether the subject conform to the standards lay down by law, ordinance, or administrative regulation (Korbitz, 1976).

2.2.1.7. Roles of parties

Parties involved in SDFC facility are:

- Local government
- Central and regional government
- Water agencies
- Developer
- City planner
- Users/city dwellers

Local governments have been in charge of SDFC facilities and administer works. Central government has policy makers in planning, controlling and coordinating function for all water resources management actions. Regional government takes strategic action related to SDFC matters. Water agencies are public state companies, which intervene in the improvement of the quality of the water resource. Developers and city planner must follow the rules and regulations adopted by the local government. Users/city dwellers are concerned directly by sanitation decision and damage caused by flood (Deutsch, 1986).

2.2.1.8. Control Procedures

Control can be defined as the regulating of activities in accordance with the requirements of plans. The fundamental goal is to assure satisfactory accomplishment of the basic objectives of the organization (Flippo and Munsinger, 1975). Control is used here in the sense of constraining, regulating, and directing action in accordance with the requirements of a plan for accomplishment of an objective (Thelwell, 1977).

The basic control process, can be reduced to three steps: (1) establishing standards or "saying how things ought to be", (2) measuring performance against standard or "seeing how things really are"; and (3) correcting deviations or "straightening out what's crooked".

Standards for evaluation may be arrived at through analysis of past experience, subjective appraisal by the authority, or engineered standards based on objective, quantitative analysis.

Koontz and O'Donnell have listed ten requirements of an adequate control system. (1) reflect the nature of the activity; (2) report deviations promptly; (3) forward looking; (4) point up exceptions at critical points; (5) objective; (6) flexible; (7) reflect the organizational pattern; (8) economical; (9) understandable; (10) indicate corrective action.

Management control is tied to planning at one end of the process and often to direction at the other. Control involves a comparison against some previously established standard and then taking appropriate corrective action when an unacceptable deviation occurs. This corrective action may involve the exercise of authority and thus directing, but this need not be the case. Montana and Charnov (1987) stated the control process as indicated in Figure 2.2. below.

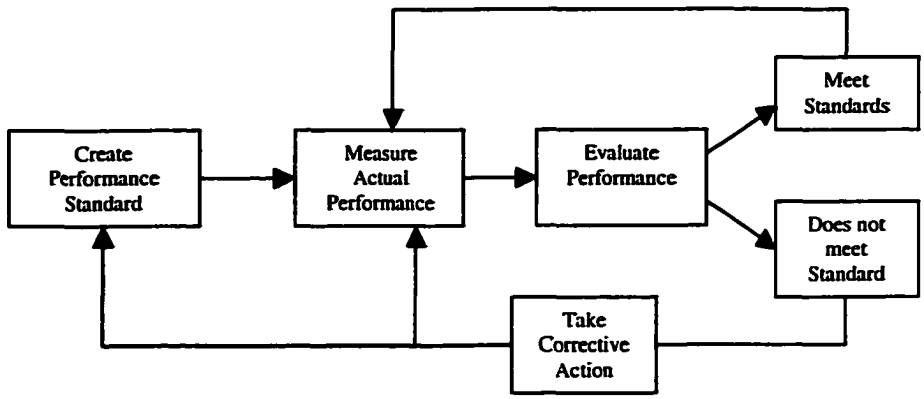


Figure 2.2. The control process

The possibility of planning errors also requires a constant inflow of information indicating planning inadequacies and variations from plans (Albers, 1972).

Donelly (1971) explored the three Types of Control as distinguished by Focus of Corrective Action, as shown in the Figure 2.3.

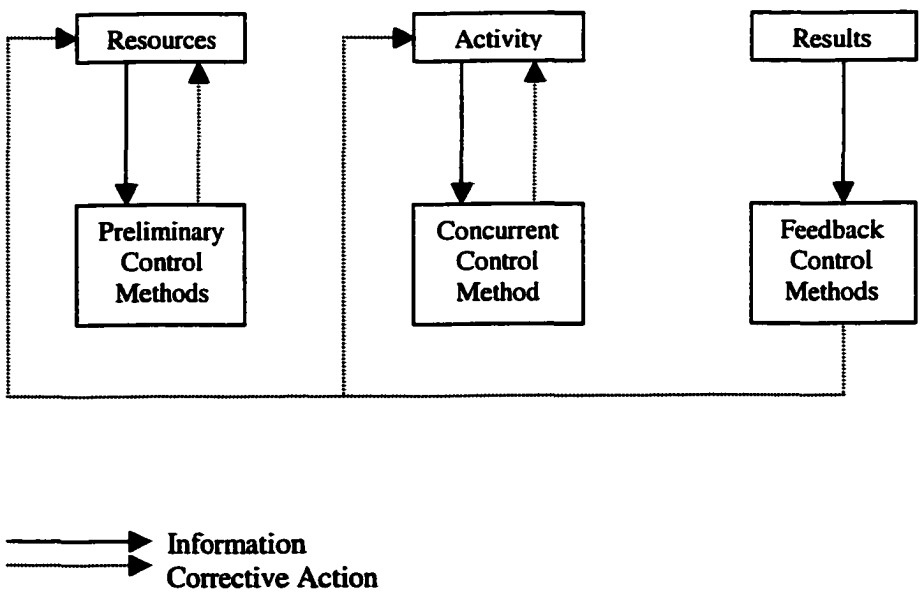


Figure 2.3. The three types of control

Preliminary controls (before the event) focus on the prevention of deviations by assuring that every possible error has been taken care of. Preliminary control adjusts the quality and quantity of resources, based upon information pertaining to these resources.

Concurrent control (during the event) endeavor to monitor the operation in progress. Through control of instructional and supervisory activities the concurrent controller seeks to maintain qualities and quantities at standard levels. Concurrent control adjusts the actual operations based upon information pertaining to these operations.

Feedback control methods focus on end results. The corrective action, if taken, is directed at improving either the resources acquisition process or the actual operations. This type of control derives its name from the fact that historical results guide future actions.

The corrective action phase of preliminary control and concurrent control adjust that which is being measured. The implementation of control requires three basic conditions: (1) standards must be established, (2) Information, (which compares actual results and standards) must be provided, and (3) action to bring about correction of any deviations between actual and standard must be possible. The logic of evident: without standards, there can be no basis for evaluating the adequacy of actual performance; without information there can be no way of knowing the situation; without provision for action to correct deviations, the entire control process becomes a pointless exercise (Donelly et.al, 1971).

The fundamental concept for management control systems is to help management accomplish an organization's objectives by providing a formalized framework for: 1) identification of pertinent control variables, 2) development of good short term plans, 3)

recording of the degree of actual fulfillment of short term plans along the set of control variables, and 4) diagnosis of deviations (Patz, 1982).

2.2.2. Technical Aspect

Under technical aspect are included: classification of storm drainage and flood control, types of facilities, risk factors for design, and planning, design, operations, and maintenance.

2.2.2.1. Classification of storm drainage and flood control

SDFC facilities have 'major' and 'minor' functions. Some components are designed to provide convenience at individual sites during minor or frequent storms. During a major storm, the capacities of convenience-oriented components may be exceeded and other components are needed to provide safety and minimize damage. A design that would eliminate all damages would be almost certainly infeasible. Expected damages from major runoff events would include erosion and scour, damage to lawns and vegetation, and damage to structures.

Runoff from urban areas, residential or commercial areas, if not properly conveyed to disposal points, can result in significant losses. Inadequate disposal of runoff results in loss of time and causes inconvenience. The threat floods pose to human life cannot be expressed in terms of dollars. The dilemma of the continuing threat to human life, mounting flood damage, and ever increasing costs for flood control structures results from developing lands subject to flooding more rapidly than flood control works can be built. Further, future floods will be greater that those for which most projects can economically be built. Many communities have low lying areas, which flood frequently and areas, which are inundated by natural watercourses.

Storm water and flood control management requires identifying flood hazards, and using that information to protect lives and minimize flood damage by conventional measures, non–conventional measures, or combinations of approaches (Dept. of Army, Sacramento Corps of Engineers, 1977). Conventional measures involve control of floodwater by dams, levees, or other structures. Non-conventional measures involve control over the use and development of flood plain lands by zoning ordinances, building codes, subdivision regulation, and other measures such as flood proofing, temporary and permanent flood plain evacuation, and tax adjustments.

Flood plain zoning limits the usage of areas to minimize damages (Poertner and Anderson, 1966). Permanent structures and improvements are prohibited. Parks and recreational areas in flood plains may be permitted. Zoning may, however, meet with opposition from landowners and officials in local government concerned about the reduction of the tax base. The possibility of "confiscation without compensation" requires careful consideration in flood plain zoning. Storm drainage systems drain minor stormwater and control some flood flows (Grigg, 1996). Minor flows can be just for convenience of the public, whereas controlling flood flows may prevent greater damage. Stormwater programs can also provide benefits from erosion and sedimentation control, control of the quality of urban runoff through management practices and treatment of wet weather flows, and the beautification of urban stream environments.

The traditional method is to drain stormwater away as rapidly as possible (Urbonas, 1993). This is done by swales, gutters, and storm sewers conveying runoff to the nearest stream or river. Other methods considered in recent years are local disposal or detention pond. Advantages often cited for those methods are:

1. Recharge of groundwater
2. Reduction in the settlement of the surface in areas of groundwater depletion
3. Preservation and enhancement of natural vegetation
4. Reduction of pollution transported to the receiving waters
5. Reduction of downstream flow peaks

The following section discusses characteristics, functions and principles of storm drainage facilities and flood control. It will also discuss definitions of flood, influence of floods on to humankind and environment and the classification of flood control measures.

2.2.2.2. Types of facilities

Urban drainage facilities include storm sewer and combined sewer systems. Storm sewer systems consist of natural and man made channels and conduits which, together with inlets, catch basins and outfall structures, function collectively to convey surface waters to disposal points outside the area of collection, and absorb, store and otherwise use storm water rather than dispose of it. This fraction of the total precipitation is referred to as storm runoff, or simply "runoff".

Another type of system conveys sanitary and industrial wastes combined with runoff and are called "combined" sewers. They intercept sanitary flow in dry weather for conveyance to a treatment plant. During periods of storms a portion of the combined flow is conducted to a treatment plant and the balance is discharged into the local waterways.

The physical management of runoff is accomplished by a combination of on-site control of runoff, in-stream control of runoff, and using runoff beneficially (Poertner, 1980). Basically, a stormwater management system has a surface runoff component; a

transport component; and a receiving water component. Both man-made works and natural features of the earth are represented in each component, as shown in Table 2.3.

Table 2.3. Stormwater system component

	System Component		
	Surface runoff	**Transport**	**Receiving water**
Natural	Overland flow	Ditches, Creek, etc.	Stream, Rivers, Ponds, Lakes, Marshes, Estuaries, Oceans, Aquifers
Man Made	Improved lots Buildings Streets, Alleys, etc. Parking Lots	Streets Ditches	

2.2.2.3. Risk factors for design

Risk is defined as the measure of a hazard combining a measure of the occurrence of an undesirable event and a measure of its effects or consequences (Villemeur, 1992). National Research Council (2000) addressed risk factors that are often important for design of SDFC:

- Hydrologic factors: flood frequency, volume, and time distribution
- Hydraulic factors: channel geometry, the roughness and slope of the channel bed
- Structural and geotechnical factors: geologic properties of foundation, seepage and other soil mechanic issues
- Seismic factors: frequency and magnitude of earthquake
- Materials and construction factors: construction quality, type and quality of materials
- Operational and maintenance factors

Design reviews are important and intended to provide an evaluation of the design at defined milestone. The design review team should include a variety of skills and be chaired by a person independent of the design team.

Impacts of floods can be placed into categories: Physical, economic, environmental, social and financial (Grigg 1983).

Salas (2000) specified the flood impacts as follows:

1. Human life
    a. Loss of human life
    b. Physical and mental injuries, and also health issues
    c. Loss of domestic animals
2. Economic
    a. Loss of infrastructure
    b. Loss of private and public property
    c. Loss of business
    d. Loss of public funds
3. Social
    a. Disruption of families
    b. Disruption of institution
    c. Interruption of education
4. Environmental
    a. Erosion of stream beds and banks
    b. Sedimentation along the flood plains and reservoirs
    c. Destruction of fish and wildlife

d. Contamination of soil and water

The US Army Corps of Engineers classifies flood damages into two general types: 1) Tangible, and 2). Intangible.

Grigg (1975) mentioned that according to Breaden's classification, flood damages can be categorized as 1) direct, 2) indirect, 3) secondary, 4) intangible, and 5) uncertainty.

Direct damage is defined as the resources to be diverted in the rehabilitation of property that has been damaged by the floodwaters. Indirect damage is defined as the magnitude of the loss in economic efficiency due to the occurrence of the flood. It includes the value of lost business and services and the costs of alleviating hardship. Secondary damages are defined as those widespread effects extending over a large segment of the economy, such as the effect on the income of those who buy and sell in the flooded area. Intangible damages are those that do not lend themselves to appraisal in monetary terms. Loss of life, impairment to public health, environmental quality and social well-being are some of the example. The uncertainty damage is related to the cost that the floodplain occupants are willing to pay to avoid a flood loss.

2.2.2.4. Planning for measures

The damage caused by flood can be reduced by developing an integrated flood control system. Flood control is defined as the set of all measures, physical or otherwise, that enable the communities minimize undue hardship to the extent practicable. (Simons, et al., 1977)

Kates and White (1961) identified four basic aims of flood control measures:

1. To reduce flooding

2. To reduce damages

3. To save lives

4. To save property

In order to achieve this aim, one or more different schemes must be selected. Several authors have classified the various flood alleviation schemes according to different criteria, although all classifications retain the same broad items. For example, compare the lists suggested by White (1965) and Sewell (1969) as indicated in Table 2.4. below.

Table 2.4. The list of flood alleviation schemes

White (1965)	Sewell (1969)
Land elevation	Accept losses
Flood abatement	Public relief
Flood control	Flood proofing
Emergency Action	Structural changes
Structural changes to buildings	Emergency action
Land use changes	Regulation of land use
Public relief	Insurance
Insurance	Control land phase or channel phase

The typical of a local storm water program (Salas, 2000) are indicated in Table 2.5. below.

Table 2.5. The typical local stormwater program

Program	Objective
Flood control program	Assure life safety and land use regulation in flood plains
Drainage Ordinance	Specify levels of performance of drainage systems, use of detention storage, responsibility for drainage
Cost allocation formula	Specify who cost shares in drainage program
Erosion control ordinance	Establish incentives to prevent soil erosion
Storm water quality program	Minimize storm water pollution by management practices or treatment
Subdivision Regulations	Establishes construction standards for all UDFC related facilities

The Tennessee Valley Authority, and later Relph (1968) divided the schemes into three categories: compensatory measures, corrective measures, and preventive measures. Leopold and Maddock (1954) divided schemes into administrative, engineering and land-control types, while other classifications have been based on the scale of the adjustment. The Department of Army Sacramento District Corps of Engineers (1977) classified conventional and non–conventional methods of flood damage prevention. Kate's classification scheme allows for the interaction between various government levels, as well as for the interaction of alternatives in a comprehensive flood damage reduction program. Arey and Bauman classify the adjustment to floods as direct and indirect. Yevjevich has presented a systematic treatment based on five basic groups of measures: a) prevention, 2) prediction, 3) proofing, 4) physical control, and 5) insurance. The US Water Resources Council (1981) described strategies and tools for achieving flood hazard reduction into structural and non-structural activities.

From the discussion above, various classification schemes for flood damage reduction have been advanced. In the broadest sense, Simons, et al. (1977) stated that

flood control measures could be conceptually classified as: 1). An adjustment of the river flow to suit man's convenience, or 2). An adjustment in man's activities to suit the river convenience. These two general criteria are important in that they help isolate the underlying philosophy of any flood control measure. Thus, structural adjustments, such as the building of dams, levees and channel improvements, would belong to the first criterion of adjustment, while nonstructural adjustments, such as flooding proofing, emergency evacuation, land use zoning, flood insurance, and others, would belong to the second criterion.

2.2.2.5. Details of Codes and Standards

The land use plan, zoning and subdivision regulation set out the fundamental policies and procedures for determining where and how a community should grow. The codes and standard ordinances address specific problems such as the health and safety of buildings and houses, agricultural uses, tree cover, storm water management, signs, nuisances, and access to the sun for solar energy devices (Daniels et al, 1988).

A well–known drainage criteria manual as a standard design for urban stormwater development includes not only engineering guidelines for design and construction, but also address best management practices for maintenance (UDFC District, 1999).

2.2.2.6. Functions of SDFC structures

Urban drainage and flood control management have the following specific objectives

1. Prevent health hazards, loss of life and property damage on site
2. Minimize inconvenience from inundation and flooding on site
3. Minimize alteration of the local groundwater system and the hydrology of receiving watercourses

4. Minimize downstream flooding, changes in natural stream channel geometry and channel erosion
5. Minimize pollution discharges to watercourses
6. Minimize sediment pollution of watercourses from construction activity
7. Minimize impairment of fisheries, fish habitat and other aquatic life

Some other functions are including reduced street maintenance, reduced traffic delays, improved aesthetics, and land value enhancement (Grigg, 1978).

2.2.2.7. Design Approaches

Technical features of the planning process include system layout, selection of basic systems, assessment of risk, and other steps. A good reference for planning is the Urban Storm Drainage Criteria Manual, mentioned earlier. Planning distinguishes between minor stormwater and major flood control systems.

For minor systems, stormwater can result in significant losses if systems do not properly convey runoff to disposal points. Inadequate disposal of runoff also results in loss of time and causes inconvenience.

For major systems, the issue is flood hazards, such as those studied by US Government for Metropolitan Denver and the South Platte River and tributaries, Colorado, Wyoming and Nebraska (US Army Corps of Engineers, 1984). This study gave plan components for flood hazards (Table 2.6).

Table 2.6. Plan objectives and flood control component

Flood control component	Plan Objectives		
	Eliminate existing hazards	Minimize impacts of remaining hazards	Prevent creation of additional hazards
Flood storage – dams	V		
Flood containment-Levees, Floodwalls, Channel enlargement, Floodway excavation. Bridge modifications	V		
Flood diversion-Channels Tunnels	V		
Flood proofing-Elevation, Filling, Waterproofing	V		V
Removal or Relocation of flood plain structures-Razing and Clearing, Relocating	V		
Flood plain regulations-Zoning and subdivision Regulations, Building Codes			V
Emergency evacuation—Warning system, Evacuation Plan, and Shelter Arrangements		V	
Flood Insurance		V	

The components were combined into alternative plans for each study area to satisfy the three plan objectives. The alternatives were evaluated and those with the best potential were retained and evaluated in greater detail. Finally, the alternative plan that offered the best balance between economic efficiency, environmental quality, and local desires was selected. The selected plan or plan components is implemented by local, regional, or State government, or by the Federal government, as appropriate. This is a typical approach in the US.

High velocity from steep streams increases structural damage, breakage and loss of contents. Sediment accompanies inundation, and the cost of cleanup is included in all damage appraisals. Sediment transport increases with depth and velocity of the flood wave, and deposition occurs from decreasing velocity over the floodplain. The location of property in a flood prone area determines its risk. Type of occupancy, whether residential, commercial or industrial, has a marked influence upon the average annual damages, and on the method of determining them. The damages to the structures themselves do not vary greatly with the type of industry or business, but damages to the contents will depend upon type of merchandise, vulnerability, techniques of handling and storing, and the amount of fixed equipment that is subject to damage and cannot be removed in advance of the flood. Type of construction is directly related to the damages that a structure is likely to suffer. Brick or masonry veneer will offer greater resistance to flood damage than a frame structure (Simons, et.al.1977).

2.2.2.8. Operation and Maintenance

The operation and maintenance of stormwater management facilities are critical in sustaining aesthetic values and long-term effectiveness of the facility. Poor operation and inadequate maintenance not only reduce the usefulness of facilities but can cause the facility to become unacceptable to the public because of that kind of condition such as an eyesore, nuisance, and health hazard (APWA, 1981). Operation and maintenance activities deal with control of algae and aquatic vegetation, mosquito, erosion, safety features also removal of debris and sediment. Beside general maintenance, such as cleaning, grass mowing and weed control, operation and maintenance activities should

take into account the structural maintenance, access and hydraulic facilities such as pipes, channels, outflow control structure, pumps.

For pipe construction, operation and maintenance activities should consider why early failure could occur. Schwieterman (1982) made a list of the reasons for pipe failure as indicated below.

1. No outlet pipes at open ditch, or headwalls that were not of sufficient size and strength
2. Improper installation. The ditch was not of proper width so the backfill did not bed properly in the void on the bottom half of the tile and/or the ditch bottom did not have the proper contour, which is .5 of the outside diameter of the installed tile.
3. Poor outlets and poor maintenance on outlet and open ditches. A submerged outlet creates undue pressure on a system, thereby causing either suck or blow holes.
4. Poor quality tile and tile of insufficient strength.
5. Connection usually not of a manufactured type or, if hand-made, poorly connected and mortared.
6. No provision for surface drainage
7. No provisions for annual inspection and the necessary maintenance.
8. Large joint spacing
9. Very poorly built and improperly placed inlets and receivers.
10. Insufficient inspection during construction

2.2.3. Financial Aspect

Financial aspect includes determining financial feasibility, how to pay for initial systems (capital expenditures), and how to pay for operation and maintenance. It includes not only the amounts of financing but the responsibilities of different parties, and the means of controlling and spending money, such as planning, programming, and budget systems.

2.2.3.1. Sources of funds

Shoemaker (1974) mentioned about the six means of funding capital resources for the financing of drainage project. These are special assessment bond, service charge, general obligation bonds, capital improvement money, the urban drainage and flood control district, the state government, and the federal government. Cyre (1982) mentioned about general obligation bonding repaid by property taxes, revenue bonding repaid by utility service charges, utility tax revenues, and community development block grant funds.

The sources of revenue for annual operating expenses are general fund, drainage utility service charges, inter-fund loans to drainage utility, and fees and charges. Fee and charges consists of plan review and inspection fees, on site detention/retention system, inspection fees, impact fees, system development charges, general facilities charges, in-lieu of construction charges, latecomer fees for developer extensions (Cyre, 1982).

2.2.3.2. Cost Sharing

Discussing about cost allocation, Poertner (1974) explored six alternatives method of cost allocation as indicated below.

1. Method of oversizing

In this method, the new developer pays only the additional cost that his drainage, based on drainage area alone, will add to the planned drainage system to make the basic system adequate for everyone.

2. Flow-contributed method

This method is similar to the above method, but it allows for the different values of the runoff coefficient C for various land uses in the new development. The assessed fee is based on the ratio of flow from the lot in question to the total drainage basin flow.

3. Method of peak flows

This method is a modification of the previous method, where the owner of the new development would pay according to the ratio of the peak runoff from his property to the peak runoff from the remainder of the drainage area.

4. Peak flow time method

This procedure further modifies the previous method by allocating the cost according to the runoff flows at a certain time, namely, the time of peak sewer flow. Thus, if the peak flow from a portion of a new development lags the peak flow from other property in the development, the cost allocated to this property would be less. The owner would pay according to the ratio of his contribution to the runoff flow in the facility at the time of peak flow.

5. Ratio of saving method

By this method, cost allocations are made based on the cost that would be incurred if each area built its own storm drainage system. Preliminary designs and

approximate cost estimates are prepared for the separate projects and the cost of the joint project is apportioned to each party in the ratio that the separate costs bear to each other.

6. Distance from outlet

In this method, the charge for drainage is based on the length of sewer pipe serving the lot owner.

2.3. STORM DRAINAGE AND FLOOD CONTROL MANAGEMENT IN THE US

2.3.1. Introduction

The concern about storm water and flood control in the United States has been expressed for a number of years. Adjustments in stormwater practice have been made mainly from the seventies, although adjustment in flood control started earlier (Smith, 1979). In the United States, stormwater and flood control programs have changed a great deal since emphasis began. In the case of flood control, federal dam-building programs have ended, and emphasis is now on non-structural programs. In the case of stormwater, local governments now strive to control increased runoff from new developments and to meet ever–tightening water quality regulations. The Environmental Protection Agency has emerged as a main federal agency working in stormwater because of water quality aspects.

The adjustment was in conjunction with a positive attention about the environment where law and regulation about the environment was applied in the United States in the same decade (Grigg, 1996). Environment issues are related to the water supply problem, which is related to the storm water and flood control problem.

In storm water and flood control for residential areas success in storm water and flood control management depends upon the designated parties in institutional, technical, and financial aspects.

2.3.2. The Institutional Aspects

In the US, SDFC management is mainly a local government responsibility, such as municipalities, townships, cities and counties. However, some programs are designed by federal and state governments, which support or regulate local government. The program in federal government, state government and sub state government are illustrated below, in Table 2.7.

Table 2.7. Program and government level

Government level	Program
Federal level	Flood Control by federal reservoirs and on large streams Floodplain Management policy and insurance programs
State level	Flood Control reservoirs Limited floodplain management Stormwater Management policies
Sub State level	Flood Control by local means Floodplain Management in local areas Stormwater Management in local areas

2.3.2.1. Federal Government Activity

In stormwater management, no federal agency has general responsibility and control. Action is under local initiatives. There is some sub state regional action, and a few states have statewide policies and programs. Generally, stormwater management is

by local ordinances, which differ even in adjacent areas. In Federal Level, the institution responsible for the flood hazard mitigation is described below are Soil Conservation Service, Corps of Engineers, National Oceanic and Atmospheric Administration, Department of Housing and Urban Development, Community Planning and Development, Federal Housing Administration, Geological Survey, Water and Power Resources Service, Federal Highway Administration, Federal Disaster Assistance Administration, Federal Insurance Administration, Tennessee Valley Authority.

In the federal government major structural flood control programs are by the Corps of Engineers, which consults with local agencies, but functions with its own field offices for planning, construction, operation, and maintenance. The Soil Conservation Service (now Natural Resources Conservation Service) has a network of conservation districts which function at local levels. Federal Emergency Management Agency (FEMA) provides the financial incentives of the flood insurance program, a motivating force for state and local ordinances.

2.3.2.2. State activity and program

As an example of the state program, the Pennsylvania Stormwater Management Act was passed in 1978, and its policies and purposes are to:

1. Encourage planning and management of stormwater runoff in each watershed, which is consistent with sound water and land use practice.
2. Authorize a comprehensive program of stormwater management designated to preserve and restore the flood carrying capacity of Commonwealth stream; to preserve to the maximum extent practicable natural stormwater runoff regimes

and natural course, current, and cross section of water of the Commonwealth; and to protect and conserve ground waters and ground water recharge areas

3. Encourage local administration and management of stormwater consistent with the Commonwealth's duty as trustee of natural resources and the people's constitutional right to the preservation of natural, economic, scenic, aesthetic, recreational, and historic values of the environment.

Florida's program mitigates degradation of the quality of receiving waters from stormwater discharges. Florida requires licenses or permits for urban stromwater discharges that are determined to be significant by the state. Existing discharges are also subject to permitting authority if determined to have significant impact. There is provision for delegation of this authority to local regional governments where they demonstrate the capability to administer the program.

2.3.2.3. Sub state Regional Organizations

A few stormwater management systems cover areas larger than a single municipality (Whipple and Tucker, 1983). The Metropolitan Sanitary District of Chicago administers controls throughout a multi-jurisdictional area. The Delaware and Raritan Canal Commission of New Jersey enforces stormwater management to protect a historic canal and controls runoff to reduce pollution as well as flooding. The Water Management Districts in Florida, particularly the South Florida and Southwest Florida Districts, are multi county organizations involved in stormwater management. These districts were created to provide for management of water and related land resources; to promote the conservation, development and proper utilization of surface and groundwater; to provide water storage for beneficial purposes; to prevent damage from floods, soil erosion, and

excessive drainage; to preserve natural resources, fish, and wildlife; and to promote recreational development. An important aspect and basic activity of the South Florida Water Management District (SFWMD) is a surface water management-permitting program.

Other examples of regional drainage and flood control authorities are the Albuquerque Metropolitan Arroyo Flood Control Authority and the Denver Area Urban Drainage and Flood Control District. The Urban Drainage and Flood Control District (UDFCD) has developed a regional drainage criteria manual, adopted floodplain regulation criteria, delineated flood hazard areas, developed program of annually sending flood hazard brochure to floodplain occupants, designed and constructed regional drainage and flood control facilities, developed early flood warning systems, held seminars and conferences, and maintained drainage and flood control facilities. The UDFCD has police power authority to control development in floodplains, ahs powers of condemnation, and can charge drainage fees. The UDFCD was established by special sate statue and is the only organization of its kind in Colorado. The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) is a similar organization covering the Albuquerque metropolitan area, in New Mexico. The AMAFCA is also unique to New Mexico (Whipple and Tucker, 1983).

2.3.2.4. Non Governmental Activity

Non-governmental organization involvement in storm water management is necessary because the federal government involvement is limited. Therefore research is mostly by non-governmental organizations. The American Society of Civil Engineers, especially its Urban Water Resources Research Council, and the American Public Works Association

contributed materially. However, federally–supported research by universities has been significant, as with support from the Office of Water Research and Technology, Department of the Interior. Since there is no large industry closely involved in stormwater management, these lightly funded activities provided important sources of technical guidance.

2.3.3. Technical Aspect

As an example of technical guidance, the Urban Storm Drainage Criteria Manual was developed by the Denver Regional Council of Governments in 1969 for use in the Denver metropolitan region was adopted and used by local governments in the region since 1969. It has been updated and maintained since 1970 by the Urban Drainage and Flood Control District. Many other criteria manuals have since been developed and adopted throughout the United States.

The criteria manual contains the following major chapter topics:

Volume I	Volume II
Drainage Policy	Major Drainage
Colorado Drainage Law	Hydraulic Structures
Planning	Inlets and Culverts
Rainfall	Storage
Runoff	Irrigation Ditches
Storm Sewers	Flood proofing
Streets	Auxiliary Uses
Stormwater Inlets	

The manual was updated in 2000 and is now available on CD.

2.3.4. Financial Aspect

Financing needs can be categorized into two basic areas: 1) existing development, or problems needing remedial treatment, and 2) new development, or situations offering the opportunity to prevent problems (Whipple and Tucker, 1983). Some practices for financing flood management projects are listed in Table 2.8.

Table 2.8. Methods of Financing Floodplain and Channel Management Projects

Development Status	Source of Fund
Existing Developments	General Tax Fund Special assessments Service charges of fees Federal or state assistance Bonds Private funds
New development	Developer fees Developer provided facilities Dedications Floodplain regulation

2.4. SDFC ENVIRONMENT IN DEVELOPING COUNTRIES

In this section we outline the general conditions in developing countries that affect how SDFC is practiced. These include the economic and social conditions, the human and organizational resources, and the institutional environment to improve SDFC.

2.4.1. General Overview

Developing countries have many similarities and face similar threats and problems. Their main challenges are population growth, economic development, and infrastructure management to support economic growth and alleviate poverty through job opportunities.

A factor limiting the solution of developing countries, which prevents good urban development and solution of problems like stormwater, is their political situation, which is often not stable. Racial, religion and political issues trigger conflict. Examples include the conflict in Bosnia – Herzegovina as a struggle among Croats, Muslims and Serbs, ethnic tension in Kosovo and in newly independent Macedonia, and African civil conflicts in Somalia, Sudan, Mozambique, Angola, and Liberia. These conflicts cause mass misery and dissolving authority (Maynes, 1995).

In the developing countries search for workable government forms and democracy has been difficult. John Stuart Mill predicted for some of the problems, democracy is "next to impossible" in a country with a multiethnic population (Nelson, 1995).

Other factors are cultural, for example, collectivism rather than individualism. Asian people are considered collectivist with a strong emphasis on maintaining relationships. Given this sensitivity, they seek harmony and communicate that they respect their partners as capable and worthy (Ting-Toomey, 1988). This leads them to be hesitant about engaging in aggressive interaction that may challenge the face of others. Collectivist philosophy might be aligned to aid in water management, since people have to work together cooperatively.

2.4.2. Urbanization difficulties

Urbanization is a primary issue faced by big cities in developing countries. Basically, this issue is caused by regional disparities. Big cities have facilities, such as access to education, wages, and job opportunities, which are lacking in rural areas. In Africa, urbanization relates to factors such as location, political significance, development of mining, manufacturing, and services, and expatriate population for individual countries. (Hance, 1970). In much of Asia, secondary education facilities are not within commuting distance of villages. Children wanting to pursue secondary education must move to towns for extended periods, arranging to stay with relatives or friends or in hostels. Most commonly, they do not return to their villages because jobs are not available there (Jones, 1975).

Developing countries look to industrialization to cure poverty and this results in greater demand for goods and services, thereby increasing levels of consumption and eventually increasing employment and production to meet these demands (Chandrasekhar, 1967).

Industrialization has accelerated urbanization. Rates of development have varied widely, inducing large-scale movement of population (Querishi, 1967). The growth of cities has concentrated population, especially in the largest cities. The result is a mass of problems related to land use, transportation, utilities, and infrastructure facilities (Wilkinson, 1967).

To cope with congestion, some Asian governments have tried back-to-the-land schemes. Notable among these are the Federal Land Development Authority (FLDA) program in Malaysia and the National Resettlement and Rehabilitation Administration

(NARRA) scheme in the Philippines. In the Xia Fang and Hui Fang movements in China urban cadres were "sent down' to work in villages and people who were not needed in cities were returned to their villages (Laquian, 1973). In Indonesia, to reduce urbanization, the government applied decentralization of industry and control of migration into the cities.

Creeping urbanism in Malaysia was described by Guyot (1977), who cited efforts to improve the countryside. Regional development schemes revolving around 'growth poles' are also emerging. Authorities have been set up in the Philippines. Burma is pursuing a policy of decentralization. Malaysia is adding a spatial component to its comprehensive plans. All these hope that migration can be slowed.

2.4.3. Indonesia: comparison with the US

Indonesia is experiencing change due to social, economy, cultural, religion, safety and labor issues. The most crucial problem is the social gap between the wealthy and the poor. Since the recent monetary crisis, this has worsened and may explode into conflict and influence the economic situation.

Culturally, Indonesia has 30 provinces with different ethnic groups, each with its own culture. Conflict among them will endanger safety and life. Moreover, the government might evacuate tribes from certain areas, such as Borneo in 2000 (Kompas, 2000). Conflict among religions (Kompas, 1999) occurs when parties take advantage of the unstable situation.

Stability in Indonesia is sometimes worsened by conflicts among religions and ethnic groups. This influences the economic situation and leads to workforce/labor

problems. Jobless people indicate the interrelated social, economic and stabilization situations.

These are only a few of the challenges developing countries are facing. Their condition differs sharply from developed countries in three major ways, governmental system, cultural and law, and social demographics. This is shown by comparison between the United States and Indonesia (Table 2.9).

Table 2.9. Comparison of developing countries and the United States

	United States	**Indonesia**
Governmental System		
Structure/Pattern	Decentralization	Centralization
Democracy	More democracy	Less democracy
Local government	Strong	Weak
Decision making	Participative	Top-down
Culture and Law		
Discipline	High	Low
Working spirit	High	Low
Need of supervision	Low	Strong
Law enforcement	Strong	Weak
Law obedience	High	Low
Social and Demography		
Individualism	Strong	Weak
Dependable	Low	High
Population growth	Low	High
Poverty	Low	High
Urbanization	Low	High
Educational background	High	Low
Health awareness	High	Low

(Kompas 1998, 2000; Suarapembaruan 2000, Winarno 1998)

These factors have direct influence on management of storm drainage and flood control because urbanization, housing development, poverty and use of rivers are related to storm drainage and flood control facility management.

Population growth causes urbanization and need to enroll in schools and get jobs. This drives need for housing and new residential developments.

In the meantime, as a result of weak local government and top-down decision making development and social welfare suffer. Population growth includes skilled and unskilled people. Poverty is exported from small towns to big cities. Urban areas in Indonesia have poverty percentage of 20,1% (World Bank, 1994). Poverty in urban areas in Botswana, Mozambique, Egypt, Uganda and Marocco is higher than 25%. In Asia, Bangladesh is the highest (58.2%), other countries such as Pakistan, Sri Lanka, Philippines and India are more than 25%. In Latin America, Brazil, Colombia, Guatemala, Haiti, Honduras are above 37% (World Bank, 1994).

Low educational and economic levels cause weak awareness towards clean environment and health. People who build their shelter by the river habitually dispose their garbage to the river; on the other hand, other people make the river as their place to build their house. This situation caused drainage problem either in old and new residential area.

From the above discussion obviously we have a vicious cause and effect problem. This matter is shown as a conclusion about SDFC in developing countries, illustrated in Figure 2.4. below.

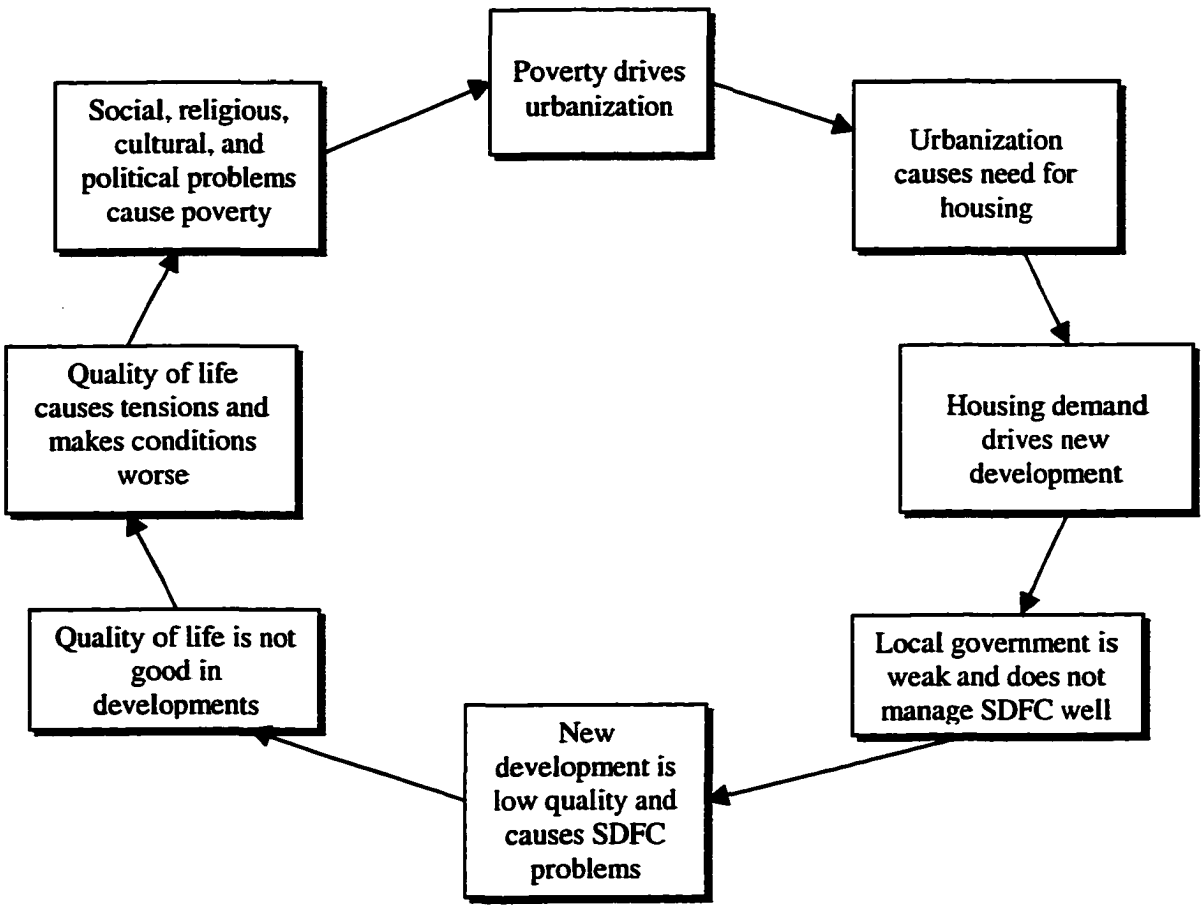


Figure 2.4. Conclusion about SDFC in Developing countries

CHAPTER 3

DRAINAGE AND FLOOD CONTROL IN INDONESIA: THE BEKASI CASE STUDY

Land development drives the need for storm water and flood control facilities, and in this chapter we discuss land development in Indonesia to create new residential areas, to include socio-economic drivers and the conditions under which SDFC facilities must function. The chapter begins by explaining new residential development in Indonesia, then introduces the Bekasi case study and concludes with a description of conditions for SDFC programs. The Bekasi case study enables the discussion to focus on a specific situation to make sure the conceptual discussion is rooted in reality.

3.1. NEW RESIDENTIAL DEVELOPMENTS IN INDONESIA

3.1.1. Introduction

In Indonesia, as in the United States, new residential area development is by real estate and developer companies, which acquire land, and then design, construct and sell houses.

Demand for housing is to meet basic needs and then meet higher social needs of occupants, and these determine type, size, and price of housing. The developer must provide not just basic houses but homes with facilities and infrastructure. The homes and infrastructure lead to a "residential area living in harmony and harmonious in living," a slogan for the Indonesia State Ministry of Housing (Judohusodo, 1998). Storm drainage and flood control facilities are important components of the infrastructure of new developments.

3.1.2. Real Estate Development in Indonesia

Rapid urban development is occurring in areas such as Jakarta and surrounding areas. Figure 1-2 (in chapter 1) shows how 'new town' projects and industrial parks have developed ribbon-like along the toll roads feeding into the city's outer ring road. Recently, Bekasi to the east and Tangerang to the west have become centers for growth of manufacturing employment and population and projects in the hilly terrain south of Jakarta are less closely–tied to employment centers and toll roads.

The new developments are huge. The entire area of the Region of Jakarta, roughly the area within the outer ring road, is about 66,000 hectares. By October 1996, over 90,000 hectares outside the Capital City Region had received government approval for development (KOMPAS, 1996). Of this total, 13,300 hectares had been built upon by 1997.

Table B.1. (see Appendix B) lists residential projects over 500 hectares by location and size. Until the mid-1980's, 500 hectares was a very large project but after the mid-1980's, a number of companies created projects larger than 500 hectares.

The process of land and SDFC development takes place in several phases. The first phase begins from the feasibility study by the developer. The main aspect in the feasibility study is economical analysis. Land acquisition for the proposed project may be done before the feasibility study is carried out, at the same time or after the study is completed. In actual practice, many investors with their entrepreneurship in mind do land acquisition long before the feasibility has been done. Usually they try to buy the land when the land price is low. Besides, developers are competing with one another in land acquisition, and this makes land availability rare from time to time.

Next will be the proposal, which includes the concept, pre-planning and engineering design. The proposal will be reviewed by the authorized institution for the technical aspect and consistency to rules and regulations. In this phase revision may be required until approval.

The next phase is land development and housing construction. In this phase, the controlling system for the development should be done internally by the developers before it passes to the authorized institution. The objective of the controlling system is to maintain the quality of the output, matched with the proposal submitted for approval. Upon completion of the housing development and facilities, the developers will hand over the units to the customers and assets in the form of public facilities and infrastructure such as SDFC facility to the local government. Final review for public facilities and infrastructure included SDFC is at this time. This is to ensure that such facilities are in good working condition. Upon completion and transfer, the operation and maintenance of the facilities will be solely the responsibilities of the local government. Figure 3.1. shows the flow of implementation in new residential area (Yong, personal discussion, 2000).

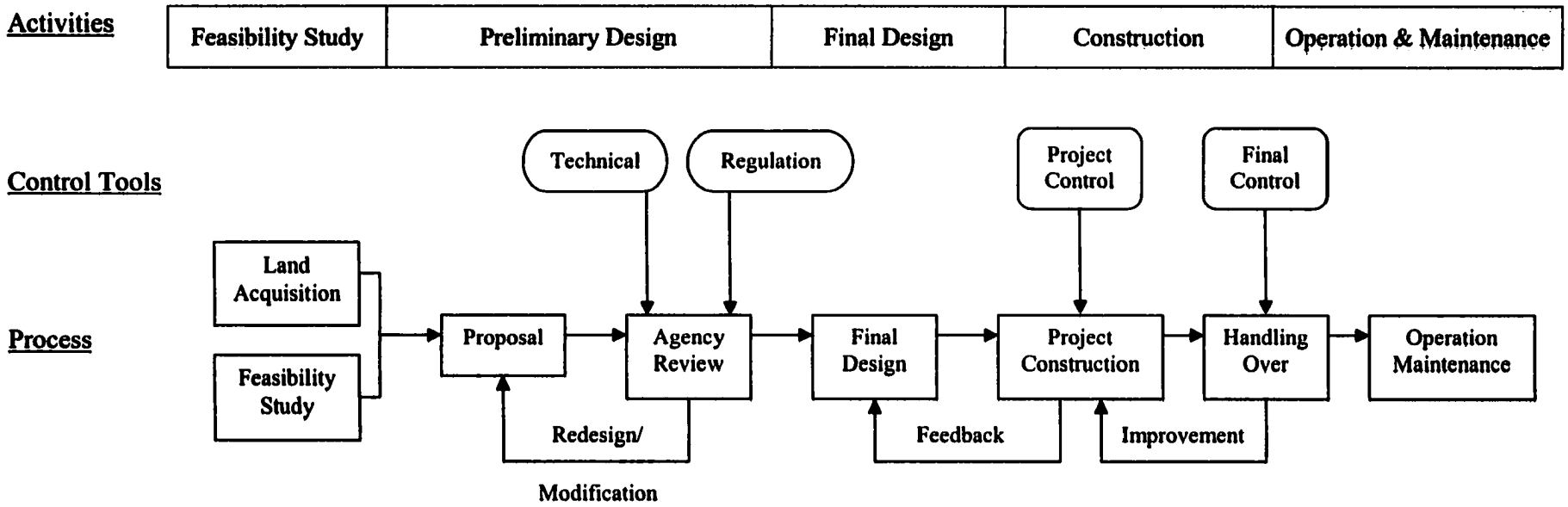


Figure 3.1. Process of Land Development

3.1.3. Government's regulation of land use

In contrast to the United States, the Indonesian central government is involved in regulation of land use. This includes agencies such as the Department of Home Affairs, the National Land Board Office, the State Ministry of Population and Environmental Affairs, the State Ministry of Housing, and the Department of Public Works. Also, regional officials are involved, including the Regent, the Governor of the province, and local Head of the department office.

For small developments (less than five ha), approval rests with the Regent or Head of the Regency and for larger parcels, approval comes from the Governor of the Province with recommendation from the Regent.

Regulations of the Minister of Home Affairs concern the composition of development, and state that 40 percent of the area should accommodate infrastructure and public facilities, including roads, drainage ditches/canals, environmental gardens, open spaces, sports facilities, places of worship and health facilities. Each lot can have 60% of building coverage, but in areas with such as recharge areas, the building coverage is only 20%. This national regulation illustrates a point, which will become important later, the specification of development rules at the national level, whereas in the United States, this is a local prerogative.

The approval situation is complex. Developers deal with separate agencies for different facilities. For example, for a separate sports club facility, approval should be obtained from the Minister of Youth and Sports. For a private water treatment plant, the developer has to deal with the Department of Public Works, through the Directorate

General of Water Resources. The following chart, Figure 3.2. illustrates the process of approval in land development.

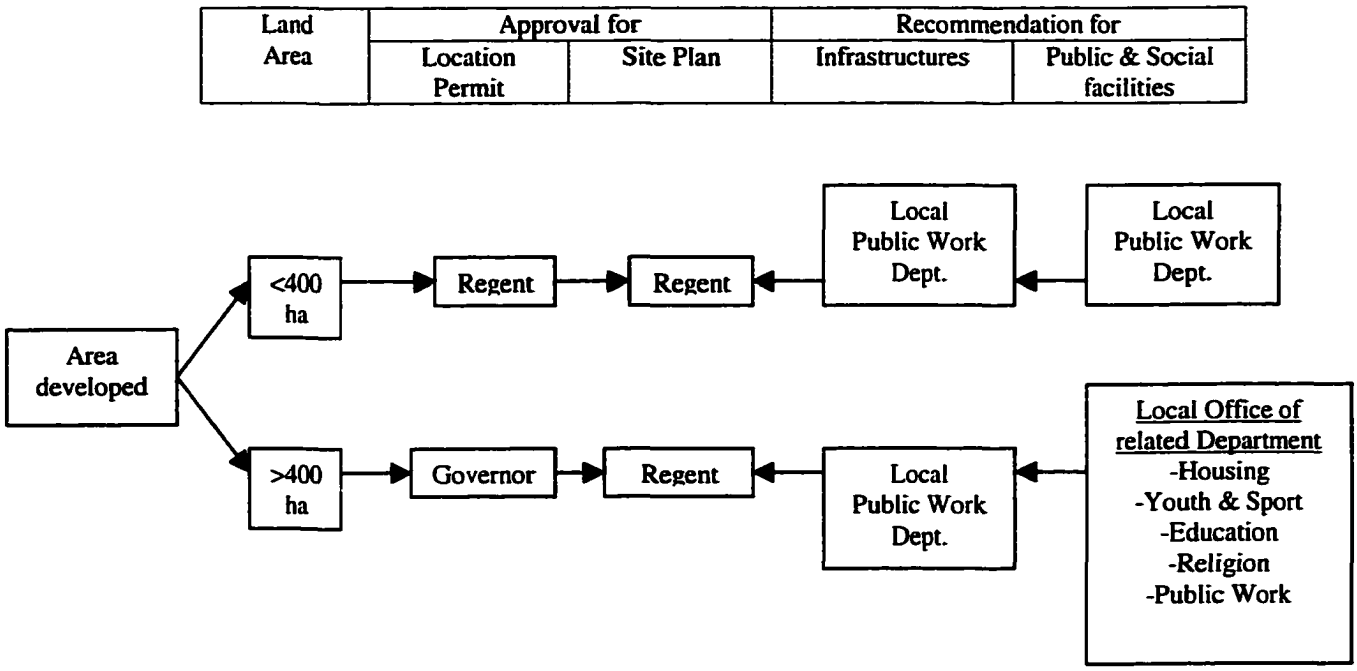


Figure 3.2. Approval process in land development

After all houses have been sold and after tests for quality standards, the Developer transfers infrastructure and facilities to the local government.

Construction of houses and residential areas is regulated by Broad Guidelines for the National Development) of 1978 Chapter IV, sub D, point 7 sub a and d, (GBHN) which cover increasing supply of housing and affordable housing; and the government's role in land planning. This does not include ownership by the government, but gives the government strong roles in land use management, including distribution of land and legal relationships between people and land.

Ownership of land carries social functions with it. According to Article 6 of the Basic Agrarian Law these include limits on ownership; equity in ownership; protection of the poor; promotion of cooperation; productive use of land; provision for condemnation in public interest; responsibility to protect land; and special provisions for religious and public uses.

Another policy instrument is the regulation on land development, normally included in the master plan of the city, when it exists. Use of land in urban areas differs from use in rural areas, where the economic base is agriculture. In urban areas, development is mainly for building and efficiency in use of space for population density. In urban areas changes in land use are frequent, in line with increase in people and needs. This causes problems like uncontrolled development, traffic jams, environmental pollution and others, and enforcement of regulations is required.

3.1.4. Demand for housing

The need for housing is related to population growth and the average number of people in a family. A high growth rate and decrease in number of persons in a family will increase the need for housing, as is happening in the urban areas of Indonesia.

Indonesia has a large population and high growth rate. In 1980, 30.5 million people lived in 384 urban areas with population of 10,000 or more, with 40% or 12.2 million people living in five cities of more than one million inhabitants (Jakarta, Surabaya, Bandung, Medan and Semarang). In 1995 the capital city of Jakarta was the largest with about 9.7 million people (CBS, City in Figure, 1995).

Indonesia now has about 210 million people and a growth rate of 2.3% per annum. Only about 60% of the people can meet their housing need, and the remainder

needs government assistance (REI, 1998). Thus, the government gives priority to low-cost houses with affordable mortgages. If a house is occupied by an average of five persons, the annual need for new houses in Indonesia is approximately 851,000 units. This number is needed just for new population growth and does not include houses needing replacement and rehabilitation. Only about 106,750 new houses per year can be provided currently or only 12.5% of the need. This imbalance occurs because of high urban growth from natural increase and migration; increasing cost of house construction; limited incomes; and limited funds available nationally.

Meanwhile, some people like to buy luxury homes beyond their capability, and developers take advantage of this, which may lead to default on loans.

Another phenomenon is reducing the size of houses for the lower middle class, especially for houses built with a mortgage. This offsets the cost of houses exceeding the income of the people. Reduction in size of houses is thus not because the occupant wants to be more efficient, but of limited income.

Another side of the housing problem is economic globalization. For example, Jakarta as the capital of Indonesia is a preferred destination for foreign investors in property, increasing frequency and intensity of land development. The acceleration of land development in Jakarta caused relocation of several residential areas and spectacular increases in the price of land. This situation had a strong social effect on the population, both directly and indirectly.

3.1.5. Technological environment

Unlike computer technology, the technology of house construction hardly changes at all. Prefabricated housing is not popular, and is only used to build high-rise, low-cost lease

apartments. Technology to build houses is considered simple and requires human resources, from laborers to professionals like architects, managers, socio-economic experts, and experts in other fields.

Capability of government planning staffs in the field of housing should be improved, including quality control, implementation, building systems and other areas.

3.1.6. The real estate industry

The housing industry in Indonesia involves public–private cooperation. The government determines the target for construction in five-year development plans. For the fifth Plan (1989-1994), it set the target of 450,000 units of housing of which 73% has to be built by members of the Indonesian Real Estate Association (REI). Another builder is the 'Perum Perumnas', a public corporation of the National Housing Authority.

Growth of the real estate industry is indicated by increase in membership of REI since its establishment in 1972 (See Figure 3.3). The members increased from 32 in 1972 to nearly 2500 by 1996 (REI, 1998). The number of houses constructed by REI members increased from a total of 498 units in 1976 to 627,052 units in 1990.

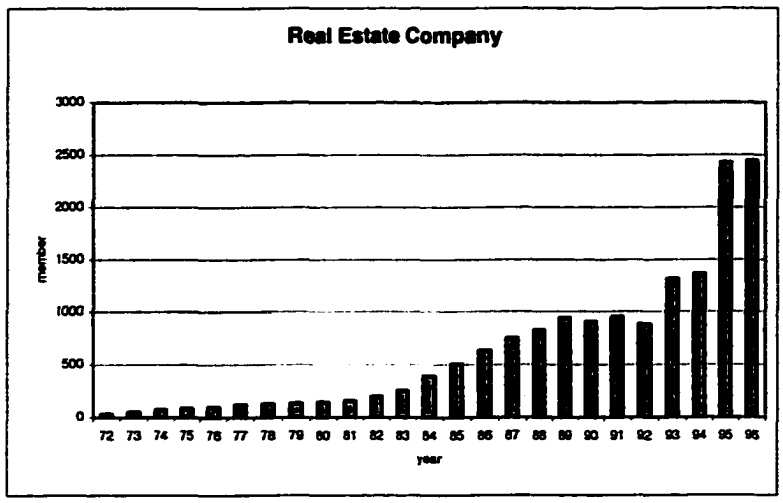


Figure 3.3. Member of REI

3.1.7. The Interaction of Flood Problems in new residential developments

The impact of new residential developments to cause increased flooding is shown by Figure 3.4.

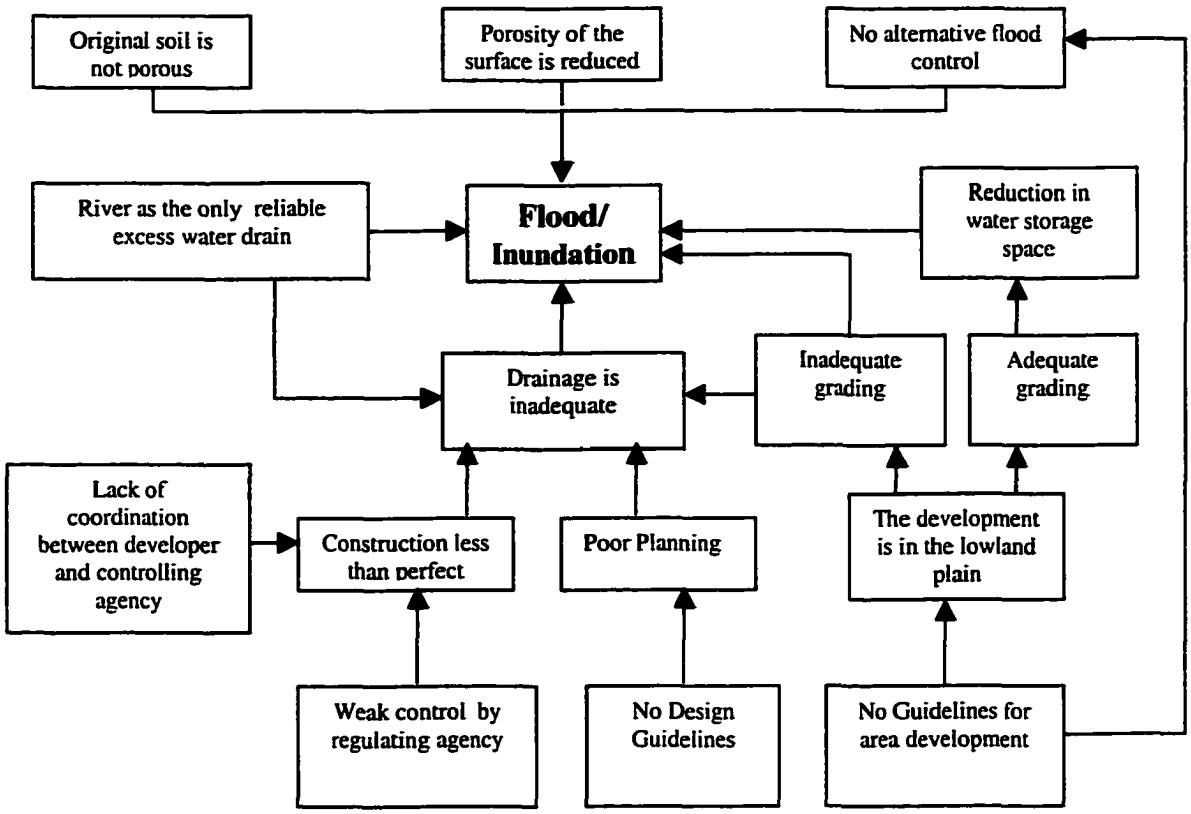


Figure 3.4. Factors related to flood in a new residential area

The diagram shows relationships between new residential development, infrastructure, neighborhood, community behavior, economic factor and institutional roles.

In addition to drainage problems, the flood system is affected by daily activities such as bath, cleaning, toilet and other household activities of poor residents. Jakarta has

20.1% poor in its total population (UN Habitat, 1996). Figure A.1, A.2, A.3. and A.4. in Appendix A illustrates this condition.

Socially speaking, the awareness towards water hygiene, especially river hygiene, is very low, as shown by the disposal of garbage to the river (Figure A.5. Appendix A). This not only affects water quality, but also decreases flow capacity and its function as a source of supply. Lack of organized and affordable public works to collect garbage is, of course, a factor.

Inadequate drainage systems in new residential developments is caused by planning and construction factors. The lack of expertise in engineering design requires better technical guidance. Figure 3.4. shows the connection of poor planning and low performance.

Construction quality is influenced by control exercised by the regulatory agency and coordination between the developer and the agency. Without coordination, construction may be implemented with design changes that do not consider future conditions, for which the planning has in fact been made. Provincial governments can exercise control over urban drainage, runoff quantity and quality, watershed planning and land use management, but drainage works are installed under municipal control.

The weak supervision is caused by lack of a specific agency with a mandate to supervise and by overlap and conflicts in roles. Overlaps lead to time consuming redundant reviews of the same information.

Inadequate regulations cause a weak control mechanism and also lead to unclear responsibilities. Unclear authority causes agency roles to overlap, thus making control mechanisms ineffective and muddling the work sphere. The unclear responsibility of each

agency also explains the lack of guidelines on development on technical design for drainage systems.

Guidelines on building new residential developments are very important, considering that developers give priority to locations that are not only flat, but also low in elevation. Fast-growing towns are often located near the coast having a slope of less than 3% and location these are subject to flood. Also low areas close to natural canals/ditches floods caused by rainwater cannot be avoided.

Developers favor low land because it may be low in price and profitable. Developers usually raise the elevation of the land to increase the selling price, but leveling may be faulty. However, increasing the elevation of the area eliminates storage space for excess water and leads to relocation of floods to the developments around it. The surrounding developments are developments that have been built earlier and may have a satisfactory drainage system at that time, so that they were never bothered by floods or inundation. However, new flood problems may occur by this "displaced water." Drainage law in the United States deals with this problem (see Grigg, 1996).

Clearly, guidelines on the construction of drainage systems and on land development of area become very important.

Many engineering issues arise in proper design. These would include alternative flood control systems, such as detention or retention ponds, consideration of physical condition of soils, and other issues. Low areas were often rice fields in the past and may have low porosity.

Now we have explained how new development occurs, how it affects flooding, and we turn to explain the Bekasi case.

3.2. BEKASI AS A NEW RESIDENTIAL DEVELOPMENT IN INDONESIA

Bekasi regency, is typical of Indonesia, and is authorized by Law No. 22 year 1999, which gives it authority to manage its region.

Population growth in Bekasi is affected by urbanization and increase in commuters from Bekasi to Jakarta. Its new development influences storm drainage and flood control substantially.

3.2.1. General overview

Some key aspects of the Bekasi regency are:

- Area of 127,388 Ha (Table B.2, Appendix B)
- Located in northern part of West Java (Figure A.6, A.7, A.8, Appendix A)
- Contains 15 Kecamatan (Districts) and 187 Desa (Villages)
  (Table B.2, Appendix B)
- Relatively has flat topography (Figure A.9, Appendix A)
- Rainfall depth 1,408 – 3,190 mm and duration 84 – 139 days
  (Table B.3, Appendix B)
- Drained by16 rivers, ranging from 3 - 80 meters in width
  (Figure A.10, Appendix A)
- Has critical forest area of 9,074 ha (too small for groundwater recharge and ecosystem protection)
- About 19,745 ha (15.5%) of Bekasi have seawater intrusion, while 25,605 ha (20.1%) has shallow ground water

3.2.2. Government Organization

Government administration in Indonesia consists of Central Government, Province Government, Regency Government, District Region and the Village.

In Bekasi, a Bupati serves as Region Head. The organization is based on local ordinance number 11, year of 1992. The Regent (Bupati) assisted by a Regent Secretary (Sekwilda), who has 3 assistants: Regional Administration Assistant, Administration Assistant and Development Administration Assistant. A Regent as executive authority works with the Region Council as the legislative authority. The Sekwilda assists the Regent in government implementation, development and character building. In addition, the Sekwilda conducts administration and organization and provides technical administrative services to other agencies.

3.2.3. Population and employment

Population in Bekasi in 1998 was 1,613,195 with 1,266 inhabitants/km2. Rate of growth for period of 1994 - 1997 was 6.34%. Table B.4. Appendix B illustrates the condition of population in Bekasi. Employment is: industrial sector 30.72%, trading 22.16%, services 19.34%, agriculture 5.69%, transportation 14.52% and the remaining derived from construction, bank and finance institution, mining and exploration, etc.

3.2.4. Development in Bekasi

3.2.4.1. Economic Indicator

The Gross Domestic Regional Product (PDRB) in Bekasi is increasing. Growth is dominated by industrial sector, which contributed 68,31% in 1997. Other contribution is from trading sector with 14,28% and agriculture sector with only 3,91%. (See Table B.5, Appendix B).

3.2.4.2. The regional planning and development Board

Region development planning is by the Regional Development Board (BAPPEDA). The authority is in Local Government Regulation No. 05/HK-PD/OP.021.2/81, year of 1984. Structural position and function of BAPPEDA according to Regent Decree of Bekasi No. 07, year of 2000 is described as follows.

BAPPEDA is responsible for defining the basic concept for region development, region five years development planning (REPELITA) and yearly Program Implementation, which is either funded by the region itself or proposed to the Province Government to be included in Province Development program, or proposed to the Central Government to be included in National Program.

Physical and Infrastructure Division is responsible for compiling, processing and comprising material for development planning in statistic and report sector which includes the activities of compiling data, analyst and evaluation of all report submitted by official/agency/institute, vertical institute and all district in Bekasi region.

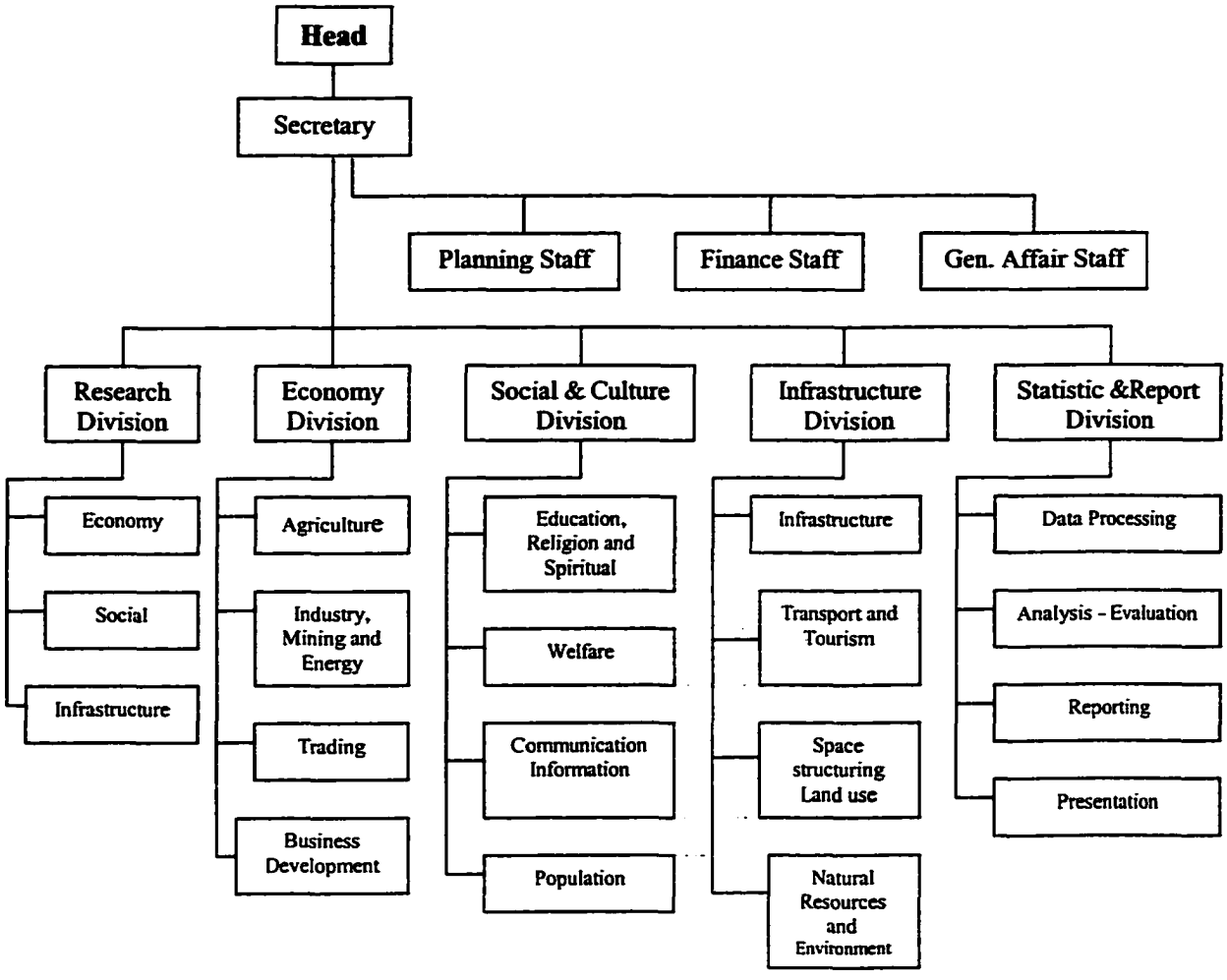


Figure 3.5. Organizational chart of BAPPEDA

(The Regional Planning and Development Board)

3.2.4.3. Development implementation in Bekasi

Development implementation in Bekasi is governed by the Five Years Region Development Planning (REPELITA).

Development objectives in residential areas for REPELITA VII (1999 - 2004) are paraphrased as follows:

1. Control of healthy residential supplies.
2. Increase living quality and create harmonious and solidarity of the society, and raise value of religion and culture.
3. Provide quality and evenly distributed residences within a health and decent neighborhood and a living environment with security, peace and prosperity at an affordable price.
4. Enable growth of integrated residential areas according to space system planning, inter-relatedness and social environment and legal assurance.
5. Increase the initiative and role of society in business to upgrade and complete the residential area.
6. Expand social and health facility, healthy water supply, religious service, education, trading and transportation, infrastructure including the drainage system and other important facilities in evenly distributed according to population growth environment, social, economy and cultural activities and region space system planning.

3.2.4.4. Residential Development

During PELITA VI (1994-1999), residential sector development was directed to upgrading the condition of actual residential environment, to renovation of villages and to the residence illumination program.

The residential development and improvement realization is as follows:

1. The issuance of permit and recommendation for residential in 187 location with total area of 15.037 ha.
2. Improvement of residential area which its facilities and infrastructure is not sufficient. This activity is carried out in 15 sub districts (Kecamatan), covering for 83 villages.
3. The implementation of depressed area renovation in urban area.

Total number of developers who establish residential development in Bekasi in 1998 is 71 developers with total land use of 15.542,99 ha.

Trend of developed area in Bekasi regency (Kabupaten Bekasi) from 1993 to 1996 is indicated in the Table B.6. Appendix B. Trend of the location permit for residential area and industrial area in Bekasi from 1979 to 1996 is also illustrated in Table B.7. Appendix B.

3.2.4.5. Consolidation and space structuring development

Based on the objective of REPELITA VI carried out until 1999, Bekasi had accomplished the space structure, which includes space planning, purpose and control. The structuring scope is limited to village/region, urban, mainstay and special region. The land use plan for year 2003 in Bekasi is generally for agriculture with its contribution as indicated in Table B.8. Appendix B. In structuring the urban area there area several elements of

guidance are applied such as RUTRK (Master Planning for Urban Space), RDTRK (Detail Planning for Urban Space) and RTRK (Technical Planning for Urban Space). The erection of new residential development also affects the decreasing agricultural area. The agricultural area in Bekasi in 1998 is 56,186 ha or equal to 44,10% from the total area. The rice field area is decreasing compared to 1997, which covers 56.311 ha. We have seen now how Bekasi was developed, and we examine the status of flooding.

3.2.5. Implementation of Storm Drainage and Flood Control in the Bekasi Regency

3.2.5.1. Current situation

We will discuss policy and plans first, then turn to the current situation. Policy and strategy for SDFC comes from provincial government through the Directorate General of Planning and Engineering (Cipta Karya) of the Department of Public Works. The policy is contained in the 1998 - 1999 space assignment plan for the Jabotabek (Jakarta, Bogor, Tangerang, Bekasi) area. The policy aims to create a flood and inundation free city environment by adjusting the watersheds through united and coordinated efforts in river control with a regional drainage system.

To realize this, the following steps and efforts were initiated.

1. Utilize the 100 year flood for protection
2. Increase capacity of rivers by dredging
3. Improve and restore the function of lakes and reservoirs
4. Preserve functions of the conservation forests, especially water functions
5. Construct a connection between the Ciliwung - Cisadane rivers in the Bogor Regency

6. Control building on river banks in the Jakarta - Bogor - Tangerang - Bekasi area by reforesting or clearing buildings from, in accordance with the existing river border line
7. Exercise land use control in watersheds to maintain appropriate functions
8. Construct flood control systems for control purposes
9. Increase the role of the community in guarding the river.

Some steps and efforts are short term and some are long term, but floods cannot be postponed as new developments continue.

Meanwhile, the RDPB (Regional Development Planning Board) is making a study of the drainage system in the Bekasi Regency to add detail to the knowledge base. Through cooperation with engineering consultants, the purpose of this study is to anticipate the increasing possibility of floods in the residential developments, industrial areas and agricultural/rice field areas existing in the region. The study will provide direction to the planning and implementation of drainage development and make recommendations within the framework of the development program for the Bekasi Regency. The recommendation emerging from this study is to create blocks of drainage service and normalization of rivers, drainage canals and waterworks.

The strategy and the study discussed shows that total response is still inadequate. Strategy No. 6 (controlling building) will be especially difficult to implement because it will bear a large social cost.

As strategies are difficult to execute and recommendations are lacking in scope, it is not surprising that floods and inundation occur in the region. This condition exists in old residential developments and in recently built residential developments. It is ironical

when a newly developed area, where flooding should have been anticipated, is still flooded when rains come.

There are several interrelated problems. The change of the Bekasi area from rice fields (agricultural area) to a housing and industrial area has reduced the draining capacity of the soil, thereby increasing the surface flow and finally raising the quantity of water in the river.

1. Reduction in the area of swamps in the lowland plains, which functioned as natural flood control.
2. The main drainage system was not designed as the drainage system of a town and no fast development was anticipated.
3. The existing drainage ditches have changed into household garbage and refuse dumps.
4. Manmade obstructions in the form of railroad tracks, national roads, irrigation canals and toll roads, have restricted the flow.
5. The sizes of the ditches, siphons and culverts at the crossing with the manmade obstructions are relatively small, so that during a rain the flow is restricted.
6. Efforts at flood control are not coordinated; there is no model or clear directive concerning the direction of the drainage of rainwater.

Inundation continues, as shown by this example flood map. This situation occurred in part of the Kemamg Pratama estate (Figure 3.6.).

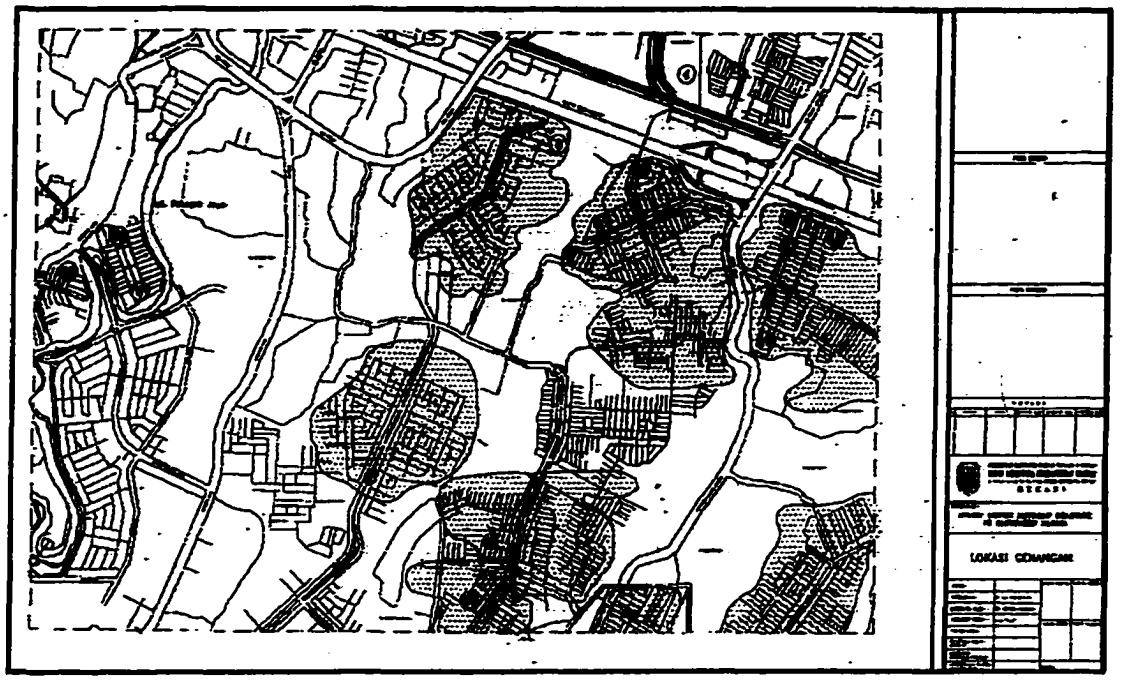


Figure 3.6. Flooding area at Kemang Pratama Estate

3.2.5.2. Institutional Aspect

Current institutional arrangements are not adequate to handle this problem. Attention of the regional government of the Bekasi Regency towards drainage and flood control is low, as can be seen from the organizational structure of the government, where there is no agency responsible for infrastructure at the sub section or the section level. In the organizational structure there is only a City sub section, which among others covers the city's infrastructure problems, which include drainage and flood control problems. This situation occurs not only in the Bekasi Regency, but also in the other regencies in Indonesia, considering that there is a similarity in the form and structure of the government organization. This means that the government appears to have many other problems to solve and is not giving attention to SDFC.

The rules and regulations, which form the basic control in implementing the development in new residential areas, are as follows:

1. The regulation of the State Minister of National Board Land Office number 2, 1999 date 10 February 1999 regarding Location Permits.
2. The regulation of Home Affair Minister number 5, 1974 regarding stipulation on land supply and distribution for real estate business.
3. The regulation of Home Affair Minister number 1, 1987 regarding the hands over of infrastructure and Public facility to Local government.
4. The regulation of Home Affair Minister number 590/441/Bangda, date 9 February 1991 regarding the land supply for public facility for housing developer companies.
5. The Home Affair Minister instruction number 30, 1990 regarding the hands over of infrastructure and public facility to local government.
6. The regulation of Home Affair Minister number 2, 1987 regarding the city planning guidance.
7. The regulation of Home Affair Minister number 15, 1975 regarding the determination on land acquisition mechanism.
8. The regulation of Home Affair Minister number 3, 1987 regarding the preparation and distribution for Land Rights for housing developer companies.
9. Law number 4, 1992 regarding housing and residences development.
10. Collective Decree, Home Affair Minister, Public Works Minister and Housing State Minister number 648-384, 1992, Number 739/KPTS/1992, Number

09/KPTS/1992 regarding the balancing among small, medium and large of housing and residences development.

11. Governor Decree/Head of West Java Province, number 593.82/1589/Pem.Um, date 19 May 1990 regarding the order for land acquisition implementation by private companies.
12. Governor Decree/Head of West Java Province, number 593.82/4539/Pem.Um, date 4 December 1990 regarding the order for location permit and land acquisition for private companies.
13. Housing Minister number 149/BT 01 01/M/7/88 date 13 July 1988 regarding the compulsory for developers companies to become the REI member.
14. The Home Affair Minister letter/Directorate General for Public Government and Region Autonomy, number 648.3/3876/PUOD date 26 October 1988 regarding the compulsory membership of developers into REI.
15. The State Minister of National Land Board Office' circular, number 410-2784 date 3 October 1996 regarding the Control/Curb for the Housing/Residences location permits in Bogor-Tangerang-Bekasi region.
16. Government regulation number 40 dates June 17, 1996 regarding land possession category.

The following Table (Table 3.1) shows relationship between those regulations and developer or development activities.

Table 3.1. Regulation on Land development

Object	Regulation
Developer companies	1. Housing Minister #149/BT0101/M7/88 2. Home Affair Minister #648.3/3876/PUOD/88
Development activities A. Permits	1. National Land Board Office #410-2784/1996 2. National Land Board Office #2/1999 3. Governor decree #593.83/1990
B. Land acquisition	1. Home Affair Minister #5/1974 2. Home Affair Minister #590/441/91 3. Home Affair Minister #15/1975 4. Home Affair Minister #3/1987 5. Governor decree #593.82/1990
C. Site Planning	1. Home Affair Minister #2/1987
D. Housing and residence	1. Law #4/1992 2. Collective decree #648-384/1992
E. Land possession	1. Government #40/1996
F. Hands over	1. Home Affair Minister #1/1987 2. Home Affair Minister #30/1990
G. Storm Drainage and Flood Control	NONE

The rule and regulation listed above apparently only conduct the development procedure and regulate the developer company. No regulation specifically covers SDFC.

3.2.5.3. Financial Aspect

Since construction of drainage channel systems is usually done at the same time with the construction of the street/road facility, developers usually add the capital cost for the SDFC into the infrastructure cost. The infrastructure cost is including the street/road, ditches, bridges, culverts, sidewalk, etc. However, there are no funds for maintenance. As previously described, drainage channels in Bekasi are directly lead to the river. The same condition also happens in a new residential area. The capital cost required for the

construction of SDFC in new residential area is merely for the drainage channel system (minor system).

From the above explanation the conclusion can be drawn that an analysis and a proposal for a storm water and flood management system in new residential developments are very badly needed. Therefore, in the following chapter a model for a storm drainage and flood control management system will be presented.

CHAPTER 4

MANAGEMENT MODEL FOR STORM DRAINAGE AND FLOOD CONTROL IN NEW RESIDENTIAL DEVELOPMENTS IN DEVELOPING COUNTRIES

4.1. INTRODUCTION

This chapter presents a model of a management system for stormwater and flood control facilities in a new residential development in developing countries, particularly Indonesia. The term "model" in this case refers to the management system, not a mathematical or computer model. Problems in stormwater and flood control spread over a diverse spectrum, such as: land and water planning; regulatory aspect; control and enforcement; detention/retention of runoff; designing, operating and maintaining drainage facilities. Therefore, the management model is required as a roadmap, charting a course through the entire spectrum of storm drainage and flood control activities. This is intended to serve as a policy and development guide for the planning and implementation of improved storm drainage and flood control systems, and to guide parties in different roles in establishing their parts of a new and improved comprehensive management system. The management system, as defined earlier, has institutional, technical and financial aspects. So, the model is intended to be a pattern, which presents methods to solve SDFC problems in the three categories—institutional, technical and financial.

This model was developed with two goals: to describe all activities that are necessary to implement successful storm drainage and flood control facilities in new residential areas, and to present the information in a form that is easy to understand and succeeds in guiding those responsible for the day-to-day management of SDFC facilities

and programs. It focuses on storm drainage and flood control in new residential developments, but does not cover the regulation of flood plain land uses.

The first part of the discussion is about the conceptual framework of storm drainage and flood control management, which will guide development of the management model. Then, the details of the model are presented.

4.2. FRAMEWORK OF THE MANAGEMENT MODEL

Figure 4.1. shows the interrelated elements of the model, including the institutional structure, supporting components, and parties involved.

The institutional part includes development and land use, overall coordination, and regulatory matters. The technical part includes site planning, engineering design, construction, operation and maintenance, and the financial part includes the cost sharing and financial management systems.

Roles and responsibilities are assigned to the real estate developer, related to the development and land use, to local government in charge in infrastructure development, to central government in the regulatory aspect, to the intergovernmental agency for overall coordination, and to other parties involved in SDFC such as professionals and local residents.

Supporting components are the site plan, master plan, rules, project management, standards, manual and training. Parties or actors involved in SDFC matters are entrepreneurs, developers, engineers, planners, investors, marketing agency, public interest group, city staff, lawyers, contractors, suppliers, real estate interest, intergovernmental agency and the public.

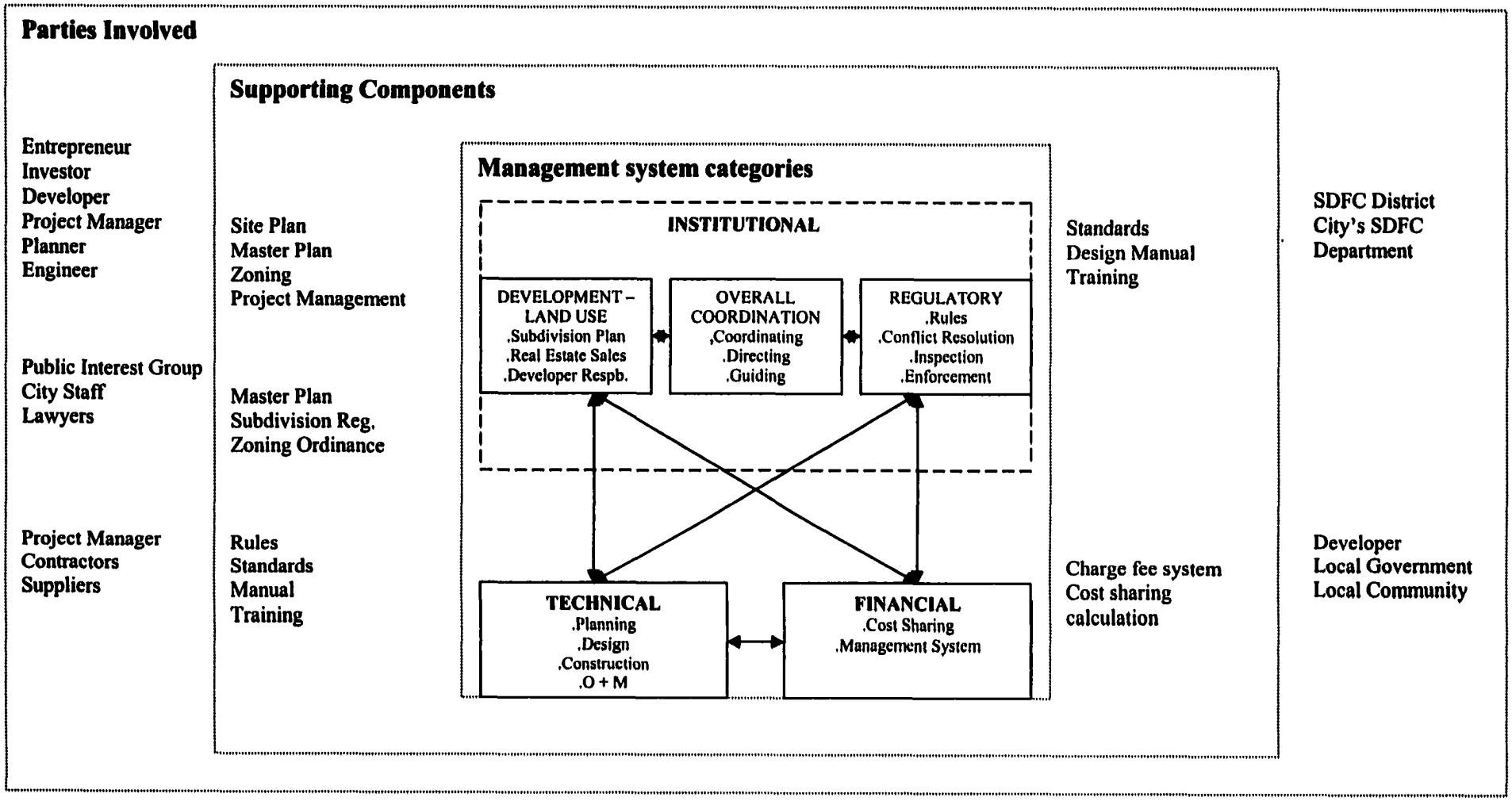


Figure 4.1. Management Environment to Solve SDFC Problem

4.3. DESIGN OF THE MODEL

A schematic view of the model of Storm Drainage and Flood Control Management is shown in Figure 4.2.

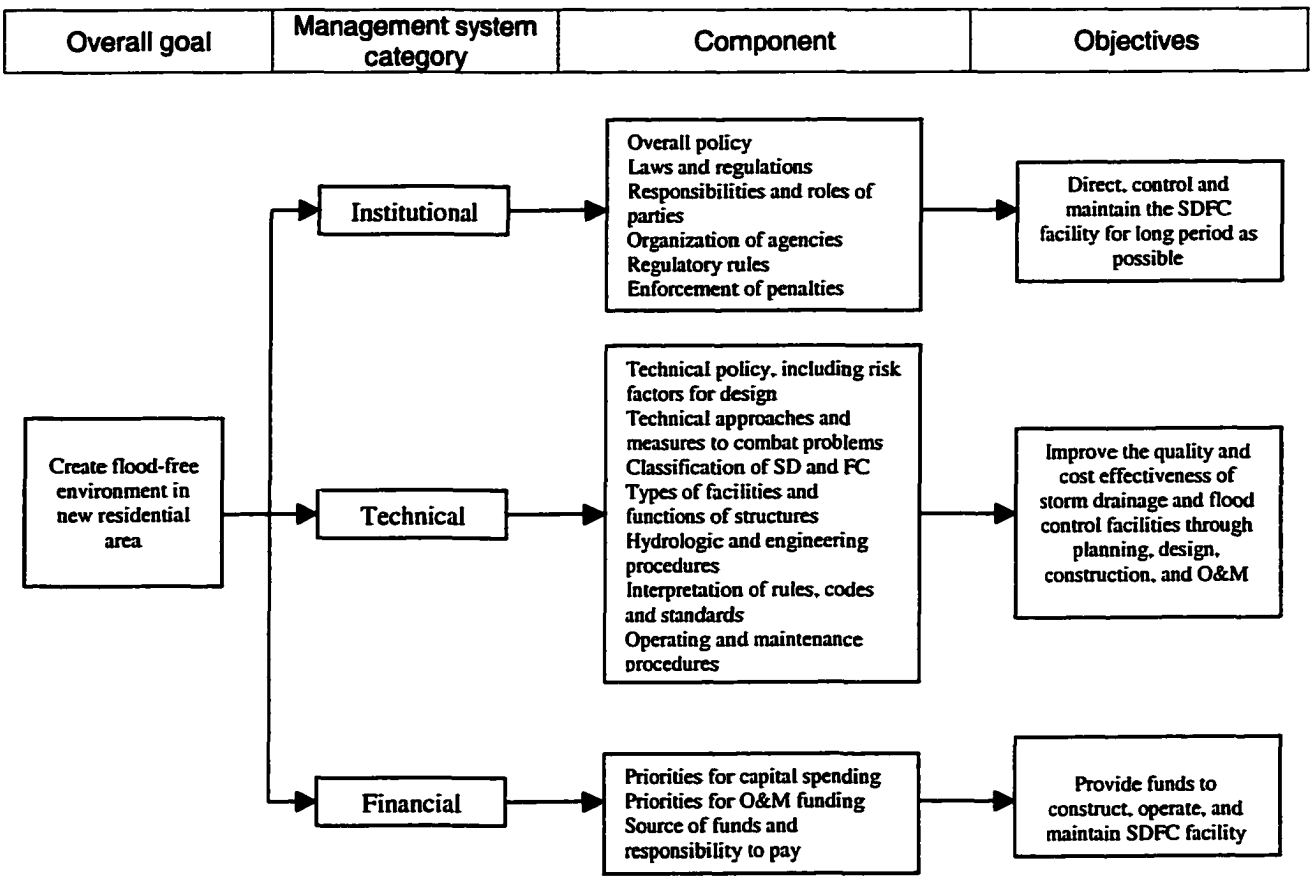


Figure 4.2. Basic Management Model

The institutional aspect is related to the entities concerned with SDFC, regarding duties, authority and regulations, and control system. The technical aspect centers on planning, engineering design, and operation and maintenance of the SDFC facilities. The

financial aspect deals with sources of funds to build the SDFC families and the allocation of costs to each party deriving advantage from the SDFC facilities concerned.

4.3.1. Institutional Aspect

The discussion of the institutional aspect will cover the organizational framework, including the hierarchy and authority, the organizational functions, the regulatory aspects, and control process in the management of storm drainage and flood control in a new residential development.

As shown on the figure, the components and objectives of the institutional element are as given on this table (Table 4.1).

Table 4.1. Institutional Components

Institutional components	Objectives
Overall policy	To set general conditions for all institutional, technical, and financial aspects of the SDFC program
Organization of agencies	To avoid overlapping and gaps among agencies
Responsibilities and roles of parties	To determine tasks necessary and allocate responsibilities for each
Planning & control procedures	To assure satisfactory accomplishment of the SDFC program
Laws and regulations	To implement policies by national, regional, and local legislation
Regulatory rules	To delineate problems and provide general solutions among parties involved
Enforcement of penalties	To ensure that rules and regulations have been implemented

The institutional aspect has roles in connection with the rules and regulations, inspections, conflict resolution, and enforcement. In a particular condition, where a major system, such as retention area, has been established, and developed, the institution responsible for maintaining this facility should be determined. Besides, regulatory

controls protecting facilities from impacts must be clearly defined and enforced by the law so that the purposes of the facilities can be met (Grigg, personal discussion, 2001).

The form of the SDFC organization may vary from one area to the other. This is because there are physical, historical, legal and political variations as well as variations in the financial conditions in each area. However, in each case, the higher levels of organizations have wider ranges of authority to make adjustments between the areas concerned, as in multi–jurisdictional problems. This is important, since in a particular drainage basin, one area will receive the effects of the activities in another area. This is a common problem in SDFC systems and requires higher levels of government for coordination.

The following section will describe the overall policy, followed by organizational framework, planning and control procedures, and regulatory functions.

4.3.1.1. Policy

Policy should be adopted before ordinances, criteria, administrative regulations, and development plans are issued. The policy would be in the form of laws, regulations, criteria and guidelines.

Policy formation might include a set of stormwater management principles from which subordinate policies will evolve. Such principles should reflect the area's physiography, physical problems, resources and comprehensive plans for land use and regional development. Policy development should consider factors such as: philosophy, attitudes and life styles of the local public; environmental and ecological problems; social, economic, and political problems; community goals and aspirations; demographic characteristics; physiography; intergovernmental relationships; hierarchy of local urban

problems and priorities; characteristics of existing land development; opportunities for urban growth; and applicable local, regional and national laws and regulations. In theory, these will be reflected in law and higher-level policies, such as national and provincial development plans, so that there is a smooth flow of policy between levels and sectors. The end product in the development of a comprehensive policy for SDFC management will reflect the profile of the particular community or area.

4.3.1.2.Organizational Framework

Considering that failure of drainage systems does not only result in property damage, but also causes traffic problems, disruption of commerce, aesthetics, health and other things, an organizational framework to prevent failure of drainage systems becomes important. The drainage problem in a newly constructed residential development cannot be separated from the parties involved in the planning, control, construction and management of the drainage facility concerned, which are:

1. The local government, here the Regency government
2. The developer and design team
3. The Provincial government
4. The Central government, and related ministry such as ministry of home affair, housing, and public work
5. Intergovernmental agency
6. Regional council of government

4.3.1.2.1. Organization of agencies

According to Law No. 22 of the year 1999 on regional autonomy, the local government has responsibility for the infrastructure in its region. In reality, the drainage and flood control problem needs a multi jurisdictional approach. A basin or a sub basin is often located in an area with different jurisdictions. Furthermore, the location of a new residential development developed by a land developer is also often in more than one regional jurisdiction. Therefore, involvement of a higher level of government, such as the provincial government or the central government, is required. The importance of the involvement of a higher regional government is to implement synchronization of regulations from one region to another, and to achieve more integrated control. The conformity of regulations gives the same economic and bureaucratic effect to all developers. Furthermore, to the community, both upstream and downstream, the integrated control will give a feeling of justice, since all parties will be responsible and bear the load of the effect of development.

Figure 4.3. below illustrates the condition of a new residential area, which is located in two different local governments with different jurisdictions. Besides, it is also shown that a single development area could be located in more than one basin.

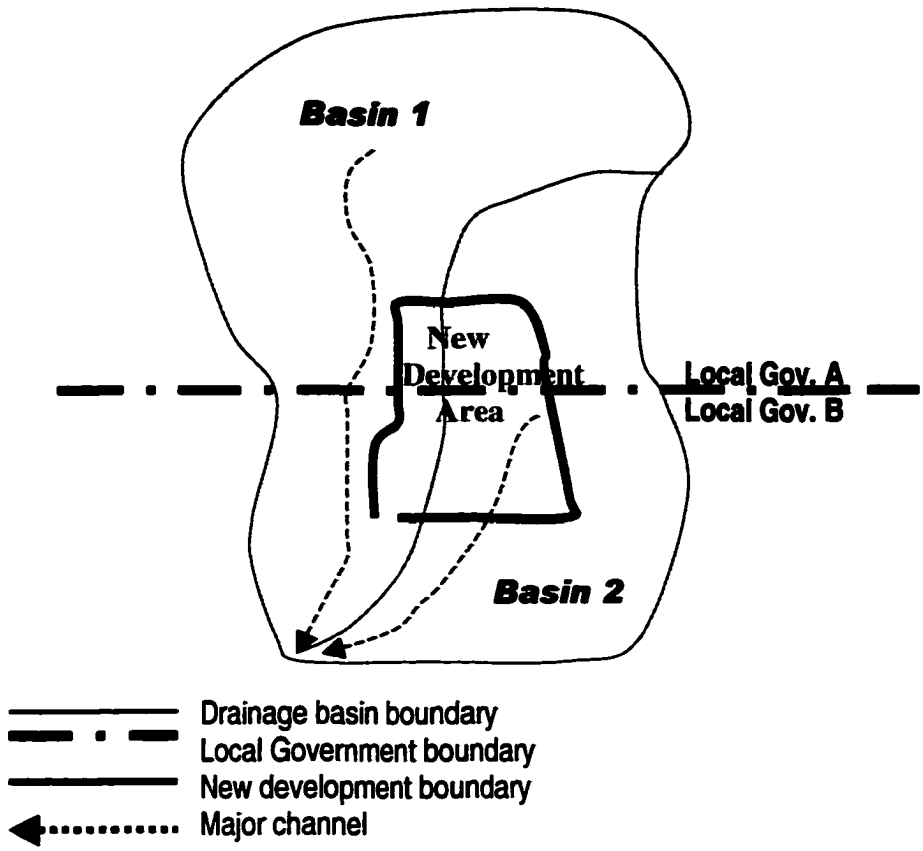


Figure 4.3. Drainage basin configuration

Although the local government has authority in SDFC management, a regional approach to solve storm water drainage and flood problems is required. It will normally be necessary to create a special district, such as a drainage district covering a certain region. Further step, a regulation or law will be enacted to determine the position, duties and responsibilities of this special district.

This district would be an intergovernmental agency, which function as a policy coordinator and to give assistance regarding planning, implementation and control of the SDFC facility development. The SDFC district would be at the provincial level and consist of

representatives of related department such as public work department, State ministry of housing, State ministry of environment. These could function on advisory committees or boards.

4.3.1.2.2. Responsibilities and roles of parties

4.3.1.2.2.1. The developer and government agency

The relationships, roles and responsibility of each party in the management of the SDFC facility are shown in the following diagram (Figure 4.4).

Stages	Site Planning and Engineering Design		Construction	Operation and Maintenance	
Functions	Guidance	Control	Construction	Operation and Maintenance	
				Before a transfer to the government	After a transfer to the government
Involved Parties	Dept. of Public Work				
	Dept. of Home Affair				
	Dept of Housing				
	SDFC District	The Local gov.			The Local gov.
		The Provincial gov.			
		The central gov.			
			Developer	Developer	

Figure 4.4. The roles and responsibility of parties involved in SDFC

In order to avoid overlapping and gap in managing SDFC, the hierarchy, authority and responsibility of each parties involved in SDFC should be mapped clearly. Figure 4.5. below illustrates this configuration.

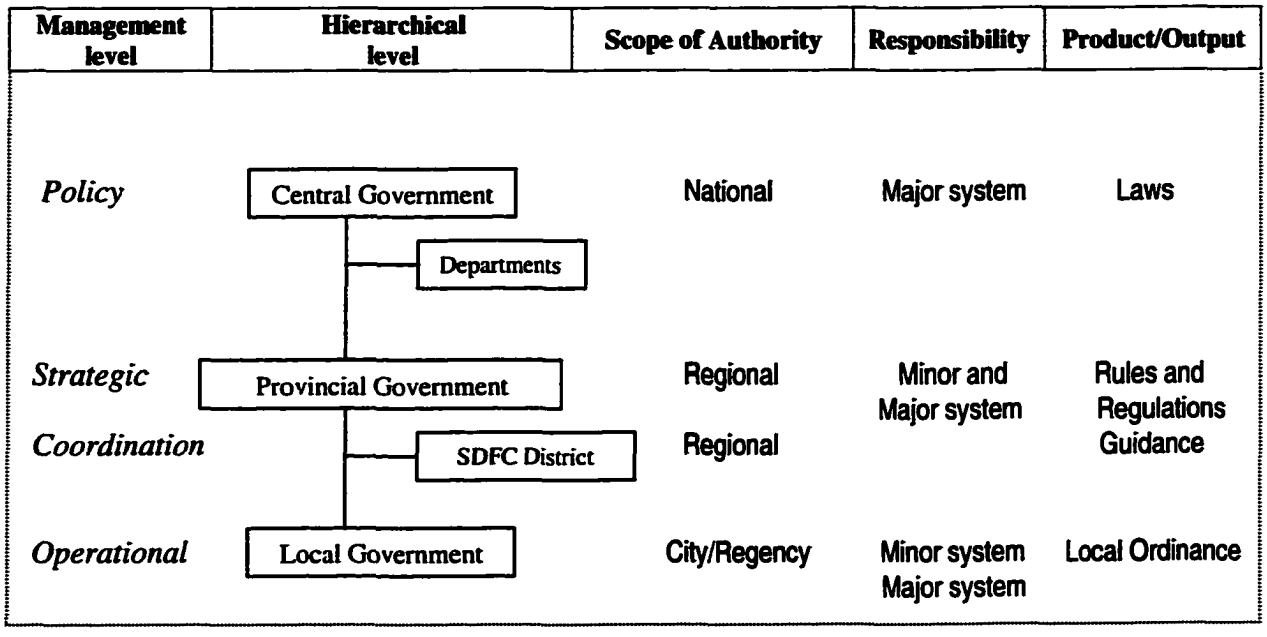


Figure 4.5. The configuration of hierarchy, authority and responsibility

4.3.1.2.2.2. The role of the community

For the maintenance of a minor SDFC facility the community, or the population of the new residential development, can be involved. They directly utilize and enjoy the SDFC facility and have a stake in it. Participation of the community can be encouraged by the Community Coordinator, the Head of the Rukun Tetangga or Neighborhood Association on the level of the Neighborhood Association, and the Head of the Rukun Warga or Administrative Unit, which coordinates several Neighborhood Associations, on the Administrative Unit level, or at the sub district or village level, coordinated by the sub district or village Head. Implementation of participation can be weekly or on public holidays but the activity is limited to work, or non-

material maintenance. When maintenance requires physical repair that needs funds and/or higher levels of skill, a separate agency is required. Prior to transfer, maintenance of a SDFC facility is the responsibility of the developer, and the responsibility of the local government after it has been transferred.

4.3.1.3. Planning and control procedures

4.3.1.3.1. Planning procedure

The local government or agency involved should implement the following matters.

1. Develop a set of goals and objectives for meeting present and future problems.
2. Develop a complete master plan for every drainage basin involved, giving the proper direction for the assignment of priorities.
3. Along with the master drainage plan, develop detailed plans and design criteria.
4. Implement the plans, allowing for future developments, which may offer or need new solutions.
5. Update the plan at regular intervals of time.

The sequence of the various stages of site planning and engineering design itself is as described in Figure 4.6.

Firstly, the site plan must conform to the Regional or City Master Plan or the Land Use Plan, and then the regulations on zoning, followed by the regulations on subdivisions. Based on these three regulations, a Land Development Guidance System for the development of a new residential development has to be compiled. Technically, to direct the planning, a design criteria manual is required.

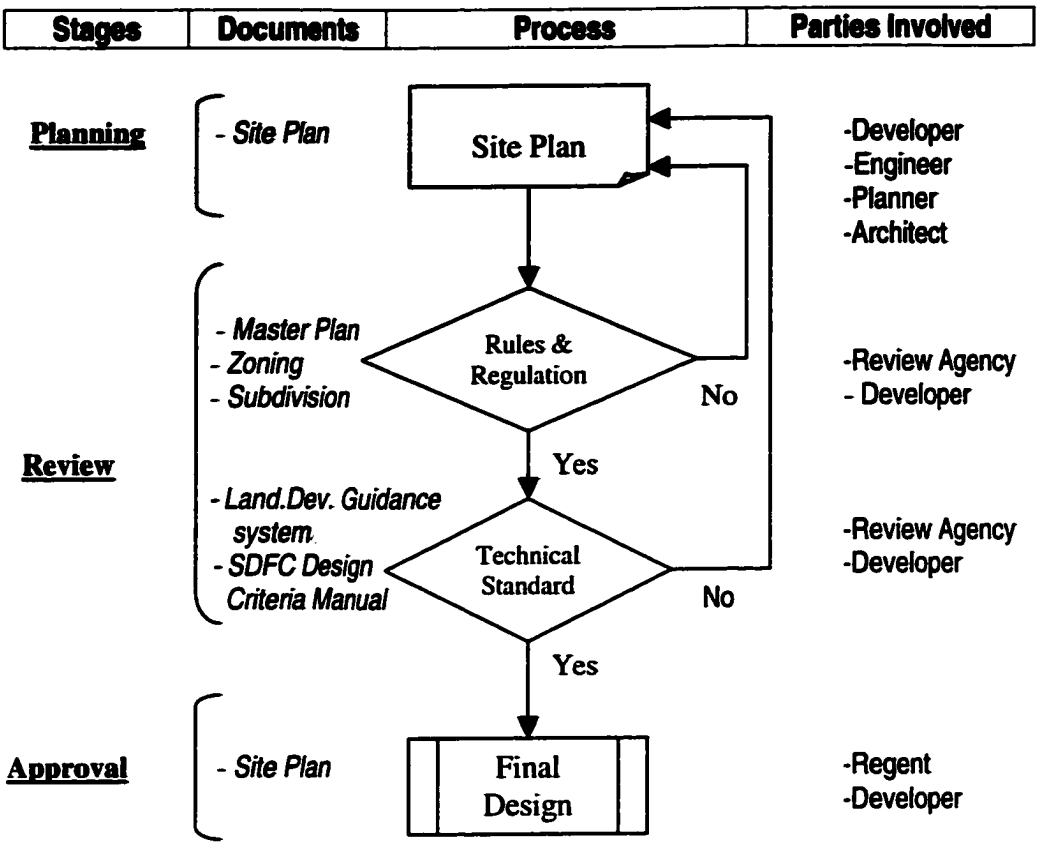


Figure 4.6. Stages in planning process

4.3.1.3.2. Control procedure

The following section will discuss the three types of control on SDFC management.

4.3.1.3.2.1. Preliminary Control

The first step consists of site plan development and engineering design for SDFC facilities. For quality control purposes, these plans must fit with the master plan of the city in general, zoning, subdivision regulation, the land development guidance system, and the design criteria manual for SDFC system development.

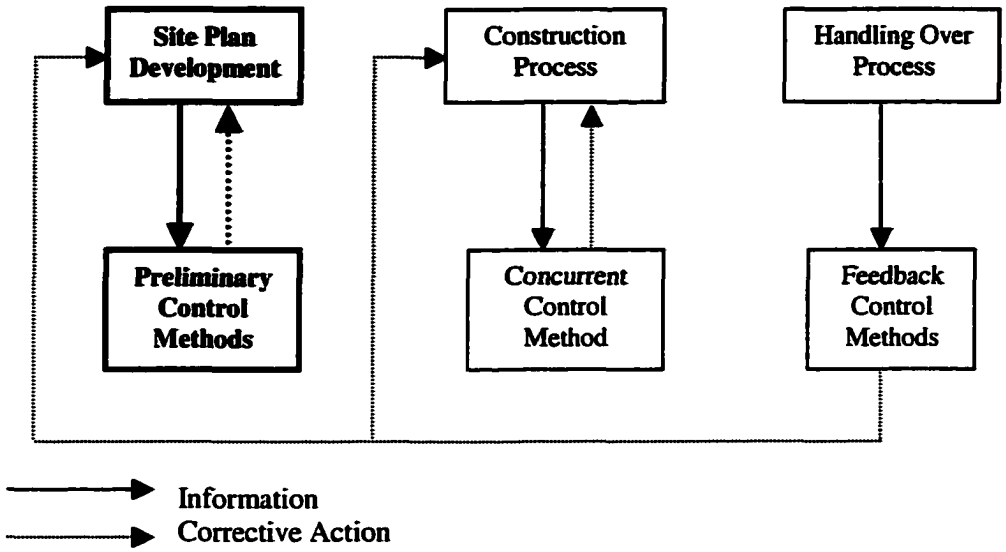


Figure 4.7. The Preliminary Control

Control would be by reviewing of the site plan for new development by the local government agency, which is responsible to this matter. In this review, land development guidance system and the design criteria manual would be a technical standard for both the real estate development and SDFC.

4.3.1.3.2.2. Construction control

Upon the completion of the storm drainage and flood control facility planning, the next phase to will be construction. Technically, this phase is the most important phase, for every activity in this phase will determine the final quality of the result. The cost and time consumed for modification and alteration will be higher than the preceding planning phase if such activity is carry out after construction begins. Therefore, adequate and proper controlling for construction of the storm drainage and flood control facility is important to avoid problems. Besides, proper controlling enables to detect any unexpected alteration that might influence the change in design. Recognizing and identifying any changes at early stage will prevent us from making any un-

necessity cost for human power, material, any related expenses and time consume. The next diagram shows the controlling needed at the construction stage.

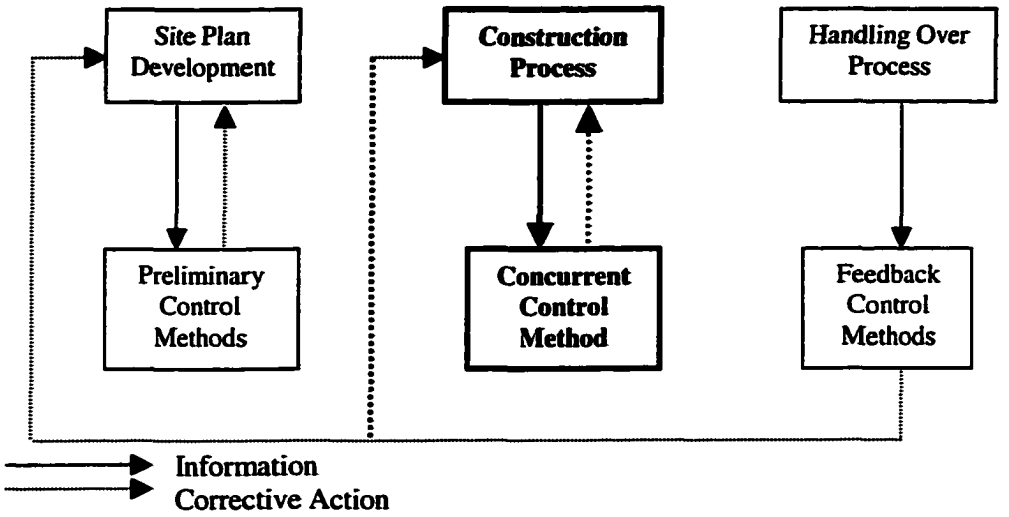


Figure 4.8. The Concurrent Control

In construction for storm drainage and flood control, there are two approaches—internal and external control. Internal control is by the developer as the executor party for the storm drainage and flood control facility, and external control is by the regulatory authority, which is local government in this case. The approaches are related to one another through the stages of controlling. Besides, both developer and local government must have adequate technical knowledge.

Technical planning will be meaningless if control is not adequate. Workshops and coordination meetings must be carried out continuously, not only to increase capability but also for continuing education.

If the storm drainage and flood control construction is completed solely by the developer, the developer requires a skillful workforce and good equipment because both the work and its control are in the same institution/board/company.

If storm drainage and flood control development is by another party, the internal control by the developer must be even stronger. For those two circumstances above, the difference between the internal and external controlling lay on the continuity supervision needed. Internal controlling took place from time to time, while external controlling is done periodically, i.e. weekly controlling, etc. Table 4.2. below illustrates the controlling implementation for the construction phase.

Table 4.2. Construction and Control

Type of Control	Conducting Parties		Time Schedule
	Development function	Controlling function	
Internal Control	Developer	Developer	Routine
	Contractor	Developer	Routine
External Control	Developer	Local Government	Periodic
	Contractor	Local Government	Periodic

4.3.1.3.2.3. Transfer to the Local Government

As discussed in the previous chapter, upon completion public facilities developed in the new residential area will be transferred to the government, subject to local government review. The review is compulsory since the construction and the hand-over period is relatively long. Final review by the local government forces the developer to maintain the facility on a periodic basis in order to secure the facility so as to avoid major repair and alteration. The other objective is to guarantee that the SDFC facility remains in good condition when it is handed over to local

government. The chart below shows the controlling process during the hand-over period from the developer to the local government.

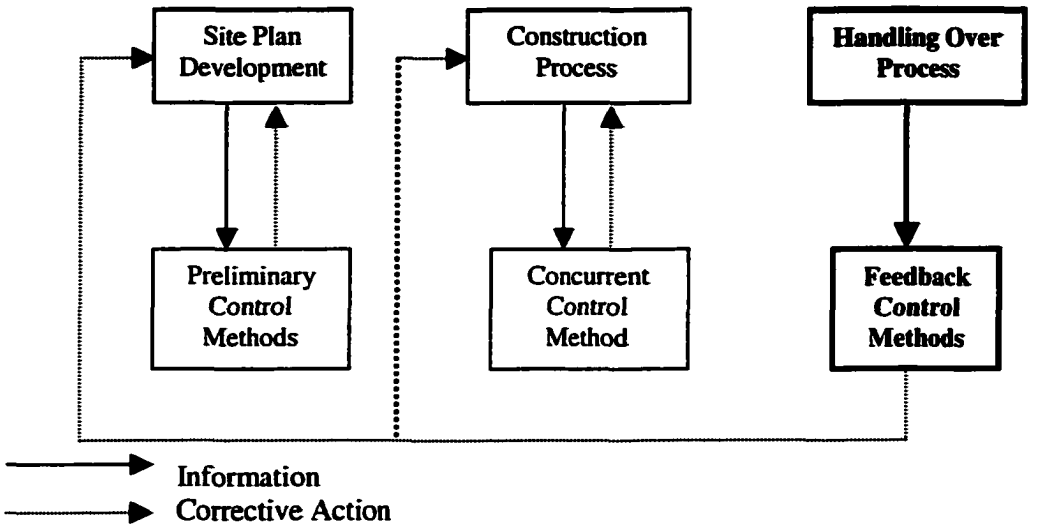


Figure 4.9. The Feedback Control

4.3.1.4. Regulatory Function

4.3.1.4.1. Laws and regulations

Damages due to floods are reduced and resources preserved if we can reduce storm water runoff. Under the "common enemy" concept the owner of the property can take all measures and means at his disposal, but subsequent problems may cause disaster, losses and suffering in the adjacent or downstream areas. This condition pushes local government to regulate measures taken. Legislation is necessary for several reasons: to delineate the problem of handling excess runoff in urban areas; to define the responsibility the owner has or should have, to control the flow rate of excess runoff from his property; and to provide a general solution or remedy by means of legislative definition rather than a multitude of lawsuits among individual property owners.

Regulations and the role of the local government in their implementation will guarantee a healthy, prosperous and safe environment. Besides, regulations are required to determine and

implement the most suitable storm water facilities and financing programs, so that costs are allocated to all parties deriving advantage from the facilities.

Legal means of controlling and requiring runoff drainage vary according to both type of the regulation used and the agency, which administers the regulation. Recognizing that local regulations will be modified to local conditions, it is useful to review examples of regulations pertaining to storm drainage and flood control facilities. This will give insight into the techniques used and foster ideas for application to local problems. In some cases, the regulations will be well defined, explaining techniques of design and the specific steps for approval.

4.3.1.4.2. The Regulatory rules

The process of composing regulations will involve the Legislative Assembly, found on every level of government. At the central government level, there is the National Legislative Assembly, at the provincial government level, there is the Regional Legislative Assembly, and for local government, there is the Municipal Legislative Assembly. The Legislative Assembly is the government partner, which functions to review, give recommendation and approve the issuance of regulations. The initial concept of regulations could be either from the government or from the Legislative assembly and be binding on the whole population and investors in land development. This local regulation concerns land use/zoning, subdivision and building codes. Enforcement of the rules for storm water drainage and flood control facilities is accomplished by means of subdivision regulations, building regulations and a fee system.

The regulation issued by local government is usually very technical because it will clearly describe the technical matter for the implementation of planning and development of new residential areas. The regulation must be in accordance with and conform to the regulation issued

by central government. In addition, the regulation issued by local government contains technical assistance for every regulation set forth by higher level of government

Regulations issued by the Provincial government give guidelines and directions to the Regency government on the uniform planning and development of land from one Regency to another. These directions and guidelines are necessary especially for land development in the border area between Regencies. It is hoped that this will prevent glaring differences in policy between the respective Regencies. Directions and guidelines from the Provincial government are also required in cases where a basin or sub basin is jurisdictionally in two different Regencies. With the role of the Provincial government, the use and development of land in that basin or sub basin can be implemented on an integrated basis.

Regulations from the Central government emphasize major systems. In those regulations it might be mandatory for every developer to construct a detention pond on the land to be developed, with a size in accordance with the size of the area to be developed. These regulations from the Central government will be adopted by the Regency government as the agency most responsible and with the full authority to manage its region.

The agencies of the Departments involved function as information sources or think tanks in compiling guidelines for the implementation of land development as issued by the regional government. The guidelines meant here are, for instance, guidelines on the planning, construction and development of the area, guidelines on standard design criteria for storm drainage and flood control, and so forth.

An organizational system such as the one as outlined above should remove gaps and overlaps between the respective agencies concerned. Besides, coordination between agencies involved will improve and control of SDFC will be more comprehensive.

4.3.1.4.3. Enforcement of penalties

To ensure compliance with regulations for SDFC facility development a certain sanction is required for the developer in the planning, construction and transfer stages and to the community in the operation stage. The local government should have authority to apply law enforcement since it bears the greatest responsibility for stormwater management in the local area.

The penalty against the developer in the planning process is related to the plans submitted, which must be in accordance with the regulations and guidance by the government. Should the government not approve the site plan for a project, the permit for the development process should not be issued and the sanction is to stop the development process. The severe sanction at transfer period is to reject the SDFC facility.

A penalty given to the community would be related to the clean river program and maintaining the detention pond function properly. Sanctions are given to people who dispose the garbage to the river. Enforcement applied to people who have an effort to degrade, misuse, or change the function of detention facility.

4.3.2. Technical Aspect

As shown in the Table 4.3, the components and objectives of the technical aspects are as given on the following table.

Table 4.3. Technical Components

Technical components	Objectives
Technical policy, including risk factor for design	To address the technical category to mitigate flood
Technical approaches and measures to combat problems	To implement measures in a new development area
Classification of SD and FC	To determine major and minor system
Types of facilities and functions of structures	To recognize a proper type of structures to combat the problems
Hydrologic and engineering procedures	To achieved the objectives of SDFC facility
Interpretation of rules, codes and standards	To implement rules, codes and standard in planning and design of SDFC facility
Operating and maintenance procedures	To guarantee that all SDFC facilities function properly

4.3.2.1. Technical policy

The technical policies can be fit into one or more of the following categories: hydrology, surface drainage, planning and design, construction, operation and maintenance. The determination of runoff magnitude shall be by statistical analysis based on actual measured flood occurrences. The surface drainage addresses the definition of adequate drainage. The planning for SDFC facilities shall be coordinated with planning for open space, solid disposal and transportation, which is indicated in mater plan and subdivision regulation. Construction shall be in accordance to the planning and design set forth. Operation and maintenance shall guarantee that all SDFC facilities function properly.

4.3.2.2. Technical approach and measures

4.3.2.2.1. Technical approach

The SDFC system used in a new residential area shall be adequate to mitigate flood problems. This needs to recognize classification of storm drainage and flood control, types of facilities and functions of structures. The technical measures proposed in this study are detention storage and

using porous pavement. Detention facility used based upon the situation where creek or river is under capacity caused by improper used of this major system. Porous pavement is applied to maintain the porous surface on the area.

4.3.2.2.2. Classification of SD and FC

Storm drainage and flood control facilities have major and minor functions. The minor systems are designed to obtain convenience at individual sites during frequent storms. This system is the collection system, included inlets, storm drains, etc. The major systems are intended to provide safety and minimize damage, when the capacities of minor systems are exceeded. This is the transport system, including trunks, valley streams, creeks, etc.

SDFC management in terms of its technical aspects and minor and major systems should be in line with activities such as planning, design, construction, operation and maintenance.

4.3.2.2.3. Types of facilities and function of structures

Basically, a SDFC system has three major components: the surface runoff component which is the initial runoff guidance system; the transport component which collects and transports storm water runoff; and the receiving water component which serves as the means of disposing of the runoff. Both man-made works and natural features of the earth are represented in each component as shown in Table 4.4.

Table 4.4. SDFC system component

	System Component		
	Surface runoff	Transport	Receiving water
Natural	Overland flow	Ditches, Creek, etc.	Stream, Rivers, Ponds, Lakes, Marshes, Estuaries, Oceans, Aquifers
Man Made	Improved lots Buildings Streets, Alleys, etc. Parking Lots	Streets Ditches	

4.3.2.2.4. Technical Measures

Technical measures applicable to new residential developments consist of detention ponds and porous pavement. In connection with the dry pond, roads and parking lots should be made from porous building materials.

In connection with the drainage system concept, the system consists of not only those components that contain and convey storm water, but also those that absorb; store and otherwise use storm water rather than dispose of it. What is meant by use here is, for instance, to fill a pond, which can be used as a recreation facility, fishing, recharge area, etc. This example makes it clear that the rainwater is not just disposed of, but that steps are taken to utilize that rainwater after it has been collected in a pond.

4.3.2.2.4.1. Use of a Detention Pond

To prevent floods in new residential developments during the rainy season, not only must the drainage system be good, but also application of an alternative system of flood control is required. This alternative system is to build a detention pond in every new residential development of a certain size. The application of a detention pond is in line with the concept of storm drainage itself, in the sense of moving water from one place to another. In the event that the rainwater cannot be moved to another place, in this case a river, it is of course necessary to build a special facility to receive the rainwater. Besides, a detention pond, which is a storage facility for excess rainwater, is also meant to reduce the impact of negative hydrologic response as a result of the activity of building a new residential development.

The choice of a detention pond is based on several considerations, advantageous not only technically related to the geological aspect but also for the environment of the residential development itself. Providing open space and recreation facilities, this facility is eminently suited

to fill the need of the people living in an urban environment, who desire comfort in their living habitat.

Applying the construction of a detention pond is not only valid in regions that are topographically relatively flat, but also for new residential developments built in hilly areas. Two main, very useful functions of detention ponds in hilly areas are: firstly as a recharge area, and secondly as a prevention of washing away excess runoff. The function as a percolation area is badly needed to stabilize the level of the ground water, which is often used by the people as a source of clean/potable water. The efforts to stabilize the level of the ground water upstream will reduce the possibility of inadequate ground water downstream during the dry season. Furthermore, the change in land use in these hilly regions from plantations to residential areas has lowered the capability of retaining rainwater so that it does not wash away downstream. Therefore, the function of this pond here is simultaneously as a retention pond, so that it reduces the downstream flow speed of rainwater.

Detention ponds are constructed for certain area sizes. The size and the volume of rainwater that it can contain are calculated by taking into consideration the hydrological principles, flood design chosen, and the rainfall forecast. The correct location for the construction of the detention pond can be determined in the lowest part of the area to be developed. This will reduce the excavation work during the construction later on. The excavated soil can be used as landfill or raising the level in other areas, both for esthetic as well as flood prevention reasons.

The advantage of the policy to use a detention pond as a flood control system in a new residential development is to the occupants and people living in the areas adjacent to the new development. The reasons are: firstly, because the natural drainage flows from the older areas,

according to the contours and topography of the area, is in the direction of the detention pond. Secondly, if the older residential development is close to a river and that river serves as the final stage of the storm drainage for the old residential development; then the construction of a detention pond in the new residential development will prevent overloading the river. The result will be a free drainage flow from the old residential development and that area will no longer suffer from floods caused by back flow of overloaded river capacity.

4.3.2.2.4.2. Using porous pavement

The main purpose of using pervious instead of impervious material for the pavement is to help control storm water runoff. By doing this, the pavement and the pavement base both store water, which will drain slowly into the soil or into the sewer system after the storm, has passed.

The use of porous pavement in hard stands and environmental roads in new residential developments also helps much in reducing the extent of runoff from the surface of the area. The advantage of using porous pavement is not only felt in new residential developments in the lowlands, but also in hilly areas. In hilly areas, the retention of excess runoff will prevent flooding of the downstream areas. Besides, as in the case of a detention pond, porous pavement will increase water percolation in the hilly area. The capacity of water percolation will affect the level of the ground water, which is very useful as a source of clean/potable water for the people living downstream.

4.3.2.3. Hydrologic and engineering procedures

The first step of hydrologic and engineering procedures is to get the facts. This is the most important aspect, which is related to basic hydrology, including rainfall, runoff, vegetation, soils, and infiltration. Besides, the facts are also related to historic, existing, and future land use, drainage path, discharge capacity of the existing facilities, presence of floodplain, impacts on

adjacent properties, evaluation of the existing problems, and details of the existing master drainage plans for the area of drainage basin. Based on the facts finding process, develop and analyze all reasonable alternative solutions.

Basic data required for this purpose are location maps, topographic map, vegetation, soil survey, stream survey, existing urban development, future development, and rainfall. One of the analysis should be taken is run off analysis. This analysis establishes the important baseline conditions by describing the runoff character of the drainage basin. A major step in runoff hydrology is to identify sub basin and define existing and future conditions, including the following: major tributaries, areas of existing development, areas of proposed development, possible floodwater storage sites and reaches of stream to which significant alterations may be made in the future.

4.3.2.4. Interpretation of rules, codes and standards

The planning system and design engineering for a new residential development cannot be separated from the planning system and design engineering applicable to the development of a city. A new residential development is basically a part of a city. Therefore, the planning system and design engineering for a new residential development has to conform the general planning system of the existing city.

The general planning for a city often called the Master Plan for the city or the General Planning for City Land Use or may also be called the General planning for the Utilization and Development of the City. In the development of a new, well-designed residential development, with emphasis on storm water management, attention should be paid to two aspects. The first is the site plan development of the environment of the new residential area. The second is design engineering for the storm water drainage and flood control. These two aspects cannot be

separated, since they complement each other. The engineering design for the storm water drainage depends on the overall planning of the development.

4.3.2.4.1. Site Plan Development

The Site Plan for a new residential development should be in accordance with the existing Master Plan or Land Use Plan and current Zoning and Subdivision regulations. The details should be in accordance with the Land Development Guidance System. The design for the SDFC facility should be in conformity with the existing Design Criteria Manual. The schematic showing the relationship between the general planning of the existing city and the planning for the development of a new residential development and the planning for the drainage system is shown in Figure 4.10. below.

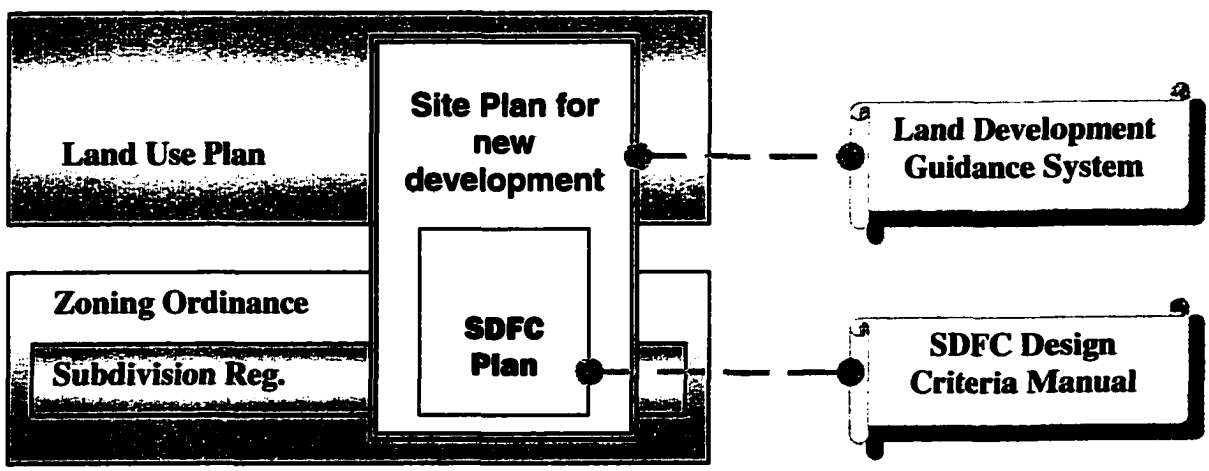


Figure 4.10. The Planning, regulation, guidance and manual relationship

4.3.2.4.2. Guidelines for Land Development

Guidelines for land development are required to implement the policies laid out in the General Zoning Plan. The land development guidance system for planned unit development is intended to improve and protect the public health. These guidelines would provide advice to proponents

carrying out the required studies and applying for approvals, and help reviewers in government agencies evaluate proposals. To simplify the approval process and minimize delays in development, those respective reviewing agencies should jointly prepare and agree on the technical guidelines and evaluation criteria. It is recommended that the guidelines and criteria be issued as interim documents and modified periodically in light of experiences gained by the proponents and the reviewers.

Sensitivity to the character of existing neighborhoods means that the new development has no conflict with the other areas. The types of conflicts are noise, odor, light and shadow, aesthetics, privacy, access and safety. Once conflicts are identified, design measures shall be considered and incorporated into the plan to mitigate conflicts between land uses.

Because of this guidance system and its emphasis on aesthetics, public health, welfare and reducing conflict between different land uses, technical guidelines are still needed.

4.3.2.4.3. Technical Guidelines and Criteria for SDFC Development

To achieve effective planning, implementation and operation, preparation of design and operational criteria are required. Criteria give a basis for consistent planning and design. Besides, these criteria will help to ensure that legal constraints are consistently considered, that procedures for estimating rainfall and runoff are consistent from plan to plan, that maintenance access is consistently provided, that standard hydraulic design criteria are consistently met.

Technical Guidelines and Criteria development for drainage works should be developed to standardize and simplify design. Acceptable design techniques, methods of analysis for precipitation, runoff, sewer pipe and appurtenance sizing, design of storage facilities and other control devices and any other useful consideration should be incorporated in the code.

Design criteria are adopted by the city for the flood handling characteristics of the two systems. All components of the major system are to be designed to handle the 100-year rainfall event. The secondary system components are assigned design rainfall requirements according to land use and property value. In high intensity use and high property valuation areas, a 10-year return period is used for the design rainfall. In single-family residential subdivisions, the 2-year return period is used for the design rainfall.

4.3.2.5. Operating and maintenance procedures

The goal of the operation and maintenance management is to guarantee that all SDFC facilities function properly, can be used as intended and give results with the quality determined in the planning stage.

Operation and maintenance of storm water drainage and a flood control facility is an important factor in determining the effectiveness of the facility and its acceptability to the public. Poor operation and maintenance not only reduces the usefulness of the facilities, but can cause the facilities to become an eyesore, nuisance or health hazard. In this discussion of the operation and maintenance aspect, we will take a look at several technical problems that are related to the operation and maintenance of SDFC facilities. Furthermore, this section will also analyze matters concerning the implementation of those activities, including the possibility of the participation of the people related to this facility.

4.3.2.5.1. Technical problems to which attention has to be paid in the operation and maintenance of SDFC facilities.

For an SDFC facility to function properly to be able of being used as intended and to give service of the quality determined at it's planning, the following technical problems have to be taken into consideration.

a. Erosion control

b. Removal of debris

c. Repair of structures

d. Shoaling of channels

e. Reseeding and planting of grassed areas

f. Bank stabilization

g. Rip rap

h. Access to the entire length of the drainage way

i. Once a year the detention basin should be inspected to detect any major structural problems. Much more frequent problems arise from a) erosion, b) sedimentation, c) accumulation of leaves and trash.

4.3.2.5.2. Implementation of the operation and maintenance activities of an SDFC facility

In principle, the implementation of the operation and maintenance activities of an SDFC facility in a new residential development can be divided into two stages, i.e., the stage before the facility and other public infrastructure are transferred to the local government and the stage after the facility and other public infrastructure are transferred to the local government. Regardless of the size of the development, whether it is more than 500 ha, less than 500 ha or only 20 ha, the above-mentioned two stages are still applicable in the operation and maintenance of the public facilities in a new residential development.

As long as the SDFC facility has not yet been transferred to the local government, the developer is fully responsible for the operation and maintenance of the SDFC facility, both the minor and the major system, in the new residential development. In practice, if some lots of land or houses in the area have been sold, or even occupied by the owners, two scenarios for the

maintenance of the SDFC facility are available to the developer. In the first scenario the developer still fully carries out all matters concerning the maintenance of the SDFC facility, without burdening the occupants. This may be related to the marketing efforts of the area, since it may give the impression that the developer is really concerned about the SDFC facility, is really responsible for its maintenance and is trying to pamper the occupants as consumers of the product he is selling. If this impression can be spread among the public, especially among prospective buyers of the houses in the development, then the sales revenue will undoubtedly increase. In the second scenario, the developer will ask the occupants for assistance in the efforts to maintain the existing SDFC facility. This assistance may be in the form of a monthly contribution, or as an additional cost to be paid in advance in addition to the sales price.

When the SDFC facility has been transferred to the local government, then the activities of operating and maintaining the SDFC facility become the responsibility of the local government. However, as far as the financial aspect is concerned, part of the money may happen, since the process of turning over the infrastructure, including the SDFC system, is implemented be obtained from the occupants. In the part that discusses the financial aspects, funding and financing of the operation and maintenance of the SDFC facility will be analyzed further.

Problems occur when the developer turns over the SDFC facility in stages, due to the large size of the area developed. In this case it may happen that the major system has been transferred, but the minor systems, related to the major system, have not been entirely transferred, or maybe even that the minor system has not yet been constructed, because this minor system is in another sector that has not yet been developed. This may sector by sector, while it is possible that a major system facility may serve more than one sector. In case the major system that has already been transferred to the local government, still serves another sector that

is still the responsibility of the developer, then of course the maintenance of the major system may still involve the developer.

4.3.3. Financial Aspect

The following analysis will be discussing priorities for capital spending, priorities for O&M funding, and the sources of funds and responsibility to pay used to construct SDFC facilities in new residential developments. The component and objectives of the financial element are as given on table 4.5.

Table 4.5. Financial components

Financial components	Objectives
Priorities for capital spending	To determine the allocation for capital spending
Priorities for O&M funding	To determine the allocation for O&M funding
Source of funds and responsibility to pay	To set up the scenario of funding SDFC facility

4.3.3.1. Capital spending

Costs that should be allocated to the parties that enjoy the use of the SDFC facility and the parties related to and responsible for the management of this facility can be classified as capital costs and operation and maintenance costs. Both types of costs are found in both the major and the minor system of the SDFC facility constructed. For the construction of a new residential development, the drainage system in the development is included in the minor system. Meant by the major system for the new residential development is the detention pond facility.

Capital costs include expenditures for land acquisition, channels, providing pipes, erosion protection, embankments, structures, and other items. In new residential area, which is developed in low and flat land, capital cost would be included detention pond facility. In addition, staff planning, engineering, and legal costs may also be substantial.

4.3.3.2. Operation and maintenance funding

The discussion about O&M costs will be related to the use of the services obtained from the SDFC facilities by the people living in the development, and other parties deriving benefit from the existing facilities and the government as the agency that owns and is responsible for the public infrastructure.

Operation and maintenance costs include cost for inspection, cleaning and repair of: inlet, channels, pipes, erosion and sediment control devices, embankments, detention ponds and basins, manholes, catch basins, drop structures, energy dissipators, and other structures. Mowing grass, other vegetation maintenance, and clearing troublesome sediment, debris, and obstructions are routine maintenance costs.

4.3.3.3. Source of funds and responsibility to pay

4.3.3.3.1. Capital Costs

According to the cost concept, for both types of systems, major and minor of the facility, the capital cost should be borne by the developer. However, for the major system a proportional system is used, depending on the size of the area to be developed. Schematically, the allocation of the capital costs is indicated in Figure 4.11. as follows.

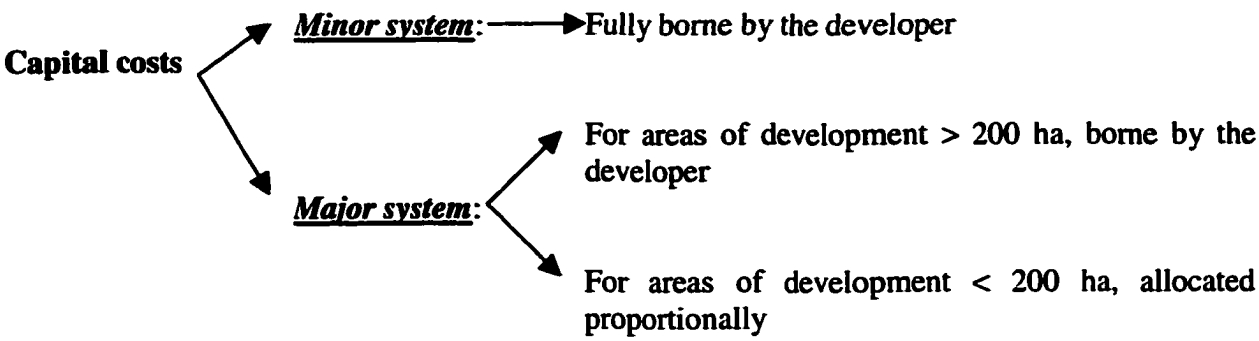


Figure 4.11. The Allocation of Capital Cost

This proportional allocation is in accordance with the Poertner's concept. The allocation charges are based on the size of the catchment area and the distance from the area to the pond to be constructed.

Another method that can be used associated with cost allocation purpose is 'method of oversizing' from Poertner as well. In this method, the new developer pays only the additional cost that his drainage, based on drainage area alone, will add to the planned drainage system to make the basic system adequate for everyone.

The authorized institution for major rebuilding cost such as for the detention/retention pond facility is the local government. This is due to the fact that the local government has the responsibility by the time the facility was transferred. The rebuilding cost budget is including in the Regional Income and Expenses Budget under the infrastructure construction section. Source of income for such budget is expected from the tax, which is unnecessarily being charged in the connection to the SDFC facility usage. Should major facility is including river normalization, the budget for this purpose might be obtained from the Province government, considering the possibility of the river basin are covering for more than one local government. Therefore, the budget allocation needs to be coordinated with the participation of Province Government.

4.3.3.3.2. Operation and Maintenance Costs

In the discussion of the O&M costs, besides a division between minor and major systems, there will also be a division based on a legal procedure, i.e., the situation before and after all public infrastructure in the development has been transferred to the local government.

4.3.3.3.2.1. Before transfer to the local government

In the situation where the public infrastructure present in the development has not yet been transferred to the local government, a distinction should be made between cost allocation for a minor system and cost allocation for a major system.

For a minor system, there are two situations, i.e., whether this infrastructure is located in an area that has already been sold or in an area that has not yet been sold. If it is located in an area that has not yet been sold, then the costs will, of course, be the responsibility of the developer. However, for facilities located in an area that has already been sold, the maintenance costs will be borne by the occupants of the houses or the owners of the land. Even then, it is still possible that the developer will bear the maintenance costs, without burdening the occupants. This may be related to the marketing efforts of the area, since it may give the impression that the developer is really concerned about the SDFC facility, is really responsible for its maintenance and is trying to pamper the occupants as consumers of the product he is selling. If this impression can be spread among the public, especially among prospective buyers of the houses in the development, then the sales revenue will undoubtedly increase.

For the major system, there is no relationship to whether the area has been sold or not. In this situation, before transfer to the local government, the developer is still responsible for the maintenance costs of the major system.

Resources of funds from the developer may be derived from the working capital intended to be used to develop the area concerned. This working capital may be derived from own capital or bank loans. The costs of the construction and O&M of the SDFC facility can be included in the costs for the development of the infrastructure or the marketing of the development. Part of the marketing costs can be used for the construction of the SDFC facility considering that a flood

free environment has its own attraction for prospective buyers. Considering that in an area with a flat topography it is relatively difficult to avoid the possibility of floods, the presence of an SDFC facility will contribute to the marketing aspect. Of course, ultimately all costs for the construction of the SDFC facility will be borne by the consumers/buyers, both as a component of the price of developed land and the price of the building.

4.3.3.3.2.2. After transfer to the local government

In this situation, the maintenance costs of both the minor and the major system become the responsibility of the local government. Funds to cover these costs could be obtained from drainage fees and land and building tax (property tax). Drainage fees are a new concept in Indonesia; until now drainage fees have never been levied. However, in analogy with garbage collection fees, drainage fees can certainly be introduced.

Part of the property tax could be allocated to cover the O&M costs, considering that there will be an increase in the receipt of property tax as result of the change in the situation of the land, from non- or low–productive land to land with an economic function. Therefore, the increase in the receipt of property tax is related to the higher classification of the land after it has been developed. Part of the property tax could be allocated to cover the shortage or subsidize the O&M costs, should the drainage fees be inadequate.

4.3.3.4. Optimizing

Basically, the drainage system and flood control measures that should be built in a new residential area must consider technical criteria. For one kind of flood control measure that has several alternatives, the best alternative chosen must be based upon financial analysis. To achieve the best economic alternative, a Benefit/Cost Ratio Analysis has to be made. The framework for the calculations and the aspects that have to be taken into consideration in this

analysis is based on the method used by United Nations (1976) as shown in the following diagram (Figure 4.12).

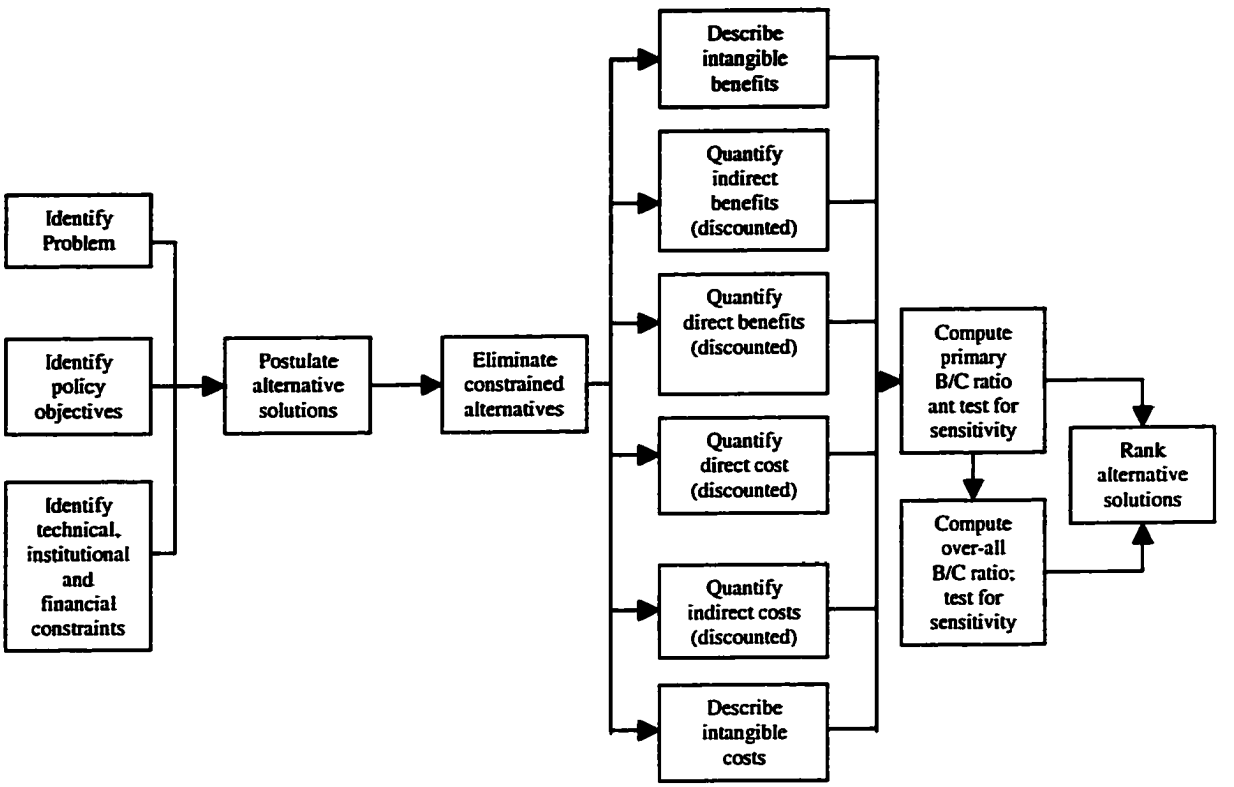


Figure 4.12. The process of benefit-cost analysis

For the benefit and cost categories that should be used in this analysis, which is also described by Grigg (1974), are as follows:

Table 4.6. Benefit and Cost components

	Benefits		Costs	
	Direct	**Indirect**	**Direct**	**Indirect**
Tangible	Reduced flood damage to public and private facilities	Reduction in traffic delays	Construction costs	Insurance subsidy costs
	Reduced probability of loss of life	Increased sense of security	Land acquisition costs	
	Land value enhancement	Alleviation of Health hazards	Cost of nonstructural programs, including flood plain zoning	Increased reconstruction costs due to the magnitude and extent of flood damage
		Increased possibilities for recreation opportunities	Evacuation and emergency program	
			Administration costs	
Intangible	Reduced inconvenience		Environmental and social costs	
	Increased sense of security			
	Alleviation of Health hazards			
	Improved aesthetic environment			

CHAPTER 5

ANALYSIS OF MODEL IMPLEMENTATION

5.1.INTRODUCTION

This chapter discusses how the technical, institutional, and financial parts of the management model can work in Indonesia and is, to the extent possible, a test of the methods developed in Chapter 4.

Implementation is a crucial matter in improving quality of life in housing developments. The discussion about implementation derives from the model's framework and includes barriers to implementation and actions taken to remove barriers.

Figure 5.1. illustrates how the model's components are mapped onto the actual situation in Indonesia.

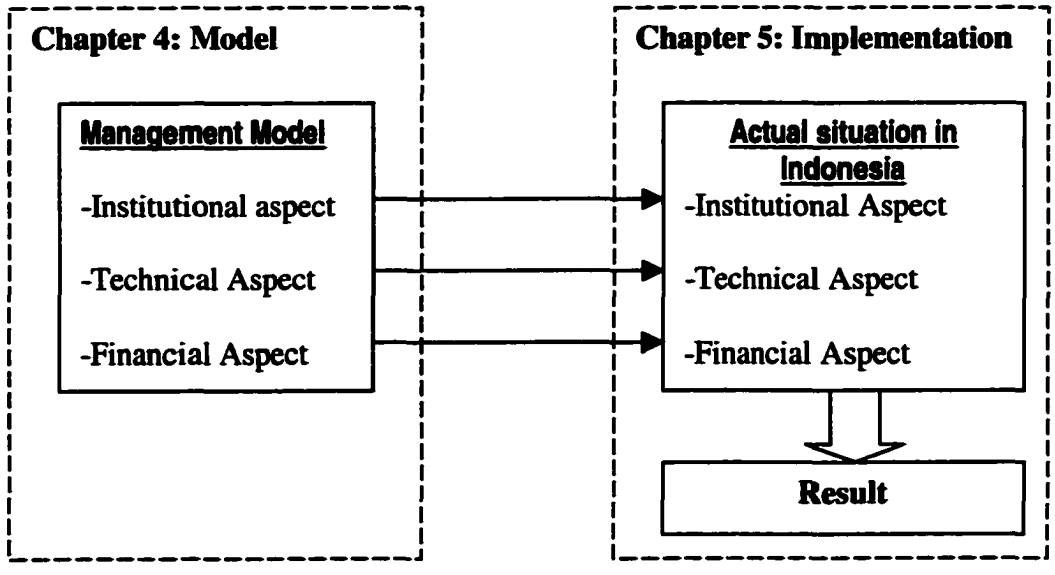


Figure 5.1. The relationship between Model and Implementation

As discussed in the last chapter, the institutional aspect includes organizational framework, regulatory aspect, and law enforcement. The technical aspect includes planning and engineering design, communication system, and technical measures. The financial aspect covers capital cost, operation and maintenance cost, and optimization.

These elements play crucial roles in implementing the model. Firm regulation is especially important, to give guidance on what needs to be done, how to accomplish it and who will be responsible. The regulation needs to have preventive and curative actions, with appropriate law enforcement.

The implementation of residential developments in Indonesia is divided into categories by size of area to be developed. This determines the type, number and size of the drainage system and flood control facilities required for each development. The smallest parcels, up to about 50 Ha, will normally have smaller channels. The largest parcels will have large channels as well as small ones.

Furthermore, the size of developments also determines obligations to be met from the physical side, like the flood control system, and the financial side, like funding development and costs of operation and maintenance.

Another classification is the legal condition of the new residential development, whether the development has been turned over only partly or totally to the local government. Turning a development over to the local government means turning over the area and all public facilities for ownership and management. In this case, ownership of the area and public facilities reverts to the local government, which then has responsibility to manage the development. However, it may be that funding to manage

the facilities is not fully by the local government, but shared by other parties, depending on benefits received.

5.2. INSTITUTIONAL ASPECT

The institutional aspect underlies better SDFC facility management, since the effectiveness of technical planning depends on institutional factors as well as construction and maintenance. The financial scheme to implement SDFC facilities also depends on the institutional system.

Law enforcement is part of the system, so the institutional system includes the organizational framework, the planning and control procedure, and the regulatory aspect. These respond to the policy framework, of course.

5.2.1. Policy

Certain policies regarding SDFC in Indonesia are not determined yet. As described in Chapter 3, the national policy in housing has been made and is connected to development in new residential areas. The guidelines include the purpose of housing development and living quality of the population, especially the low-income group. Considering the current status of policy guidance, the quality of infrastructure in residential areas, including SDFC, has not received adequate attention yet.

5.2.2. The organizational framework

A well–managed SDFC system depends on the roles of parties that influence planning, construction and operation and maintenance. The main parties are the government, developers and the professionals such as architects, planners, engineers and the communities, which are connected to the SDFC. The communities in this case are local

residences in new residential areas and the residences in the basin or sub basin area connected to the new residential area.

In order to illustrate this, the following section will discuss the organization of agencies and functions in the management of SDFC facilities. The first discussion will be about government involvement.

5.2.2.1. Organization of agencies

Of the three levels of government, central government is the policy maker, regional government acts for strategic matters and local government acts for operational activities. The central government is dominant, which is in contrast to the system in the US where the local role is greater. In Indonesia, although the local governments have better information regarding condition of their region they depend on central government in directing their activities related to efficiency, problem–solving and community prosperity.

The relationships between central government and the lower levels of government are shown in Figure 5.2. below.

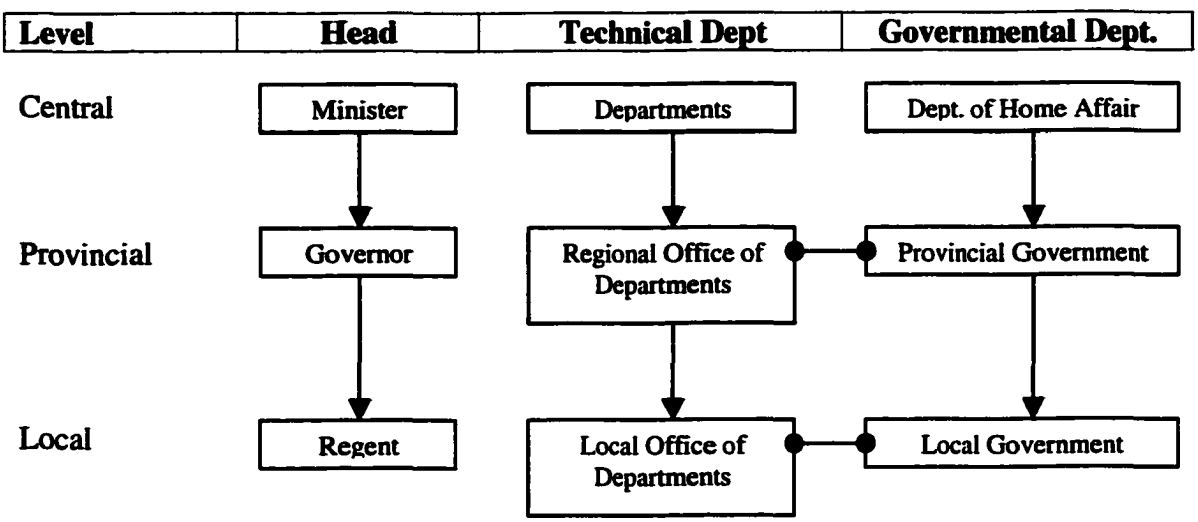


Figure 5.2. Organization of agencies

The government involvement at each level, and the roles and responsibilities of each party will be discussed as follow

5.2.2.2. Responsibilities and roles of parties

5.2.2.2.1. Central Government

Policy issued by the central government is binding on subordinates. The departments involved in SDFC are Department of Public Works, State Ministry of Housing, and Department of Home Affairs, National Land Board Office and State Ministry of Environment.

That central government involvement in Indonesia is still dominant is proven by many decisions and matters being managed at central government level and this will prolong bureaucracy and the process of decision-making. Ironically, no regulation has been set concerning new residential development with a focus on SDFC matters.

It will be necessary to draw a strict line between central government and local government in terms of role and function. SDFC facility management includes major system management, which might require regional government attention.

The central government must issue policy to avoid conflict among local government and to benefit all regions concerned. A collective regulation from more than one department should be applied by the public works department, home affair department and the ministry of housing. The following Table (Table 5.1) describes functions and roles of department, ministry and board related to SDFC management.

Table 5.1. Departments involved in SDFC and new development

Departments/Ministry/Boards	Functions	Roles in SDFC
1. Dept. of Public Works	Executor of the construction of public facilities which includes land transportation, port and city facilities. The public works department also has responsibility in city and regional planning. In water resources, the ministry through its Directorate General for water resources development is primarily responsible for planning, development and control of water resources, more specifically for irrigation, hydraulic engineering and river basin development. The public works department coordinates activities and actions related to the construction and the exploitation of water resources.	Through Directorate General of Water Resources Development, gives guidance and direction to local government regarding the major system exploitation and management. Through the Directorate General of Planning, Engineering and Urban Development, provides guidance regarding urban development and the development of new residential area, especially related to the SDFC facilities.
2. Dept. of Home Affairs	Has authorities to manage the affairs of local and province government. The authority includes but is not limited to supervising the governor, regent and its staff. Therefore, the responsibility of this department primarily is to support all activities of development. Detail arrangement are carried out by local and province government. The governor and the regent shall coordinate all development activities within their jurisdiction to achieve the greatest benefits possible.	This Department has responsibility to provide and secure land for development activities. Further, the department holds operational authorities, which connect directly to the achievement of healthy new residential areas. The arrangement set forth by central government is aimed to provide direction to local and sub district governments to achieve a harmonious policy and regulation from each government in implementing their development. Should the harmonious policy and regulation be achieved, the investors will have similar alternative place for investment from one province to another.
3. Department of Information and Communication	The main function of this department is to give information about government programs, general government policy and activities carried out to the public. This information is also intended to attract the society to be participated in relevant program.	The department will take an important position to inform about preventive and precautionary actions for society in exploiting the SDFC facility. This is due to the fact that many problems in the SDFC facility are caused by the wrong doing of the society in taking advantage of the facility, such as to live or to build shelter by the river side and to dispose garbage to the river, which is the major system in SDFC facility.

4. State Ministry for Housing	The function of the State Minister for Housing is to determine a policy in housing requirement for the society, which includes the improvement of society prosperity. Therefore, the state minister for housing's program is closely associated with the supply and demand of housing. The activities carried out presently will be to make the potential demand into the real demand by giving mortgages for housing and to develop economical housing with reasonable price.	The State Minister for Housing has important roles in providing direction regarding the proper and healthy residential area with its facility required. Since this department has no specific department to control, manage and to execute the program set forth to be carried out within department, itonly coordinates by giving input and information to all departments related to the housing, land use, urban planning, infrastructure and the management of water resources.
5. National Land Board Office	The National Land Board Office acts as the conductor for the land administration in Indonesia. NLBO has records of land, location and land possession in Indonesia. The NLBO is also authorized to define the type and land possession qualification for every piece of land that has been possessed by either one party or private institution. Type of land possession owned by private institution is categorized from the lower level such as the Hak Pakai (concession), Hak Guna Bangunan (building concession), and Hak Milik (proprietary rights). A parcel of land might also be possessed by government, which called state land. The State Land might be used for government activities such as for government offices.	The National Land Board Office has no direct relation or influence regarding to the SDFC in new residential area, however, this committee has the authority to review the location permits applied by developers, and to give recommendation to relevant authorities for issuing such permits for developers intend to develop certain location. The location permit is the permit issued for developers to develop new area in certain location. The developers have the right to do the land acquisition for further development and market the output of such development to customers. When a location has been giving a permit to one developer other developers cannot do any activity at the purposed land. Based on the situation mentioned above, this committee could have the responsibility of giving direction to developers in order to achieve desired residential area, which in accordance with the regulation stipulated. The direction might in the form of specific requirements prior to the issuance of the location permits for developers. Failing which the committee shall give sanction to developers in several stages.

6. State Ministry of Environment	The main function of this department is to review and control the activities of the industry, the development and construction of the new area/location so as to keep a harmonious environment. The minister's major attention is pollution, both soil water, river and air pollution caused by the improper management of drainage disposal system. Another important aspect is to continuously maintain the ecology for every living body in the location/area. In regard to the development of new residential area, a specific analyst of the environment impact must be undergone and to be reviewed by the environment department in order to monitor the modification. Should the impact is relatively safe and normal, the minister of environment shall issue the recommendation on permit required to pursue the development. The observation is normally designated for project with over than 200 hectares of land.	The Environment State Ministry's role is to provide guidance for the developers regarding the technical design for the SDFC, which supposed to be erected in new residential area. This department will also provide guidance for an environmentally proper design of the new residential area, including the SDFC facility for the benefit of the resident in this area.

Having completed the discussion about central government the following discussion will be concerning the province government. In regulatory aspects chapter, it describes the rules and regulation issued for central government, province and local government.

5.2.2.2.2. Provincial Government

The strategic action by provincial government is to coordinate all activities for agencies within its region. This action requires an intergovernmental agency consisting of representatives of the regional offices of Public Works, Home Affairs at the provincial level, and Housing Ministry. The intergovernmental agency should work with experts, professional organizations, university staff, and consultants, locally and overseas, to compose and define standard design criteria and guidelines for new residential area development.

The coordination task by the intergovernmental agency contains the control function in the planning phase to harmonize the environment of the surrounding areas. The most important role of this agency is to assist the Governor in controlling development in the region. As mention in Chapter 3, for a total area of development of more than 400 ha, the provincial government has the responsibility.

The next level is local government, which has a dominant role during the implementation stage. The following section discusses its role and activities.

5.2.2.2.3. Local government

As discussed in Chapter 3, according to Land regulation No. 2, year 1999, local government has a responsibility to control the development up to 400 ha.

The organization in local government includes sections or divisions responsible for planning, control, development realization, operation and maintenance. As discussed earlier, in Fort Collins and other US local governments, specific divisions take care the SDFC facilities. It is recommended that a special division be created in the local government organization in Indonesia to manage SDFC and to cooperate with urban development and public service divisions.

Local government has authority for planning, development, control and maintaining facilities in their territory, including facilities erected by private institutions. Therefore, every development activity in the territory must be acknowledged and permitted by the local government.

As described in Chapter 3, the authority of local government is limited to certain area or value levels. Furthermore, their jurisdiction is also defined by the territorial and urgency level of the project. The management of a project with national scope will be by central government, even though the location of the project is in the province. At present, central government has more prepared personnel and also will act as policy maker.

In summary, actions by local government in relation to SDFC include:

1. To form a special division for infrastructure matters including SDFC. This division is supervised by the regent and performs review of technical planning of SDFC facility in new residential areas, carries out inspection during development and receives the facility at transfer.
2. To manage the clean river program with involvement of subdivisions from the "Kecamatan" (District), "Kelurahan" (Village) level up to "Rukun Tetangga" (Neighborhood).

3. To determine local regulations as guidance for the development of new residential area. The type of local regulation will further discussed in Regulatory Aspect chapter.
4. To determine the local ordinance about the clean river.
5. To give sanction for those who violate the rules and regulations as stipulated above.

5.2.2.2.4. Public involvement

Public participation can be implemented in the planning stage and the operation and maintenance stage. Public participation in planning stages is related to marketing conducted by developers. From the developer's standpoint, information regarding the project will create confidence towards the project and increase its image and sales. On the public side, participation in this stage gives an opportunity to control the development plan.

In the operation and maintenance stage, society as the user of the facility participates to maintain the facility in good condition for long-term use and in proper condition. The main step is to increase society's awareness of the need for the SDFC facility, both minor and major.

As previously mentioned, two main changes are required: occupation by the river, and the habit to dispose garbage to the river. Increase awareness about these can be done by national and local government approach.

The national approach is carried out under the department of information, by using radio, television, and press releases. The action includes campaigns for the necessity of having a clean river from garbage and preventing housing of any kind at the

river and on the river. The campaign informs society that a clean river not only will create a healthy environment but also prevent flood problems.

The coordination of the program is by the directorate general of publishing, press and graphic and the coordination for television and radio broadcasting is by the Directorate General of Radio, Television and Film.

Local approach is coordinated by the social welfare agency, which will supervise and coordinate action in the district and village. At the village level coordination can be from the Village Defense Agency and work with the District and Villages components. The next step will be to educate people by giving information about the necessity to have a clean river.

A clean river can only become a reality if people refrain from disposing garbage to the river and avoid any building by the riverside and on the river. These actions will raise public awareness to maintain river as the major SDFC system. To overcome illegal building around the river, relocation/resettlement to another area within the city or through the transmigration program might be applied. However, this issue will not be discussed in this thesis.

5.2.2.2.5. Developers

As the main institution in development of new residential area, developers have an important position. However, the architect, engineer, planner and contractor as professional agencies have great influence too. Developers must possess adequate knowledge regarding regulation and direction in connection to their SDFC facility.

In order for developers to be aware of the regulation and guidance, a good communication system between government as policy maker and developers and

professionals must be established. The communication system should be in accordance with section 5.2.5. of chapter 5.

Following regulation is law enforcement, and it is clear that law enforcement will continue to be an important factor in management new developed area. The developers need a good understanding and working knowledge of the major law affecting their activities. This will enable developers to avoid many legal embarrassments.

5.2.2.2.6. Professionals

The professionals in this case refer to architects, engineers, planners, lawyers, contractors, and construction managers. Their involvement is to follow rules and regulation, and maintain updated results in line with the market trend. In particular, lawyers should advise developers in designing new development areas, such that the rules and regulations are adopted in this design.

Professionals shall always active in their association in order to always receive the latest information. By completing jobs in line with market trend, professionals show role to improve society through better design and construction.

5.2.2.2.7. Bank and finance institution

Bank and finance institutions act as sources for working capital for new residential area. Their involvement in SDFC management is to give special requirements to developers by the time they submit their loan proposal. Should they fail to perform these special requirements, the loan should not be given.

The above requirement refers to the condition where a site plan of the proposed land is approved by relevant authority. The site plan approval is including the approval of development of SDFC facility for the area. The obligation to show the authorities

approval for their site plan will force developers to make the site plan in accordance to the guidance and direction given by the authorities. The approval from relevant authorities will give assurance to the bank and finance institution that the developed land will be in accordance with the regulation applied. As a result, plain piece of land with low mortgage value will become an area with higher economical value. Besides, this action also shows bank concern to the public and especially to the consumer of the product that being marketed by developers. In the US the role of Federal Housing Administration, part of HUD, also has mortgage insurance rules, where property has to comply with local rules, such as flood plain, building code etc.

5.2.3. Planning and control procedure

5.2.3.1. Planning procedure

The lack of rules and regulations opens the possibility of planning modifications, which only suit certain interests. The modification might be in the form of a change of open space into residential or commercial area, according to the developer's wishes. Such a modification might happen because it increases local or regional taxes from the development of new area.

Problem arises when the open space used to be runoff storage, or development takes place on low land areas. Planning procedure included design criteria and development guidance is needed. Steps necessary in this situation are completing the zoning and master plan in the local level, setting up the special district in the regional level to provide SDFC design and criteria manual, setting up land development guidance system and sub division regulation in the local level. All new site development planning must be in accordance to this planning system.

5.2.3.2. Control procedure

Public participation is expected to influence the development of SDFC facilities, anticipating non–technical problems that might arise from the developer's attitude and the government authority's responsibility to control the development.

Developers always calculate their steps from the economical factor which makes them take a short cut by cooperating with the authority to create the image of "understanding each other's need". This situation then conditions the parties to complete the development quickly with an inadequate level of quality.

The completion of work faster than scheduled also means simplicity of kind and type of work completed. The developer tries to turn over as soon as possible so he can go to other places. The faster the development the less the interest to bear and the faster the sales income and increased reinvestment.

In order to overcome such problem the government must apply law enforcement to all parties involved. However, the lower buying interest from the society towards questioned development area will become a consideration for developers.

5.2.4. Regulatory function

The regulatory aspect is very important for it will clearly define the rules and regulations, which enable all divisions to carry out their duties well. A regulation is set forth to facilitate the activities of SDFC planning, development implementation, operation and maintenance to work orderly.

5.2.4.1. Laws and regulations

The regulation in relation to the SDFC problem in new residential area is issued in stages from the government regulation, law and the president decree which is the product of the Central government. Governor decree and Provincial regulation is the product from the province government. The local ordinance and Regent decree is the product of the local government. The regulation in local government level is very detail for it will directly manage the activities of new residential development and the SDFC facility development.

The important thing that we could do in conjunction to the institutional aspect is enact legislation to carry out the goals of the chosen solutions, to meet the master plan, guidance system, and to fit into the detailed plan.

Suitable legislation in the local government might include the following matters:

1. Master plan
2. Zoning
3. Subdivision regulation
4. New residential development
5. Public service development
6. Development of social facility in new residential area
7. Development of SDFC facility in new residential area

The regulation for new residential development is known as the land development guidance system and the SDFC facility development in new residential area might contain the design criteria and standard for planning, development realization and SDFC facility maintenance.

Other important matter in the regulation issuance is the law enforcement itself. Certain preventive action might be required to keep the regulation stands firmly. The law enforcement effort is become an integral part of the regulatory aspect especially and the institutional aspect in general.

5.2.4.2. Enforcement of penalty

In order the regulation for the SDFC facility development to be followed by all division/parties involved, a certain sanction is applicable. A definite sanction shall be applied ever since the planning, implementation and transfer stages.

The law enforcement consists of two types. The first type is designated to developers as the party involved in the development of new residential area with its SDFC facility development. The second type is designated to those who deliberately violate the clean river program.

5.2.4.2.1. Law enforcement against developer

To secure applicable sanction is carried out properly; a certain amount of development realization deposit must be given to local government by developers. Such deposit plus relevant interest is refundable upon the completion of the development and transfer.

The lowest level of such sanction is to give warning to developers and request for repair or improvement of the planning and development realization, which is not in accordance with the government regulation.

The next level of sanction is the cease of process activities, which includes dismissal of review process by government until revision and design alteration is submitted, the cease in development process until definite improvement development is made, and the cease in transfer process from developer to local government.

The highest level of sanction is the most severe level. The sanction given at the planning level is to stop the permit for the planning submitted by the developer since it is not in accordance with the regulation and guidance set forth by the government. Should the site plan for one project is not approved by government, the permit for development process will not be issued.

The sanction given at the development and construction stage is to stop the development process. The ceased is not only for the SDFC facility development but also for the overall development. Developer will bear a huge loss should the above sanction is applied, as the promotion and marketing activities for those project will automatically be stopped. If the promotion and marketing activities are terminated, the projected income shall not be achieved, while the overhead and interest has to be paid from time to time. The government expects that the developer will immediately take action to improve and continuously maintain the SDFC facility development process in line with the regulation issued by government.

The severe sanction at the transfer period is to reject the SDFC facility, and immediately use the development deposit to finance the SDFC improvement and repair. The latest sanction needs to be applied regardless it is necessity, considering the fact that the control function has already been made from the development implementation level both internal and external in routine or periodic method.

Figure 5.3. below is a procedure of law enforcement and illustrate the stages of action taken to enforce the adopted rules and regulations.

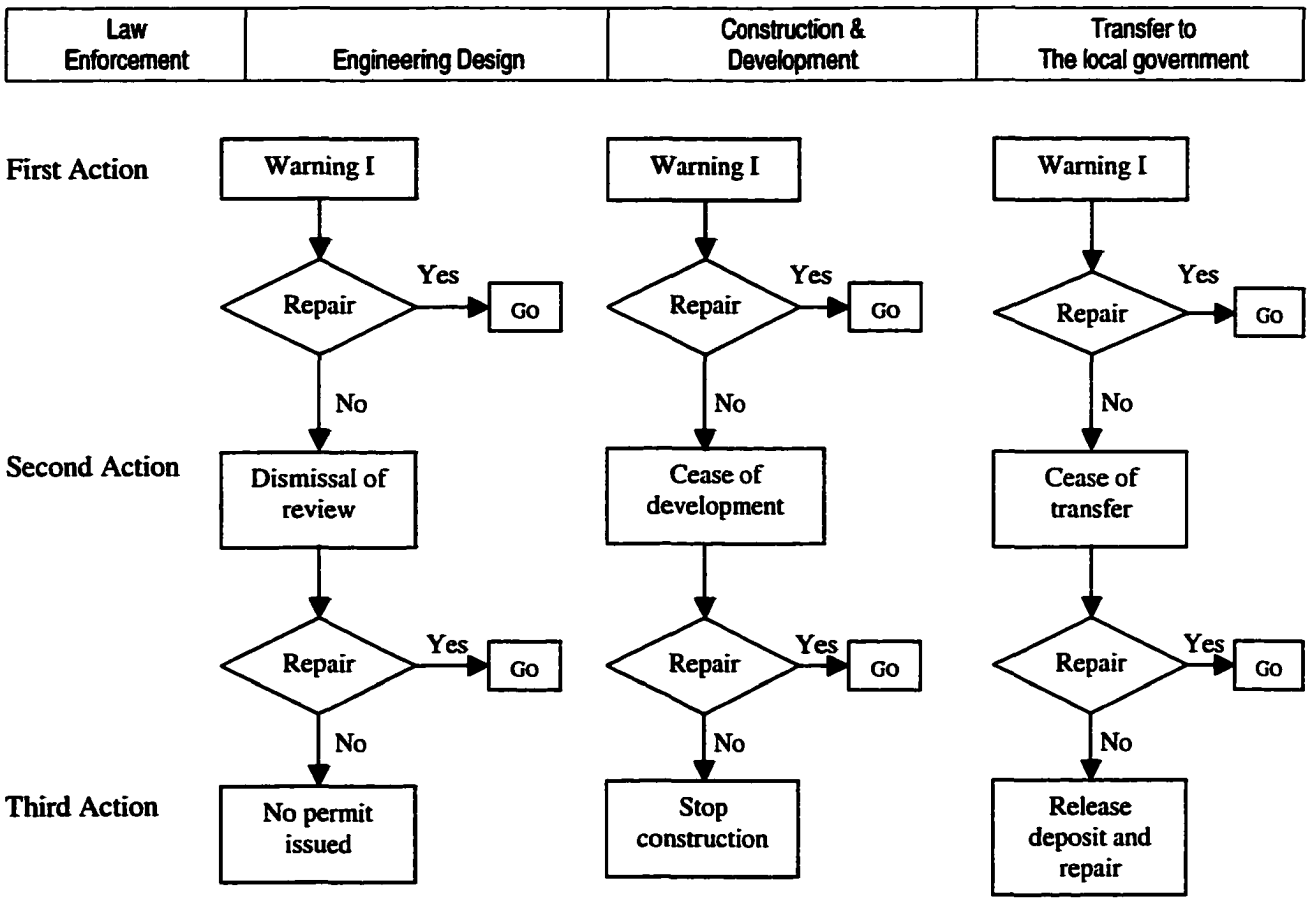


Figure 5.3. Law enforcement procedure

5.2.4.2.2. Law enforcement for clean river program

The law enforcement for the clean river program has to stand still and to be carried out firmly. Those parties who tries to defeat the program by violate the regulation has to be punished. Therefore, prior information and appeal on the program shall be given in persuasive manner and humane approach with possible and alternative solution.

The law enforcement executor is the officer in village office and supported by the civil service. Should firm action is required the officer might ask help from the police force. Upon the completion of social campaign, briefing and appeal, the next stage is to

give punishment or sanction. The first stage of punishment is to ask the people who still dispose their garbage to the river to collect them back. The period of this first stage of punishment is for 3 months from the declaration of clean river program. If the period is over the sanction for this violence is applied.

The sanction might in the form of fine in severe amount, which aimed to make the person learn to avoid them of making the similar action. The people are expected to consider this sanction before doing their action. Further sanction is to put those who keep repeating their action or fail to pay their fine in prison.

5.2.5. Communication system

The communication system is aimed to facilitate every party involved in the SDFC problem to understand and to obey particular rule and standard in SDFC. One of the most important organizations is the professional and developers companies association. Any information from the authority in federal government, province and local government can be forwarded directly and mutually through this association. A mutual condition and relation is important to create a respective condition for possible dialog so as to guarantee that all information can be received clearly. Furthermore, this association will forward all information to its member in order to give them knowledge of all guidance and assistance set forth by the government at every level of authorities.

The communication system scheme is illustrated in picture 5.4. below.

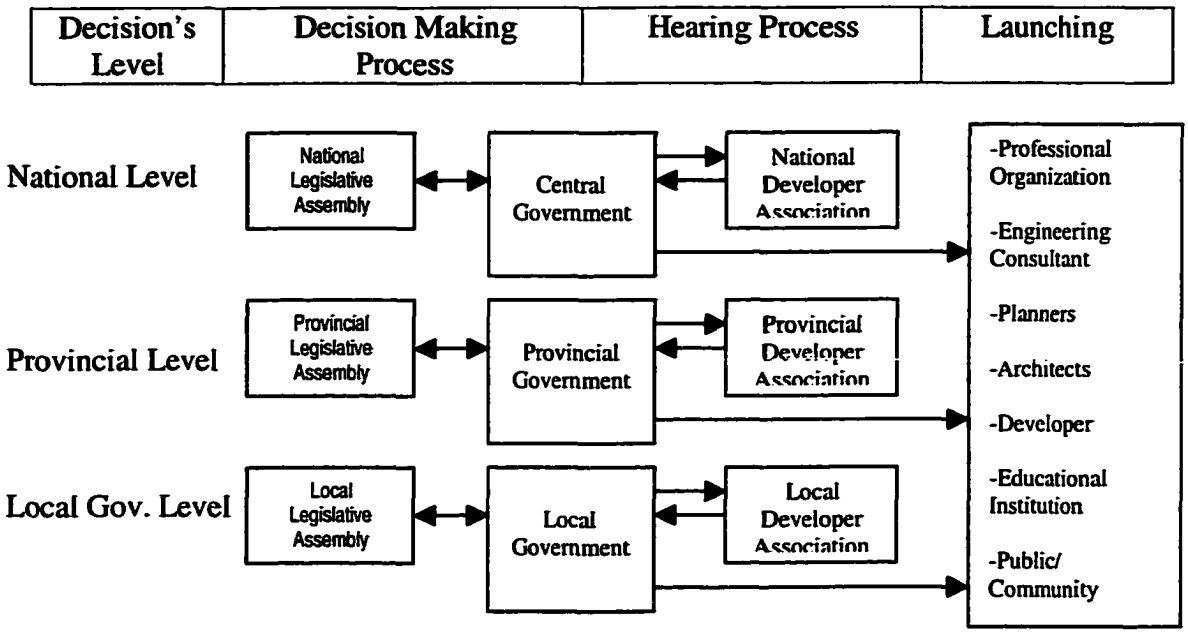


Figure 5.4. Communication system

5.3. TECHNICAL ASPECTS

There are four main issues that dominate technical aspects in relation to the implementation of the SDFC management activities. First of all, the master plan composition, including its zoning and subdivision plan. Secondly is engineering design, related to land development and SDFC facility, which includes standard and design criteria as the basic element in planning. Thirdly, the communication system that facilitates every party involved in the SDFC problem to understand and aware the basic rule and guidance to be implemented at the planning stages up to the construction and maintenance of such facility, in order to create a healthy, secure and convenient new residential area, especially from a potential flood problem. The fourth is technical

measure, particularly detention facilities, which is formed as the simplest alternative of flood control in a new development. Other problem in the technical aspect from its implementation side will be more related to the institutional aspect.

5.3.1. Site Planning

The basic foundation for the site plan development in the proposed new residential area is the region and city master plan, zoning plan and subdivision plan. In addition, the detail site plan planning has to be in accordance to the site development guidance. The technical planning detail for SDFC facility shall in accordance to the standard and design criteria manual.

The city master plan with its facilities, i.e. a proper and adequate zoning and subdivision plan can be established in several ways. The first strategy is to enhance the personnel capabilities especially those who are involved in planning and city development action in local government through a comparison study from one city/region to another. The problem in lack of planning capabilities and how to overcome this problem can be determined through the comparison study based on the experience happened in other city/region/area. The capability of the officer in local government can be obtained with a sufficient training.

The third way is to make use of the external consultant services. These consultants are beyond the experts belong to the local government institution. The service could be provided by individual expert, professionals, the consultant institution, and education institution both local and overseas. The consultants could also be used to train local staff. The cooperation scheme is described in Figure 5.5. below.

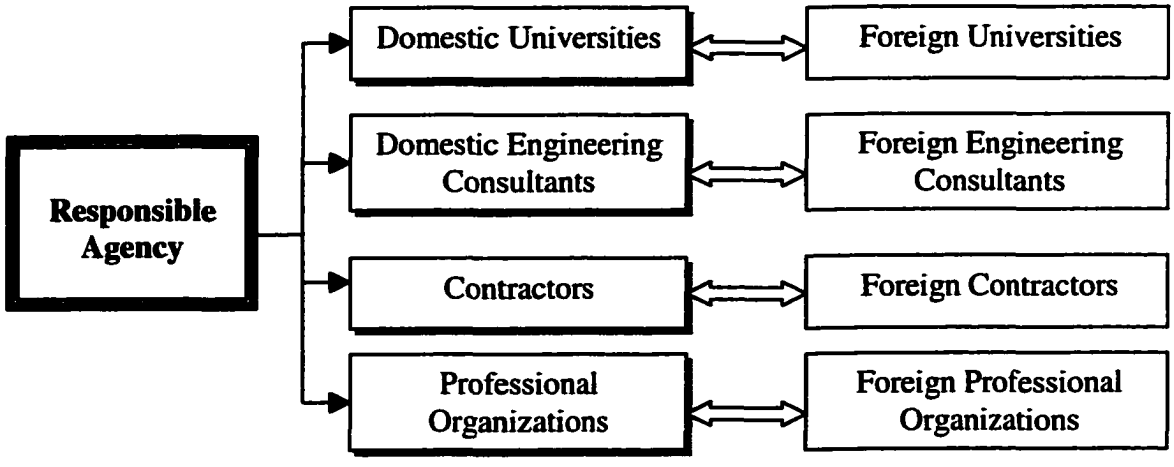
5.3.2. Engineering Design

Other important guideline is the one related to the design criteria and technical guidelines, such guideline that is more specific and detail, which includes the actual/physical development planning and the construction of SDFC facility technically. Development of design criteria and technical guidelines for the development of new residential developments based on the city's Master Plan or the General City Zoning Plan may be achieved by compiling and accommodating the thoughts and ideas of experts. For the planning of the area to be developed, it is necessary to involve experts in city and area planning, city economics, environment and environmental and landscaping architects. Involved in the technical design of storm drainage and flood control facilities of newly developed areas, should be experts in civil engineering, particularly those specialized in Infrastructure management, Water resources planning, Hydrology, Hydraulics and environment.

Institutionally, preparing these guidelines can also involve planning consultants, or contractors experienced in the implementation of the construction of drainage and flood control systems. Furthermore, experts from the universities and professional organizations could of course also be involved. Professional organizations related to this matter are the Hydraulic Engineering Association, the Consultants, and the Water Resources Engineering Association. In the case of planning consultants and experts from universities, the possibility of cooperating with foreign countries is not excluded. What are meant here by foreign countries are developed countries with proven and tested expertise in the required fields. This should be done, considering that the superiority of other countries in these fields mirrors the experience and expertise of those countries in

the fields concerned. Schematically, the mechanism of creating the Master Plan, Land Development Guidance System for newly developed areas, as well as the Technical Guidelines and criteria for storm drainage and flood control, is shown in figure 5.5. below.

First Alternative:



Second Alternative:

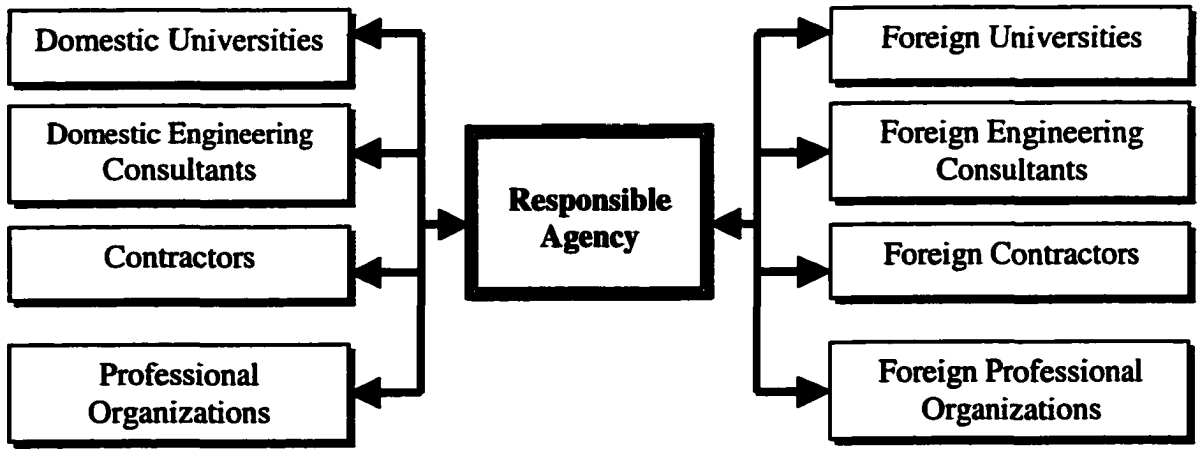


Figure 5.5. The cooperation alternatives

In the first alternative, the responsible agency deals only with three other parties. The domestic consultant or university will then cooperate with their foreign counterparts.

While in the second alternative, the responsible agency will deal directly with all parties, domestic as well as foreign.

In developing these design criteria, the special district formed in the regional level could be compiled by a committee consisting of representatives from the Indonesian Engineers Association, the Consulting Engineers Association of the region, the urban development industry, drainage equipment manufacturers and provincial ministries, including the Ministry of the Environment, Natural Resources, Housing, Transportation and Communications, and Consumer and Commercial Relations.

5.3.4. Technical measures

As previously described, the SDFC measure is emphasized in the structural aspect, for the nonstructural aspect is more related to the institutional category.

The detention and retention pond used for new residential area should be in line with the total area of land for such development. At previous chapter described the type of categories for total area developed. The total area determined the number of detention pond must be built in the proposed new residential area.

As explained in the previous chapter(s), it is proposed to have two types of pond as flood control, which should be built in newly developed residential developments. These two types of pond are: Temporary Pond and Permanent Pond. The Temporary Pond is usually called dry pond. This type of flood control can effectively be used to overcome flood problems. When the rains come, or during a certain period, the rainwater can be gathered by this facility. In accordance with its name, dry pond, this facility will run off all the rainwater previously gathered, so that the facility is dry again. Therefore, this facility serves a double function. Examples of facilities, which can serve a double

function are golf courses, recreational parks, gardens found in residential developments. Besides that, parking lots can also be used as dry ponds. Since all residential developments must have parking facilities, parks and other open spaces, in accordance with the standards and design criteria for the development of new areas, these facilities can be used as dry ponds in all categories of residential developments, regardless of the size of the area developed for the development.

Construction of permanent ponds, both those serving as water detention facilities as well as those serving as water percolation facilities, is mandatory for every developer based on the size of the area to be developed. Detention ponds in a residential development serve as an aesthetic adjunct, as well as an effective means for reducing peak flow rates in the storm sewer system serving the community.

The number of detention ponds, the location and the size of each detention pond depend on the field conditions of the area. Assuming that one detention pond can serve an area of 100 Ha, then for the development of a new residential development of 500 ha about five detention ponds will be required. For areas of 200 to 500 Ha at least two detention ponds will be required. Developers developing an area of 50 to 200 Ha have to build at least one detention pond. While for areas of less than 50 Ha, the obligation to construct a detention pond can be compensated by paying a certain sum of money to the local Government. The size of the sum to be paid depends on the size of the area to be developed. Funds so gathered will be combined with funds obtained from other developers in the same general area. These combined funds will then be used to build a common detention pond to serve several areas at the same time. The local government builds this common detention pond.

To assure that detention ponds facilities are extensively used and successfully control flooding in the new area development, the local government, cooperated with the special district, should set up an ordinance and practices in Detention of Urban Storm Water Runoff.

The ordinance also requires the volume of storage for the 100-year rainfall for any and all durations based on data of the National Weather Service. These requirements are to apply to all new constructions of 10 acres or more for residential developments, five acres or more for non-residential developments, and to all developments, regardless of size, if the total impervious area is 60 percent or greater.

The practice in detention of SDFC could be used as the source for concepts, techniques, applications, costs, problems and legal aspects of the storage of storm water.

Enforcement will be through the issuance of building permits and large park pond facilities can be dedicated to the city at which time the city will assume all maintenance and operation.

5.4. FINANCIAL ASPECTS

The main issue in the financial aspect is derived from three components, capital cost, operation and maintenance costs, and choosing the best alternative through optimization.

The discussion about capital cost generates concerns on who finally will bear this cost, such as which customer will be charged. This charge should be fair and proportionate to the beneficiaries that the customers get.

Problems in operation and maintenance are arisen related to the fund raising for operating, rebuilding, repairing and maintaining SDFC facility. Since the local government has no reliable capability to this matter, self-help association in the

community should take apart in this management activity. The following section discusses about role and participation of self-help association such as Rukun tetangga (neighborhood association at subvillage level) and Rukun Warga (neighborhood association at village level).

The first section below discusses capital costs, secondly operation and maintenance cost, then optimization.

5.4.1. Capital Cost

The developer can allocate the costs for the construction of the detention facility in two different ways. The first way is to allocate these costs proportionally to all lots of land to be sold. The other way is to allocate the greater part of the costs, particularly those related to the construction of this facility, to certain houses or lots of land. These certain lots are the ones that directly enjoy the beauty of the pond or lake. With the development of a lakeside area, the developer can raise the price of the units or the land that either faces the pond or have the pond in the back. In reality this is nothing else than an allocation of the costs for the construction of the pond.

5.4.2. Operation and Maintenance Cost

The operation and maintenance cost can be charged to the society by following the collection method of garbage disposal cost which normally applied. Every citizen is obliged to pay such levy to the garbage organizer, whom every three days takes out that domestic garbage out of the residential area. The first transportation is from the residential area to the temporary garbage pond. The next transportation will be from temporary garbage pond to the landfill, which usually located relatively far from the residential area.

In SDFC facility matters, no special manpower is required for transporting the water from residential area to its final disposal namely the river. However, the operations and maintenance acts fro the SDFC is the routine inspection to be followed by cleaning and routine maintenance and repair services should the facility has damaged. The above-mentioned activities required certain funds and the expenses are to be borne by the citizens taking advantages of the SDFC facility, such contributions might be named the service charges or drainage fees.

A general definition of the service charges is a certain levy imposed to defray the cost of particular services rendered for one's account. The most important element for this charge is the actual provision of some tangible service or commodity, a relation between the charges imposed and the value of the service renders and a specific usage of charges collected for the provision and maintenance of the particular service and service facilities.

Drainage channels need to be regularly cleaned, and the activity for this purpose can be accomplished by motivating the resident to take apart accordingly. In the US, every resident is responsible to clean the sidewalks in front of their houses when the snow falls. Social stratification in Indonesia inclined to divide the cleaning methods into two types. The first pattern is in residential area with middle to low income group of residents. The member of this group is still willing to work together hand in hand to clean the drainage channel. The act shall be carried out individually or in groups. The activity for making the environment clean can be categorized as a "Kerja Bakti" (voluntary work service). The Kerja Bakti activity could be carried out regularly. Further, in order to receive better response from the residents, the kerja bakti activity can be put in a

competition starting from the lower level of government (RT, RW, and Kelurahan) up to the province/state government. The perfect time to do the competition is during the celebration of the Indonesian's Independence Day. The competition includes and not limited to maintain and clean the roadway, environment, park, planting, trash dump, etc. Basically, group activities are still favorable for middle to low-income group of society, which in accordance to the Maslow theory in human requirement. The social need or requirement for these groups of people is high. Such potential act for work together hand in hand should be maximizing in maintaining the SDFC facility.

The second pattern is for the middle up society. The middle up society has lessened time and opportunity to see each other and do same activity together such as cleaning drainage channels. In this circumstances they are required to pay such levy which also be calculated to cover the cleaning services. The cleaning can be done by local government through its waste authority, or by private organization, which coordinated by the regent through the Waste Authority.

5.4.3. Benefit and cost ratio

The benefit and cost ratio aspect is applicable to decide alternatives projects, especially for the major facilities, which in this case is the detention pond construction. New residential area with over than 200 hectare of land will need more than one detention pond or have optional detention pond construction. In order to achieve the most economic result, a benefit and cost ratio analyst is needed. In practice, the benefit and cost ratio calculation applied in the following stages:

1. Examine flood hazard area and classify by land use
2. Determine flood damage categories by land use

3. Eliminate unlikely damage categories
4. Divide study area into reaches
5. Develop cost data
6. Identify benefits and collect supporting data
7. Obtain and develop appropriate depth versus damage tables or curves
8. Analyze the do-nothing flood damages
9. Compute the average annual flood damage potential
10. Compute the flood damages and the average annual flood damage potential for alternatives
11. Compute the benefits for each flood control alternative
12. Compute the costs for each flood control alternative
13. Select the time horizon
14. Select an appropriate discount rate
15. Convert all benefits and costs to a common time frame
16. Compare the benefits with the costs and prepare them in display form for decision makers

5.5.GENERAL FINDINGS

After analyzing the model of Chapter 4 with the actual situation in Indonesia, as outlined in this Chapter, the status of SDFC implementation in Indonesia can be summarized as follows.

Institutional aspect

1. The local governments are not well organized. There is no particular agency concerning SDFC matters, so that they can regulate, plan, design, control, operate and maintain the facility in a proper manner. The local government must appoint certain divisions to take care of the infrastructure problem in the city to assure its operation. Society involvement is expected through establishment of a "Self help" association especially for the operation and maintenance of the SDFC facility. Developing special districts at the regional level is necessary to give guidance and direction. The establishment of new agencies or institutions must be accompanied by local government rules and regulation, which are compiled and duly authorized by local government and the assembly at provincial level.
2. Laws and regulation is not completely developed. Zoning is only for certain areas. We still have to establish subdivision regulation, land development guidance system and technical design criteria manuals.
3. Enforcement for penalties must tighten, since awareness of laws among parties involved in the new area development is still poor. Public community awareness to maintain major drainage systems is low. This depends on the condition of government agencies and the existing law and regulation. Therefore, the problem is closely related to the local government and sufficient regulation system.
4. There is no specific policy and national study of SDFC at the highest level of government. Too many things have to be done, a typical condition in a developing country

Technical aspect

5. SDFC activity is not well managed, such as poor planning and design, there is no funding scheme for construction, operation and maintenance, and control to the development of SDFC facility is inadequate.
6. Technical capabilities of local agencies should be improved. Training and development of appropriate technical guidelines would be an appropriate strategy to achieve the technical knowledge requirement. In order to arrange the master plan, technical design criteria and development guidelines, the government should request opinions from professional associations such as the Indonesian Architects Association, Planning Consultant Association, and Water Resources Engineering Association, etc. Such ideas might be given directly to local government or to special district agencies in regional level.

Financial aspect

We need to develop appropriate sources of funds for rebuilding and O&M. Some alternatives are collecting taxes and fees. Self-help associations could be developed to raise funds for maintaining SDFC facilities, but ability-to-pay analysis should be conducted in line with fee methods.

Those situation leads to the cause and effect phenomenon that can be illustrated in the following figure.

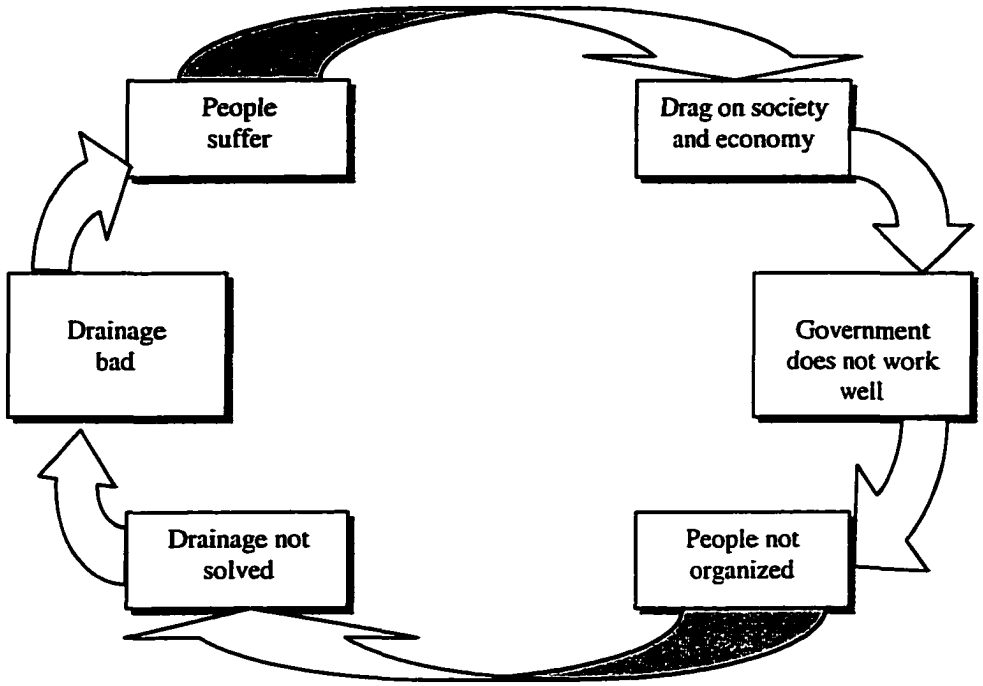


Figure 5.6. Cause effect diagram in SDFC problem

The main problem discussed in this thesis is mainly the problem of drainage system, which is not solved yet. As previously discussed in chapter 3, the drainage problem downgraded the quality of the existing SDFC facility as shown by the modifications of land use and water storage in new residential developments.

Consequently, flood problems will occur during rainy seasons. Figure 3.4. in Chapter 3 illustrated flooding in a new developed area. The problem would not occur if the drainage system in that area were in good working condition. Figure A.6. in Appendix A shows the flooded area which bring losses for the community such as damage and material loss, delay and failure for the business, schools, offices activities due to the traffic problem. Besides, the flood problem will also bring problem in hygiene

matters such as skin disease, diarrhea, potential breading of mosquito to spread even more disease to the community.

The SDFC problem leads to degraded living, which leads to drag on society and economy. The lack of SDFC facility in new developed area will consequently cause flood problems and hamper society's activities, it will also disturb the economic activities and in addition, it will leads to less trust in government and less cooperation.

Less trust in government and less cooperation between the society and government will make government not function properly. The program formulated by the government is designated to be implemented by the society for their own benefit. However, the program is meaningless when it receives no response from society and this circumstance tends to create an unorganized society.

From the previous chapter it shows that in relation to the SDFC problem there is no certain national policy, laws and enforcement which supposed to be promoted by the government which gradually makes the unorganized society.

Further effect that might also occur is less awareness and care from the society towards the SDFC facility. They use riverbank as a shelter and dispose garbage to the river without even giving thought of the result. They do not care that their act narrows the river flows, which lessen the capacity of the river. This case is illustrated in Chapter 3 and shows in Figure A.2, A.3, A.4, A.5 in Appendix A. Adding to this situation is the developers' attitude for giving less attention to develop residential area within adequate elevation level to avoid flood problem, and provide proper drainage system.

The main issue raised in this thesis is the unsolved flood problem, which influences other aspects and leads back to its main problem.

CHAPTER 6

CLOSURE

This chapter summarizes the previous discussions on storm drainage and flood control and includes conclusions and recommendations from the first five chapters.

6.1. CONCLUSIONS

1. Development in new residential areas in Indonesia is not supported by adequate SDFC management systems, leading to many problems, which influence ability to solve drainage problems. This circumstance is shown as the cause and effect cycle illustrated in Figure 5.6. The unsolved drainage problem leads to the poor condition of drainage systems and people suffer from flooding. Poor SDFC facilities lead to degraded living, which leads to a drag on society and economy, which leads to less trust in government, and less cooperation, meaning that the government not work well. This situation leads to the condition where people are not organized, which affects the unsolved drainage problem. The physical effect is the flood problem as shown in Figure A.6, Appendix A.

2. From the discussion it is obvious that flood problems in new residential developments require thorough analysis from many aspects and integrated efforts, not only technological measures. The major lines of solutions include institutional, financial, and technical measures. Institutional measures include

the developer's role in planning, development and maintenance; the government's role as the controller and in providing guidance to form the system, and law, regulation and enforcement. Financial measures include developing resources to build and maintain the facility from both developer's and government's side, and technical measures include site planning and engineering design of the SDFC facility.

An integrated management model is required. The model will be a roadmap, charting a course through the entire spectrum of SDFC management activities required for a thorough planning effort. This road map is required as guidance because this will give adequate information and comprehensive description of recommended actions to overcome the problem. It should reflect experiences of professionals who have covered the route. No standard procedure will cover every conceivable situation at every possible location. While one specific route is charted and recommended, the model acknowledges the need for adapting to local situations, and can be tailored to local needs. However, unless the institutional framework is adequate, no model will work.

3. Analysis of model implementation reveals several findings: need for overall policy concerning SDFC; need to strengthen local government SDFC management; need for strengthened laws and regulations; need for improved enforcement; need to strengthen technical capabilities of local agencies; and need to solve financial problems.

A policy is required because it has a position in the hierarchy of rules and regulations. Therefore, the policy will determine the proposed and required

actions carried out by the government, which focus on the decisions that determine the direction of governmental action. Without policy, local government won't do its job.

4. Given the dominance of central government, it is apparent that it must plan an important/dominant role in these cases, and roles of local and provincial government must also be strengthened. In a developing country, where generally an efficient use of the peoples' potential is still top-down, the government still plays a very major role. The government's involvement in arranging the daily life of the population is still hoped for and has a very important meaning. Therefore, the implementation of the management of the SDFC facility in a new residential development is still highly dependent on the government's initiative.

5. Transparency for development planning is compulsory. Transparency will enable the society to control the implementation of the proposed development. Without it, no system will work.

   Local government must state clearly their regulation in terms of land use plan and zoning. The incentive for local government is the power to attract investor in land development. Adequate information of a land use plan from local government is important.

   Developers must also state clearly their plan in accordance with the site plan approved. Developers have benefit in receiving confidence and trust from customers, which will increase sales.

6. The key success factors in managing the SDFC facility, deriving from the above matters, lie in the resolve of the government, skill of the agency concerned, the control system, the governing laws and the enforcement.

7. However, further detailed investigation might be still required in order to sharpen our knowledge about the SDFC problem in new residential areas and how to overcome it.

8. Finally, it should be realized that every new idea and system often looks complicated to implement. This new system will, of course, place demands on the local government, and the regional government above it, and need technical capability to administer and oversee the implementation of this new scheme. It will therefore be necessary to "educate" the various parties involved in the implementation of an SDFC facility in this new residential development, the developer, the local government, the related agencies and the occupants as well. One example is the need of information for the local government and the occupants about a better understanding of the proposed scheme for a drainage fee tariff. The local government and the regional government above it need to promote laws and regulations on flood control nationally. Other matters on technical planning and design have to be given to developers and related agencies.

6.2. RECOMMENDATIONS

1. Local government attention towards development in new residential areas must be increased by upgrading capabilities, knowledge and expertise of public administrators. For SDFC, local teams must supervise planning,

control, implementation and maintenance as integrated parts of city facilities. Keeping their region orderly and well managed will be a benchmark to measure the success of city management.

2. To promote interregional coordination and anticipate inadequate capabilities among local government officers, regional government must establish districts within provincial government. This district has opportunities to search for new means of providing services through cooperation with other government. Besides, they can find new ways to collaborate with private and non-profit organizations in jointly providing public services.

3. Professional development through organizations needs to be improved. This includes providing ideas to the regional level. Members of professional organizations should receive incentives such as participation in seminars, workshops, and research to enable them to form technical policy and guidance for infrastructure systems, and administrative systems for regulation and control implementation. This organization should be developed to have engineers and managers learn from each other and work together like professional organizations in the US, such as ASCE (American Society of Civil Engineers) and APWA (American Public Work Association).

4. Developers also should be involved in improving new residential areas, working through their organization, REI (Indonesian Real Estate Association). Well-managed SDFC facilities will lead to beautiful, nice and comfortable environments and attract customers, and developers will create a good image towards their product and company.

5. Government should motivate the communities to maintain SDFC facilities, including both the "Kerja Bakti" activities (voluntary work activity) and also aspects such as repairing and rebuilding of the SDFC facilities. Local communities should be motivated to manage SDFC facilities because they will have full and direct advantage from the facility. Incentives for the local governments should be developed. A harmonious environment with a well-managed SDFC facility is also attractive for residents, and homeowner associations should be established and give attention to management of the SDFC facility.

   Public involvement will enlighten local government workload, especially those that relate to the SDFC problem. In order to maximize public involvement, intensive communication between government and the society is required so that it will stimulate public awareness to maintain the facility they have used.

6. From the technical side, the use of facilities such as detention ponds in residential developments should be considered. Since detention ponds are straightforward to build and have multiple benefits, they should be considered for developing countries, not only as a flood control system in newly developed areas, but also for other purposes that promote sustainable development. By practicing sustainable development, a change in the function and the use of the land will not immediately change the ecosystem to the detriment of the next generation.

7. Further research in the area of institutional aspects is still required, especially those related to the management, control, law and regulation and law enforcement itself. The next aspect is in financial sources to secure the ongoing maintenance of the existing SDFC facilities. In the technical aspect, future research on which features work best, like detention ponds would be required.

Further research questions would be, for example, as shown on the table 6.1.

Table 6.1. Further research questions

Category	Question
Management	What could central government do to strengthen capacity of local government officers?
Control	Which institution shall be responsible to control the SDFC activities, which includes design, development and maintenance?
Rules, law and regulation	What type of rules, law and regulation shall immediately be applied? On which level laws and regulation shall be issued?
Penalty enforcement	Which institution and on what level shall the penalty enforcement be carried out? What kind of penalty shall be applied to secure proper rules and regulation application?
Financial	Who will properly finance the capital cost for the detention pond facility, how is the budget allocated for each department? What is the charge fee calculation method for the O+M considering the ability to pay from each residence?
Technical	Which features work best? How to get it organized, who plans, who pays, who maintains?

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APPENDIX A

Figure A.1. The Jakarta Metropolitan City

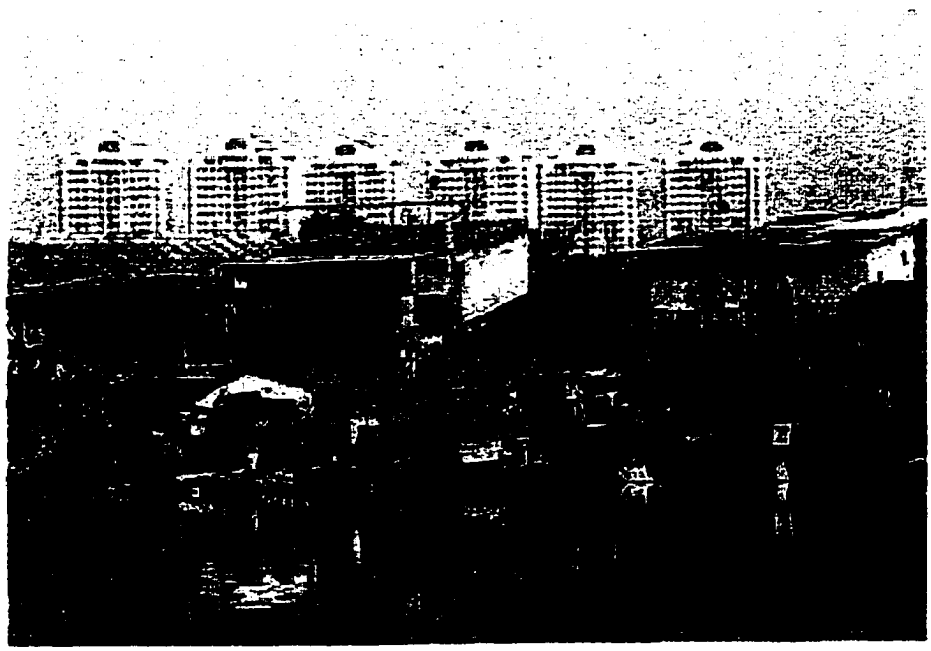

Figure A.2. Living on the riverbank

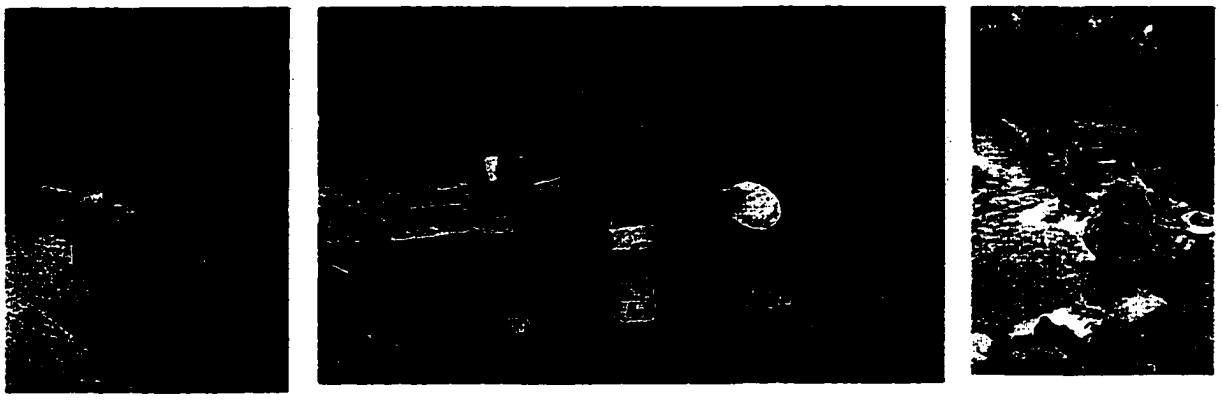

Figure A.3. Brushing teeth, washing dishes and washing the clothes

Figure A.4. Making 'tempeh' and 'pindang'

Figure A.5. Garbage disposal and flood in a residential area

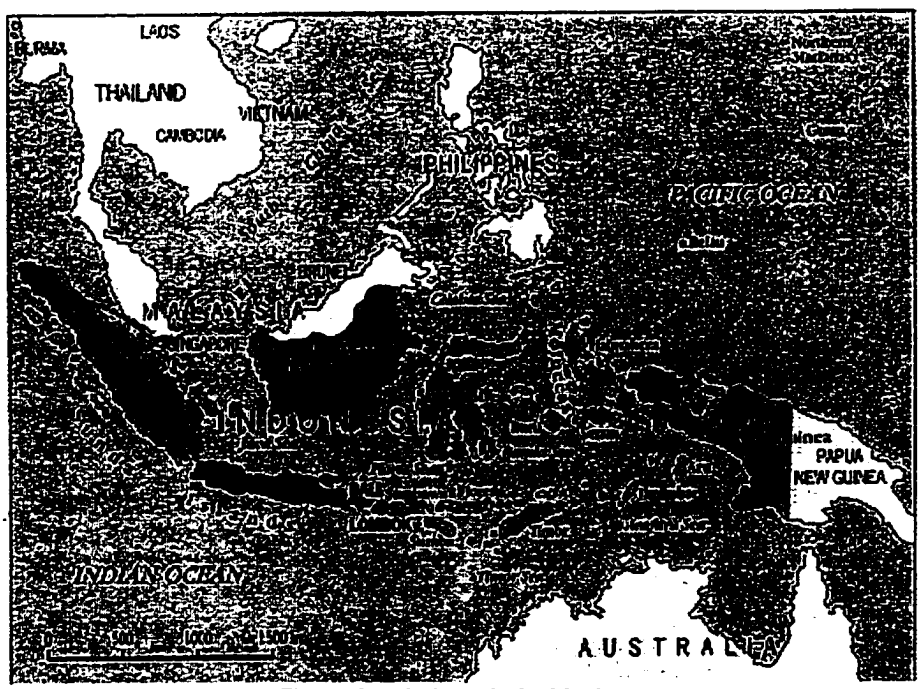

Figure A.6. Indonesia Archipelago

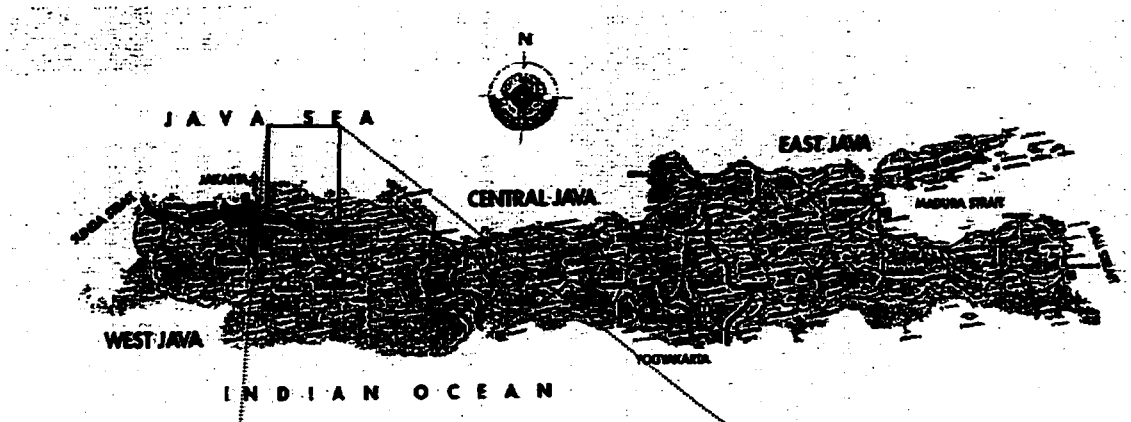

Figure A.7. Java Island

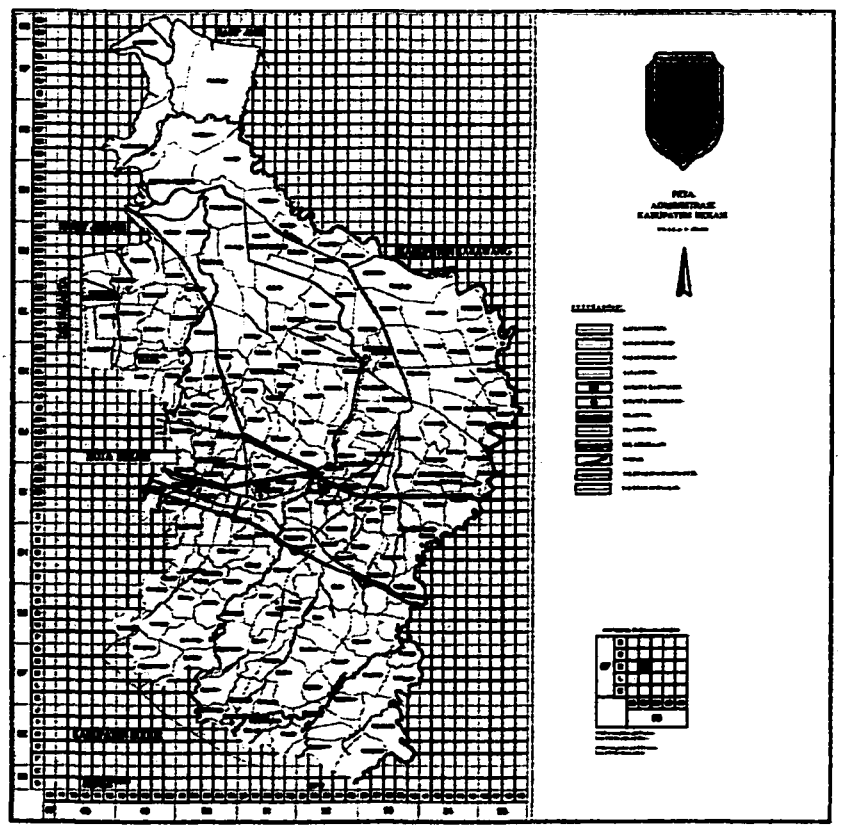

Figure A.8. Bekasi Regency

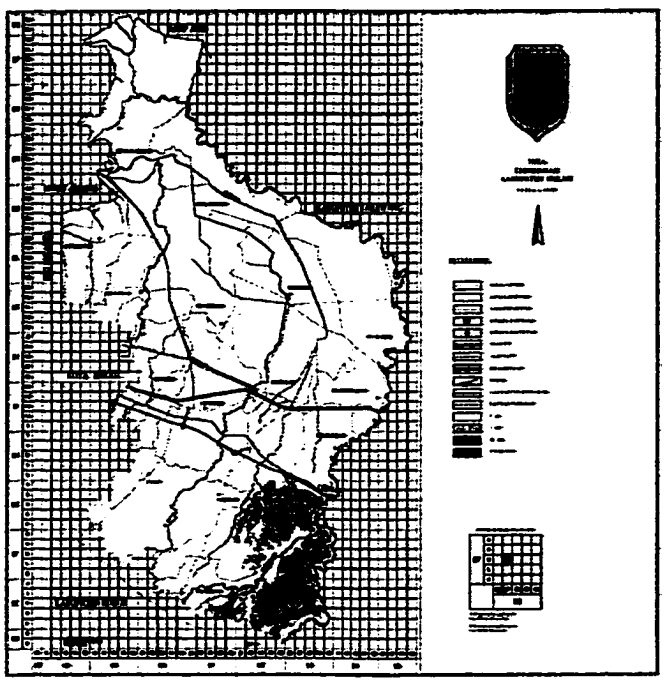

Figure A.9. Topography

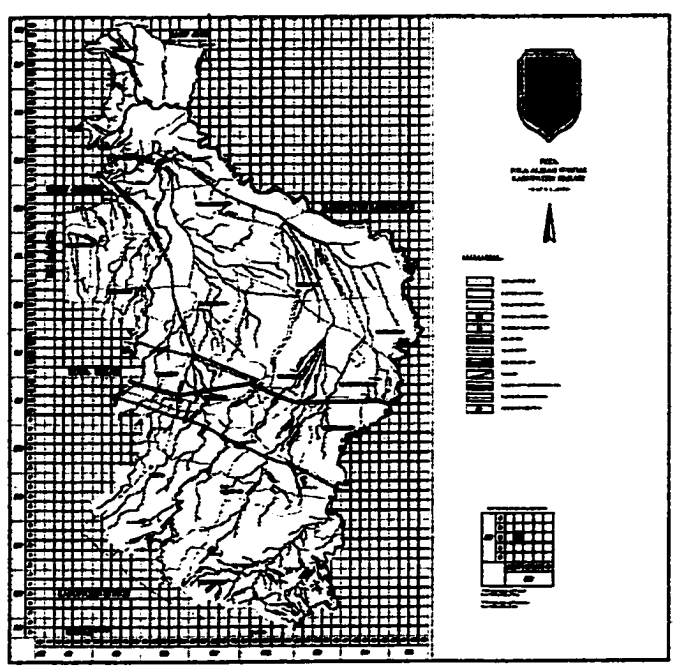

Figure A.10. Channel pattern

APPENDIX B

Table B.1. New residential district development around Jakarta

Project	Area (ha)	Launched (year)
North Jakarta		
Jakarta Waterfront City	2700	NA
West Jakarta (Tangerang)		
Teluk Naga	8000	NA
Bumi Serpong Damai	6000	1989
Kota Baru Tigaraksa	3000	1987
Citra Raya (Citra Grand City)	3000	1994
Lippo Karawaci	2630	1992
Bintaro Jaya	1700	1979
Gading Serpong	1000	1993
Kota Modern	770	1989
Alam Sutera	770	1994
East Jakarta (Bekasi)		
Lippo Cikarang	5500	1991
Kota Baru Cikarang	5400	NA
Kota Legenda	2000	1994
Bukit Indah City	1200	1996
South Jakarta (Bogor)		
Bukit Jonggol Asri	30000	1996
Bukit Sentul	2000 – 2400	NA
Citra Indah	1200	1996
Kota Wisata	1000	1997
Telaga Kahuripan	750	NA
Taman Metropolitan	600	NA

Source : Real Estate Indonesia Directory, 1998

Table B.2. The distribution of total area in Kecamatan and Desa

No	Kecamatan	Area (Ha)	Percentage (%)	Total Desa
1	Setu	7,273	5.71	13
2	Cibarusah	11,240	8.82	13
3	Serang	11,942	9.37	15
4	Lemahabang	10,084	7.92	16
5	Cikarang	6,456	5.07	13
6	Kedungwaringin	3,865	3.03	9
7	Cibitung	9,503	7.46	18
8	Tambun	7,878	6.18	18
9	Tarumajaya	5,463	4.29	8
10	Babelan	6,361	4.99	9
11	Tambelang	9,919	7.79	14
12	Sukatani	8,836	6.94	14
13	Pebayuran	9,635	7.56	13
14	Cabangbungin	6,643	5.21	9
15	Muaragembong	12,290	9.65	5
	Total	127,388	100.00	187

Source: Kabupaten Bekasi in numbers, 1998

Table B.3. Rainfall depth and duration in Kabupaten Bekasi

No	Kecamatan	Depth (mm)	Duration (day)
1	Setu	3,190	139
2	Cibarusah	1,879	126
3	Serang	1,539	120
4	Lemahabang	1,318	122
5	Cikarang	1,316	90
6	Kedungwaringin	-	-
7	Cibitung	1,835	116
8	Tambun	2,028	113
9	Tarumajaya	1,408	84
10	Babelan	1,594	92
11	Tambelang	1,511	94
12	Sukatani	1,674	102
13	Pebayuran	1,640	91
14	Cabangbungin	1,878	113
15	Muaragembong	1,712	102

Source: Kabupaten Bekasi in numbers, 1998

Table B.4. Total Population, Population growth, density and projection in year 2003

No.	Kecamatan	Area (Ha)	1993	1994	1995	1996	1998*	2003 (Projected)	Population Density (people/ha)
1	Setu	7,273	61,495	61,756	75,581	79,804	71,210	111,948	16
2	Cibarusah	11,240	55,751	56,102	67,886	71,579	63,706	98,131	9
3	Serang	11,942	67,966	68,236	81,551	86,009	78,771	118,221	10
4	Lemahabang	10,084	102,455	105,917	150,136	161,424	115,139	258,412	26
5	Cikarang	6,456	100,767	100,943	133,499	143,528	108,463	202,619	31
6	Kedungwaringin	3,865	46,918	47,584	44,499	47,842	55,409	57,708	15
7	Cibitung	9,503	132,295	133,098	171,030	183,884	134,098	238,522	25
8	Tambun	7,878	163,651	167,266	206,175	221,673	219,269	369,412	47
9	Tarumajaya	5,463	38,201	38,938	46,294	48,739	56,274	85,400	16
10	Babelan	6,361	75,112	70,112	87,547	95,064	75,081	115,163	18
11	Tambelang	9,919	57,765	58,218	69,522	73,190	62,872	94,504	10
12	Sukatani	8,836	80,196	81,102	95,469	100,534	90,886	133,850	15
13	Pebayuran	9,635	69,205	70,142	84,785	89,274	80,188	124,372	13
14	Cabangbungin	6,643	40,169	40,310	49,204	51,919	46,221	72,134	11
15	Muaragembong	12,290	21,093	21,146	26,794	28,327	20,101	33,710	3
	Total	127,388	1,115,032	1,122,864	1,391,967	1,484,786	1,279,686	2,116,109	17

Source: Kabupaten Bekasi in numbers, 1998 *Until September 1998

Table B.5. Gross Regional Domestic Product – Bekasi

No.	Activity	Year									
		1993 (million rupiah)	%	1994 (million rupiah)	%	1995 (million rupiah)	%	1996 (million rupiah)	%	1997 (million rupiah)	%
1	Agriculture	351,771	8.57	359,691	7.07	374,308	5.96	383,697	5.01	355,946	3.91
2	Mining & Exploration	8,512	0.21	10,364	0.20	13,258	0.21	16,498	0.22	18,934	0.21
3	Processing Industry	2,616,970	63.79	3,284,470	64.55	4,130,911	65.76	5,130,258	66.93	6,213,225	68.31
4	Electricity, Gas & Water	53,535	1.30	71,043	1.40	91,227	1.45	106,269	1.39	137,289	1.51
5	Building/Construction	126,824	3.09	155,474	3.06	196,362	3.13	239,811	3.13	258,541	2.84
6	Trading, Hotel & Restaurant	582,451	14.20	732,121	14.39	914,035	14.55	1,107,037	14.44	1,299,200	14.28
7	Transportation & Communication	63,224	1.54	96,540	1.90	117,123	1.86	152,032	1.98	172,882	1.90
8	Bank & Finance Institution	152,791	3.72	178,253	3.50	203,081	3.23	261,471	3.41	336,548	3.70
9	Services	146,291	3.57	200,498	3.94	241,753	3.85	268,578	3.50	303,005	3.33
	Total GRDP	4,104,362	100.00	5,090,448	100.00	6,284,053	100.00	7,667,647	100.00	9,097,567	100.00

Source: CBS Bekasi Regency, 1998

Table B.6. Trend of developed area in Kabupaten Bekasi 1993 – 1996

No	Kecamatan	Area (Ha)	Land for building and yard				Growth		Average Growth Rate (%/year)
			1993		1996				
			Area (Ha)	(%)	Area (Ha)	(%)	Area (Ha)	Proportion (%)	
1	Setu	7,273	1,030	14.16	2,074	28.52	1,044	14.35	33.79
2	Cibarusah	11,240	556	4.95	1,020	9.07	464	4.13	27.82
3	Serang	11,942	1,545	12.94	3,720	31.15	2,175	18.21	46.93
4	Lemahabang	10,084	3,555	35.25	5,284	52.40	1,729	17.15	16.21
5	Cikarang	6,456	1,162	18.00	1,285	19.90	123	1.91	3.53
6	Kedungwaringin	3,865	557	14.41	579	14.98	22	0.57	1.32
7	Cibitung	9,503	4,482	47.16	4,998	52.59	516	5.43	3.84
8	Tambun	7,878	3,052	38.74	3,919	49.75	8,867	11.01	9.47
9	Tarumajaya	5,463	373	6.83	702	12.85	329	6.02	29.40
10	Babelan	6,361	654	10.28	1,845	29.00	1,191	18.72	60.70
11	Tambelang	9,919	706	7.12	706	7.12	-	0.00	0.00
12	Sukatani	8,836	353	4.00	358	4.05	5	0.06	0.47
13	Pebayuran	9,635	748	7.76	748	7.76	-	0.00	0.00
14	Cabangbungin	6,643	1,214	18.27	1,214	18.27	-	0.00	0.00
15	Muaragembong	12,290	319	2.60	1,003	8.16	684	50.57	71.47
	Total	127,388	20,306		29,455		9,149		
	Growth Rate (%)			15.94		23.12		7.18	15.02

Source: Kabupaten Bekasi in numbers, CBS-1996

Table B.7. Trend of total area of Location Permit for Housing and Industrial Zone in Kabupaten Bekasi 1979 – 1996

No	Kecamatan	Housing Zone			Industrial Zone		
		1979-1993 (Ha)	1994-1996 (Ha)	Total (Ha)	1984-1993 (Ha)	1994-1996 (Ha)	Total (Ha)
1	Setu	500.00	1,350.00	1,850.00	15.76	-	15.73
2	Cibarusah	45.00	-	45.00	-	-	-
3	Serang	15.00	2,173.00	2,188.00	92.99	3.70	96.69
4	Lemahabang	690.00	3,319.56	4,009.56	1,166.64	75.09	1,241.73
5	Cikarang	11.00	-	11.00	71.24	9.99	81.24
6	Kedungwaringin	-	-	-	28.38	172.50	200.88
7	Cibitung	572.48	488.00	1,060.48	408.97	352.77	761.74
8	Tambun	2,778.36	1,991.67	4,770.03	161.00	23.30	184.30
9	Tarumajaya	1.30	977.00	978.30	-	155.37	155.37
10	Babelan	124.90	-	124.90	2.10	-	2.10
11	Tambelang	-	-	-	-	-	-
12	Sukatani	-	-	-	0.50	-	0.50
	Total	3,477.04	10,299.23	13,776.27	1,947.54	792.75	2,740.28

Source: Kabupaten Bekasi in numbers, CBS-1996

Table B.8. Land use plan for year 2003

No	Land use	Area (Ha)
1	Preservation area	11,092.5
2	Yearly Cultivation plant area	4,232.5
3	Agriculture cultivation area (non rice)	3,897.5
4	Agriculture cultivation area (rice)	74,422.0
5	Fishponds	8,565.0
6	Tourism	437.5
7	Residential	14,869.0
8	Industrial zone	9,772.0
9	Coastal Training Center	100.0
	Total	127,388.0

Source: CBS Bekasi Regency, 1998