INTEGRATED

WATER QUALITY MANAGEMENT

IN

THAILAND

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GLOSSARY

Baht	Thai currency $ NZ 1 = 16 Baht
BOD	Biochemical Oxygen Demand (BOD). Oxygen consumed by the degradation of organic matter by organisms. Usually measured at 20 C and over 5 days.
Carrying capacity	Capacity of ecosystem to support organisms, while maintaining its productivity, adaptability and capacity of renewal.
COD	Chemical Oxygen Demand (COD). Oxygen consumed by the degradation of organic matters by strong chemicals.
Consent authority	The Minister of Conservation, a regional council, a territorial authority, or local authority that is both a regional council and a territorial authority, whose permission is required to carry out an activity for which a resource consent is required under the RMA 1991.
Criterion	Scientific data evaluated to derive the recommended limited for water uses.
Ecosystem	A system of plants, animals, and other living organisms together with the non-living components of their environment.
Externality	Costs of production activities that are not taken into account by the subjects making economic decisions. they do not bear these costs, but transfer them to other persons or to society as a whole.
Guideline	Numeric concentration or narrative statement recommended to support and maintain a designated water use.
Intrinsic value	In relation to ecosystems, means those aspects of ecosystems and their constituents parts which have value in their own right, including: (a) Their biological and genetic diversity; and (b) The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience.
Iwi authority	The authority which represents an iwi and which is recognised by that iwi as having authority to do so.
Local authority	Under the RMA 1991 means a regional council or territorial authority.
Periphyton	Benthic algae grow on the bed and on solid objects such as logs. These organisms play important roles in healthy ecosystems, but they can proliferate in certain situations and degrade desired water uses. Impacts include the smothering of natural aquatic communities, water intakes, degradation of water appearance and clarity.

pH	This term expresses the acidity of the water. pH 1 is very acid; pH 7 is neutral; pH 12 is very alkaline.
Pollution	The discharge by humans (directly or indirectly) of substances or energy into the aquatic environment, the results of which are such as to cause hazards to human health, harm to living resources and to aquatic ecosystems, damage to amenities or interference with other legitimate uses of water.
Saturation concentration	The maximum amount of a substances which can be dissolved in water. For oxygen, this declines with increasing temperature.
Standards	Numeric concentration or narrative statement that is recognised in enforceable environmental control laws of a level of government.
Suspended solids	Small particles suspended in the water column.

ACRONYMS

<	Less than
>	More than
=	Equal to
AEE	Assessment of Environmental Effect
BAT	Best Available Control Technology Economically Achievable
BCT	Best Conventional Control Technology
BMA	Bangkok Metropolitan Administration
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
BOP	Bay of Plenty Regional Council
BPO	Best Practical Option
BPT	Best Practical Control Technology Currently Available
CAP	Changwat (provincial) Action Plan
Changwat	Province
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DOC	The New Zealand Department of Conservation
DP	District Plan
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EQA 1992	The Enhancement and Conservation of National Environmental Quality Act 1992
EQMP	The Environmental Quality Management Plan

FA 1992 The Factory Act 1992

Hg Mercury

ICWE International Conference on Water and Environment

IEAT Industrial Estate Authority of Thailand

IUCN International Union for Conservation of Nature and Natural Resources

MfE Ministry for the Environment

mg/l Milligrame per litre

MOSTE Ministry of Science, Technology and Environment

N Nitrogen

NESDB The National Economic and Social Development Board

NESDP The National Economic and Social Development Plan

NPS National Policy Statement

NRA National Rivers Authority

NZCPS New Zealand Coastal Policy Statement

OECD Organisation for Economic Co-operation and Development

P Phosphorus

Pb Lead

PCB Polychlorinated biphenyl

PHA 1992 The Public Health Act 1992

PPP Polluter-Pays Principle

RC Regional Council

RCPS Regional Coastal Policy Statement

RMA 1991 The New Zealand Resource Management Act 1991

RMLR Resource Management Law Reform

RP Regional Plan

RPS Regional Policy Statement

SEA Strategic Environmental Assessment

SS Suspended Solids

UK The United Kingdom

UN The United Nations

UNEP United Nations Environment Programme

U.S.A. The United States of America

U.S.EPA. The United State Environmental Protection Agency

WCED The World Commission on Environment and Development

WWF World Wide Fund For Nature

ABSTRACT

This thesis analyses the theoretical requirements for an integrated approach to freshwater resource management. The New Zealand and the Thai systems are then compared to understand variations between the two systems of planning at three different stages - Pre-Implementation, Implementation and Post-Implementation Stages. Finally, recommendations are made for improving the Thai system.

The research findings confirm that the New Zealand system measures up to criteria for ensuring sustainable development of freshwater resources. The system provides for planning based on river catchments and a variety of policy instruments may be used to achieve country objectives at all levels in the system. The Thai system provides for planning and developing of policy at national level and some parts of decision-making are delegated to the provincial level. At the implementation stage, the New Zealand system provides for a non-regulatory approach. Whereas, in Thailand, methods of policy implementation based on regulatory approach, are well-developed. At Post-Implementation stage, the New Zealand system provides for a monitoring system and less severe penalties than Thailand, where the system does not explicitly provide for monitoring, but severe penalties are imposed for deliberate actions to pollute rivers.

The findings suggest that the Thai system of water resources management can be improved in a number of ways, but the fragmentation of the planning process is the principle obstacle. Besides that, various future research areas identify which improvements to river water quality management in Thailand are a priority.

CHAPTER ONE

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INTRODUCTION

1.1 Introduction

Although economic development has benefited Thailand enormously over the last decade, the negative repercussions of economic development is evident by the general deterioration of the environment and the exploitation of natural resources, particularly in relation to forestry and water resource management. It can also shown that a growing numbers of health and social problems can be related to environmental degradation and unbalanced development (Handley, 1991). Water pollution is one of the most severe environmental problems, as freshwater is crucial for use as sources of water supply for domestic and industrial uses, fishery, agriculture, and electric generation. Rivers are also used as the receiving water for both domestic and industrial wastewater. This causes pollution in many rivers, especially the Chao Phraya and Thachin Rivers where urban growth and economic development are concentrated along the river shore.

Urban growth and economic development contribute to water pollution in the Chao Phraya and Thachin river catchments in that discharges from households excluding discharges from toilets drain directly into stormwater drainage systems which connect to nearby canals or rivers. Many of small factories which are not registered under the Factory Act 1992 do not operate wastewater treatment facilities (due to lack of space, funds, or both) are also draining wastewater into nearby canals. Therefore, most of the canals in and around major cities face severe polluted. It is found that approximately 70 percent of water pollution in terms of BOD loading in Bangkok Metropolitan Area is from domestic sources, of which 90 percent are from residential buildings and restaurants (Mekvichai et al., 1990 in Mekvichai, 1993). Pollution from toxic substances is mainly generated by industrial activities.

Other sources of water pollution are agricultural activities e.g. fish farms, swine farms and runoff from agricultural areas. This means that the rapid economic expansion in the past, together with the government policy to change economic structure to become more industrialized and service oriented, and the transformation of rural societies to

urban communities have led to more serious pollution problems. These problems have severe impacts on the quality of life of the Thai people, as well as affecting further development of the country.

Therefore, urgent measures are required to deal with environmental pollution of water resources which are basic to people's life and economic development, to maintain the existing quality of water at appropriate levels, and in some cases (e.g. the Chao Phraya river) to improve water quality. These measures should be integrated in a framework which governs natural resource management and economic development of the country.

Water has unique characteristics which make it different from other resources both in terms of complexity of the hydrological cycle and management system. Therefore, it requires an integrated management approach. Moreover, water resource management requires decentralization of funds, political power and personnel to local authorities which are appropriate for managing local needs (WCED, 1987).

The WCED (1987) also indicates that the prevention and reduction of water pollution will remain a critical task of resource conservation. Since cleaning up after pollution occurs is an expensive solution, all countries should anticipate and prevent pollution problems, where possible. In some cases, existing situations may require improvement (WCED, 1987).

1.2 Aim and Objectives of the Research

The aim of this study is to develop an integrated approach for river water quality management in Thailand. The objectives of the study are:

(1) To research the theoretical issues concerned with river water quality management;

(2) To evaluate how the New Zealand and the Thai systems of water management measure up to theoretical approaches to management of quality of the river water;

(3) To compare the system of river water quality management between New Zealand and Thailand;

(4) To make recommendations for the improvement of river water quality management in Thailand based on theoretical and New Zealand experiences.

1.3 Methodology

This research is carried out by analysing books, reports, journals, and information from the organisations concerned. The following process will be used:

(a) Research theoretical approaches to the management of water quality in rivers; and develop criteria to be used in analysis of the New Zealand and the Thai frameworks;

(b) Analyze how the New Zealand and the Thai systems of water quality management in the river, measure up against selected criteria;

(c) Compare the two systems of river water quality management based on selected criteria;

(d) Make recommendations to improve water quality management in Thailand.

1.4 Limitations of the Research

The time of study is limited to one year, therefore this research only focuses on quality of freshwater rivers, excluding lakes, underground water and coastal waters.

The New Zealand Resource Management Act 1991 which governs natural and physical resource management in New Zealand is new. Some types of policy instruments are still in draft forms e.g. regional policy statement, regional plans, while some have not yet been developed (e.g. National Policy Statement, and national environmental quality standards).

There are various organisations and Acts dealing with river water quality management in Thailand. This study is limited to three principle Acts - the Enhancement and Conservation of National Environmental Quality 1992, the Factory Act 1992 and the Public Health Act 1992. Two national plans are also considered - the Seventh National Economic and Social Development Plan (1992-1996) and the Environmental Quality Management Plan. Although the principle Thai Acts have been effective since 1992, some policy instruments provided for in the Acts are not yet implemented e.g. notification of the Minister of Public Health dealing with offensive business notified

under the Public Health Act 1992. The two national plans provide guidelines for economic development, and natural and physical resources planning at all levels of organisations. Besides these two national plans, other plans of central organisations also provide guidelines for the preparation of plans at various levels and they also provide for regulations dealing with specific issues (e.g. in 1990 the Ministry of Interior notified a regulation about planning for local self government administrative units including the Provincial Administrative Organisations, municipalities, sanitary districts, and the City of Pattaya).

The principle contribution of this study will be recommendations to improve the resource management framework in Thailand by using river water quality management as a model. Moreover, the system should aim to achieve sustainable development which is the same goal for other countries. Therefore, the principle purpose of systems of management in each country be the achievement of sustainable development. It is, also, worthwhile to see how the New Zealand and the Thai framework measure up to the strategies recommended by the world leading organisations (IUCN/UNEP/WWF, 1991; WECD 1991 and Agenda 21) and the ideas of various theorists. Improvement of the Thai system of water resource management enables the country to achieve targets towards sustainable development.

1.5 Outlines of the Research

This research is divided into six chapters including the introduction, where rationale, goals, objectives and rationale of the study are outlined. In addition, the methodology and limitations of the study are described.

Chapter Two reviews the theoretical study of water resource management based on the view of leading organisations dealing with environmental management which are WCED 1987, IUCN/UNEP/WWF 1991, ICWE 1992 and Agenda 21 (Sitarz, 1993). Some theorists are also included. This Chapter indicates what a country should provide for in the system of environmental and resource management to achieve the objective of sustainable development. Criteria for assessment of river water quality management are then developed and drawn on to analyze the New Zealand and the Thai systems of management in Chapters Three and Four and a comparative study in Chapter Five.

Chapter Five uses information gained from the preceding chapters in a comparative study. The Chapter compares the provision of policy instruments in the New Zealand and the Thai systems of river water quality management. The Chapter also makes recommendations for improvement of river water quality management in Thailand based on theoretical and New Zealand experiences.

Chapter Six draws the results of the preceding chapters. The aim of the thesis is revisited, and the principle research findings are highlighted. The Chapter also makes recommendations for improvement of management of river water quality in Thailand and identifies some possibilities for future research efforts.

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CHAPTER TWO

CHAPTER TWO

DEVELOPING CRITERIA FOR EVALUATING RIVER WATER QUALITY MANAGEMENT: LITERATURE REVIEW

2.0 Objectives:

1. To review the theoretical basis for an effective water quality management system.
2. To select criteria by which New Zealand and Thai river water management systems (at the pre-implementation, implementation, and post-implementation stages will be evaluated in a comparative study.

2.1 Introduction

The review is divided into three principle stages of planning - pre-implementation, implementation and post-implementation stages. Of course there may be overlaps where techniques are used in various phases of the planning process.

The Pre-Implementation Stage refers to activities which can be carried out before plan is bring about into practice. These activities include those applied in planning processes to moderate the impact of policy/plan/programmes on the water quality in rivers.

Implementation refers to activities which can be conducted in the implementation of plans. These include regulatory approaches (e.g. water quality standard, effluent standard); zoning; and, economic instruments (e.g. charges, subsidies, marketable emission permit). Public works (e.g. on-site treatment plant); Best Management Practices for non-point sources of pollution; advocacy to other organisations about relevant matters controlled under their jurisdiction and provision of information and services are also important mechanisms.

Post-Implementation refers to activities which may be conducted after plans are implemented. These comprise enforcement, monitoring and auditing systems, environmental reporting, and Environmental Impact Assessment of individual projects.

2.2 Sustainable Development for Water Resource

The definition of sustainable development envisaged by the WCED (1987) is:

> "*development that meets the needs of the present without compromising the ability of the future generations to meet their needs.*" (WCED, 1987, p.43)

The WCED (1987) also indicates that economic development cannot be separated from environmental management. Therefore, each country sould adopt the concept of sustainable development and provide a framework for the integration of nvironmental policies and development strategies. Water resources, in particular, are a natural resource which can be used by various users for many types of development as well as for life supporting capacity of ecological systems. Therefore, any development using and/or impacting on water resources should ensure that the use of water is sustainable.

The nature of water itself makes it different from other resources. Water resources seem to be difficult to define because of the complexity of the hydrological cycle as shown in Fig. 2.1. The system is interrelated and only a fraction of water - mainly surface fresh water and ground water - is available for human use, even though enormous quantities of water are cycled (Tietenberg, 1992). As water passes through surface runoff to sea and oceans, it can be serve as a basic resource for economic and social development in a number of development sectors (e.g. fisheries, industry, energy, agriculture, etc.). Therefore, use of water at any place may affect other uses both positively and negatively, in terms of its quantity and quality. For example, diversion of water from one area reduces both water quantity and may decrease assimilative capacity of that water body which may affect other uses. On the other hand, diverting water may help increase dissolved oxygen concentration in water bodies (Parker and Penning-Rowsell, 1980). This means that the system of management is going to be slightly different from those governing use of other resources.

However, traditional management systems for development are often fragmented into sectoral approaches. The WCED (1987) and Evers (1989) note that many of the environmental and development problems that confront us have their roots in institutional rigidities which create sectoral fragmentation of responsibility in a higher interrelated set of problems. Therefore, sustainable use of natural resources cannot be

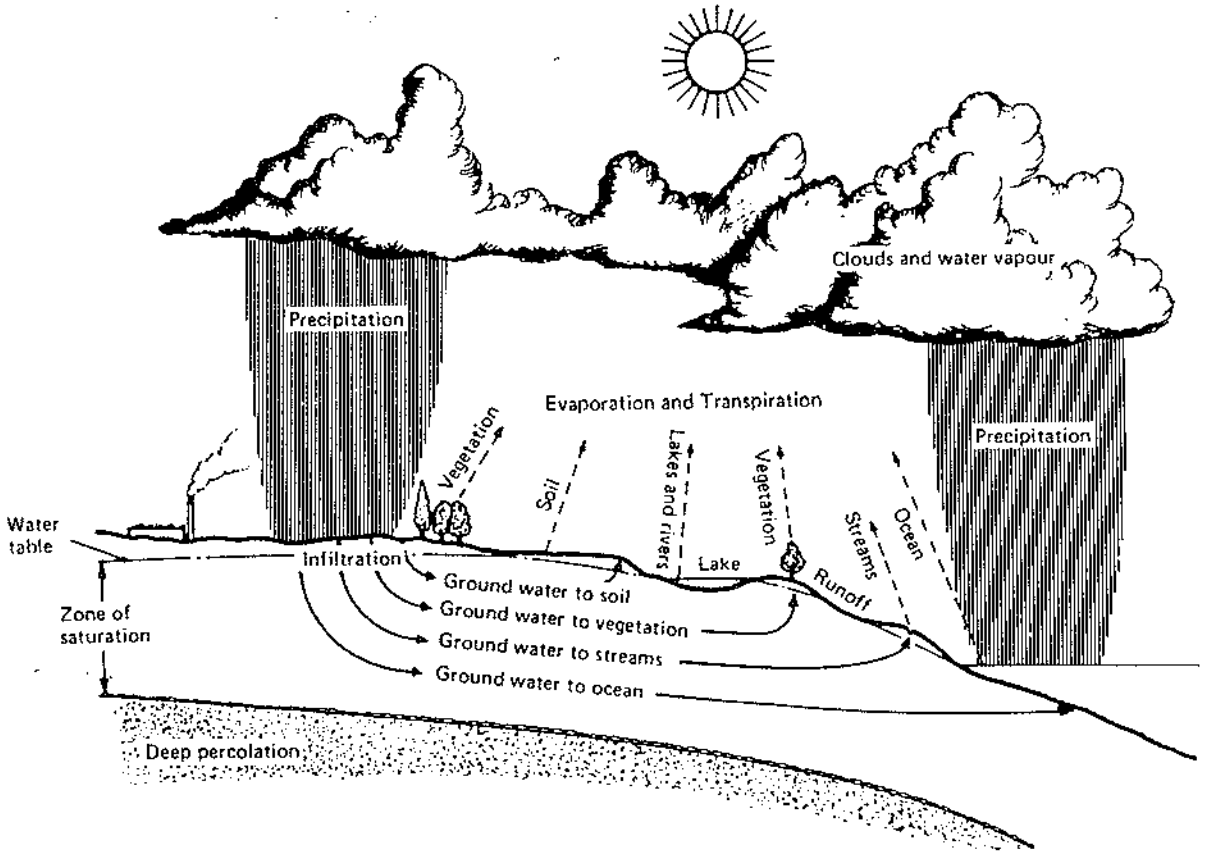

Figure 2.1 The Hydrologic Cycle

Source: Franks, 1987

ensured while decisions on different types of environmental resources (such as water and land use) are made separately (Forrest and Morison, 1991).

To cope with water pollution problems these fundamental requirements for managing water resources should be understood and recognised. Water resource management should provide a systematic way of planning in order to promote sustainable use of the water resource while maintaining a good water quality, and preventing or remedying the adverse affects on river water quality and ecosystems. Therefore, planning process is a key component of water resource management as the ICWE (1992) recommends that:

> "*Water resources development and management should be planned in an integrated manner, taking into account long-term planning needs as well as shorter horizons, i.e., it should incorporate environmental, economic and social considerations based on the principle of sustainability; it should include the requirements of all users as well as those related to the prevention and mitigation of water-related hazards; and it should be an integral part of the socio-economic development planning process.*" (ICWE, 1992, p.16)

Lute and Lewis (1991) also advocate water resource planning because it provides a process for making equitable and efficient decisions about the future use of the resource.

Moreover, there also need to analyze the whole water cycle (Stephenson and Petersen, 1991; ICWE, 1992) including:

(a) Distribution of rainfall, conservation of water resources, systems of water supply and wastewater treatment;
(b) Issues across the whole of a river basin or a groundwater aquifer;
(c) Interaction with other natural resources and land use;
(d) The need to look at inter-sectoral needs;
(e) An ecological approach which respect existing ecosystems.

The planning process needs to include to develop policies/plans/programmes, to bring all aspects about implementation and to evaluate and feed back the policies/plans/ programmes by employing enforcement and monitoring mechanisms. The process is divided into three stages which are Pre-Implementation, Implementation and Post-Implementation Stages. Each stage will be described.

2.3 Pre-Implementation Stage - Planning Process

The pre-Implementation Stage of planning processes consists of general process of planning and understanding the appropriate level of planning. The first part deals with initial phase of planning process where programmes are developed. Strategic Environmental Assessment should be provided at this stage as a tool to assess policy/plan/programme. The subsequent part deals with planning at three different levels - national, regional, local levels, since details in plans may differ slightly at each level.

This section deals with a conventional planning process for fresh water resource management, a system of Strategic Environmental Assessment, as well as planning at three different levels of administration - national, regional, and local levels.

Stephenson and Petersen (1991) describe general '**Environmental Planning**' as:

> "*Planning is a process, a systematic way of investigating a problem. It is both an art and a science, an exercise in managing information, acquiring information, evaluating it, and analysing it and then making decisions. It is a systematic way of establishing long-range national objectives and devising long-term strategies and short-term action programmes to achieve those objectives and to implement the strategies by solving present and projects future problems. Planning is a systematic study of alternative solutions to a problem or need, including the costs, benefits and adverse impacts of the alternative, and selection the best plan.*" (Stephenson and Petersen, 1991, p.8)

The end product of planning process are plans which can be categorized into two types of plan - an institutional plan and a physical plan. To achieve sustainable development of water resources, both types of plans are necessary.

> "*An Institutional Plan is designed to put mandate, organization, resources together to focus on a particular problem, while a Physical Plan focuses on suggestion appropriate physical relationship between an environmental and development activities in order to achieve a goal or objective.*" (Hunkeler, 1981, p.18)

Three types of planning approaches - Rational Comprehensive, Strategic, Interactive approaches - may be applied in determining an integrated planning process for use of water. The Rational Comprehensive planning approach follows the conventional planning process -to survey, to analyze, to evaluate data and to select the best plan insofar as information is available. A strategic approach focuses on organisation objectives, the means to achieve them and the changing priorities and limitations of decision-making environment. While the interactive approach focuses on defining the

values and roles of individuals and organisation involving in the planning process (Rosier, 1992).

Lang (1986) suggests that all three types of approaches have strengths which may be integrated - to make planning strategic, to adopt an interactive style, and to adopt multiple perspectives for organisations, politicians and personnel involved. This integrated approach provides flexibility in planning process. Strengths and weakness of the three main approaches are analyzed by Lang (1986), and are summarised in Figure 2.2.

The Rational Comprehensive planning process is well known to planners in the area of natural environment. The end-product of this type of approach is usually a master plan. The US National Water Commission defines '**Water Planning**', similar to conventional comprehensive planning, as:

> "*Planning is the creative and analytical process of: (1) hypothesizing sets of possible goals, (2) assembling needed information to develop and systematically analyze alternative courses of action for attainment of such goals, (3) displaying the information and consequences of alternative actions in an authoritative manner, (4) devising detailed procedures for carrying out the actions and (5) recommending courses of actions as an aid to decision makers in deciding a set of goals and courses of action to pursue.*" (Water Resource Planning, national Water Commission, Washington, D.C., May, 1972 in Grigg, 1985, pp.21-22)

Petersen (1984) and Grigg (1988) suggest that a conventional planning process for developing a water resources plan generally consists of three principle phases - problem identification and goal setting, studying, analysing and formulation of alternatives and decision-making and plan selection - as shown in Fig. 2.3.

Phase 1 - Problem Identification and Goal-Setting

This is the phase in which any problems need to be identified and accepted. This is an important phase of the planning process. Any problems which are not clearly identified may lead to failure in implementation of any policy. This phase also provides for equity considerations and flexibility.

Figure 2.2 Comparison of Conventional, Strategic and Interactive Planing

Conventional Planning	Strategic Planning	Interactive Planning
- More oriented to substantive issue and data collection.	- More oriented to resources management of organisations, intra- and inter-organisational relations are major concerns.	- More oriented to interaction of participants throughout the planning process.
- Scope of planning is wide, goals are vague and inconsistent.	- Scope of planning is focused and selective, clearly express mission statements for what the organisation attempts to fulfil.	- Scope of planning is focused and selective.
- Less dynamic, planning occurs at fixed intervals, seldom carries out monitoring, and reviews the plan.	- More dynamic, attempts o anticipate future conditions and possible responses to them, involves monitoring and review of the plan.	- More dynamic, the planning process includes information feedback, consultation and negotiation.
- Stakeholders are not involved until late in the planning process.	- Provides a collaboration with stakeholders.	- Allow public to get invvlved especially stakeholders.
- Budgeting and planning is, normally, separated from each other.	- Organisational resources are integrated into the planning process especially the budget becomes a major integrating mechanism.	- Focuses on mobilization of support.
- Assumes that plan is what we should do and success measured by achievment of plan's objectives.	- Assumes to adapt stresses within organisation by looking for opportunities and threats in the organisational environment and coming up with better ways of meeting objectives.	- Assumes that plan is what we agree to do and success measures by achievement of agreement on action.

Source: Adapted from Lang, 1986.

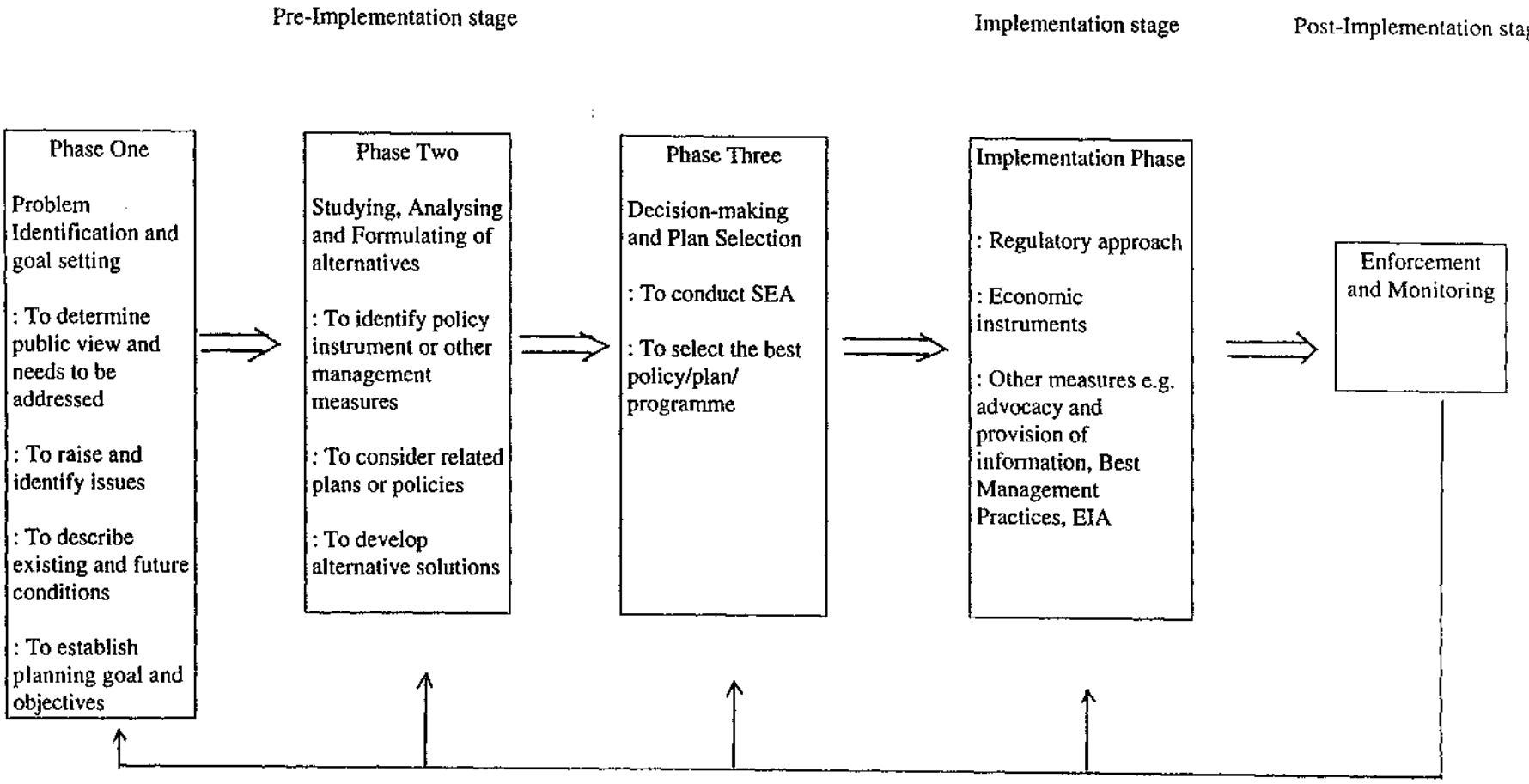

Figure 2.3 Conventional Planning Process

(Source: Adapted from Petersen, 1984 and Grigg, 1988

The initial phase focuses on determining the public views about problems and needs, issues are then identified and related to water resources. Base conditions and potential conditions in the future including economic, social and environmental conditions, existing and future land and water uses, and development programmes will be taken into consideration to establish planning goals and objectives. These can be expressed in terms of national policy, and planning goals and objectives at regional or local planning levels, examples are shown in Figure 2.4.

Figure 2.4 Examples of Planning Policy/Goal/Objective

Long-term national policy for uses of water resources includes[1]:
- To establish a long-term national objectives such as to improve social and economic conditions, to meet water needs with adequate supplies of acceptable quality over time;
- To set up short-term goals for individual river catchment or local areas such as to provide safe source of water supply;
- To establish priorities programme for implementing such objectives or goals with recognition of financial constraints.

The US Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies identifies the national objective as[2]
"To contribute to national economic development consistent with protecting the nation's environment pursuant to national environmental statues, applicable executive orders, and other planning requirements".

Short- or medium-term national policy includes[3]:
- To develop integrated, multipurpose development plans for the country or a river basin;
- To develop the best policies for the regulation of contaminants that are discharged into waterways.

Source: 1,2 Stephenson and Petersen; 1991; 3 Grigg, 1988

Grigg (1985) suggests that goals should be clear for each particular problem. They must be flexible and formulated with the idea that they may change in the future.

The objectives of each plan depends on the responsibilities of various organisations at different levels of government; the phase in the problem-solving process and the nature of fresh water problems. However, to use the planing process as an approach to achieve sustainable development, planners should take into consideration of equity of present and future generation and flexibility of the plan. This phase can serve equity of present and future generations by allowing participation representing the public interest of groups or individuals both beneficially or adversely affected by the policy/programme/project. This will ensure that the poor get their fair share of resources to sustain economic growth in any nation (WCED, 1987).

Public participation may be formal (e.g. hearing, inter-agency committees), and informal (e.g. brochures, response to inquiries) (Goodman, 1984). Information gained from participatory approach may help change of goal and objectives, assist identification and analysis of the problems and solutions, provide guidance to alternative formation, as well as indicate the acceptability and preference of possible recommendations (Ibid.).

The flexibility of the plan can be derived by re-examining the planning objectives while planning progresses (Stephenson and Petersen, 1991). Consequently, specific objectives will be selected to develop alternative plans in the next phase.

Phase 2 - Studying, Analysing and Formulation of Alternatives

This phase involves the development of alternative solutions based on planning objectives identified in Phase One. The alternatives will be expressed in terms of **'Plan'**, **'Programme'** and **'Project'** which are defined[1] as:

> *'programmes' or 'plans' are sets of related activities and expenditure that give effect to policy.... Programmes may in turn be composed of 'project', discrete activities usually at specific locations, and often requiring capital expenditure.* (Her Majesty's Treasury in Therivel et al., 1992, pp.37-38)

It means that plans are then needed to operationalise policy from Phase One, as Parker and Penning-Rowsell define a **'Plan'** as:

> *a means by which policies are put into operation and is concerned with reaching objectives or targets and integrating a set of smaller scale schemes in order to meet them. Plans are also concerned with timing, phasing and coordination of schemes to match financial budgets ...* (Parker and Penning-Rowsell, 1980, p.13)

At this phase policy instruments or management measures will be identified. These include, for examples, regulatory approach (e.g. effluent standard, permit system), economic instrument (e.g. subsidy, charge), public works (e.g. wastewater treatment plants). Detail of each measure is described in the Implementation Stage section. Planners should also take into consideration of other related plan/policy e.g. from other organisations at national, regional, or local levels and from individual projects. Judgement can then be exercised to determine which instruments are feasible and should be studied in more detail. Finally, alternative solutions to a particular problem

[1] Specified by Her Majesty's Treasury and the United Kingdom Department of the Environment in Therivel et al., 1992

will be developed by combining different measures into system of management to solve problems and needs under the most suitable conditions including legal, institutional, social, technological and environmental constraints.

Phase 3 - Decision-Making and Plan Selection

Selection of best plan should:

(a) Be based on comparison of the evaluated effects of alternatives and on the evaluation of the degree to which each plan meet the criteria (e.g. effectiveness, acceptability and efficiency) in economic, social and ecological terms;

(b) Take into account the integration of different purposes and interests of different uses while maintain the water quality and ecosystem structure (Grigg, 1988);

(c) Provide for public involvement to ensure acceptance from all beneficially and adversely affected groups of people.

An ideal process would also provide for consideration of the appropriateness of overall plan objectives and the effects of the plan on socio-economic conditions and the environment, as Wathern et al. (1988) suggest that:

> "*A rational planning system should ensure that environmental, social and economic consequences of a policy are considered during its formulation, whilst the implications of individual proposals are assessed adequately before any decision to proceed.*" (Wathern et al., 1988, p.103)

Therefore, a system of Strategic Environmental Assessment (SEA) of policies/plans/programmes should be developed. SEA is defined as:

> "*the formalized, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making.*" (Therivel et al., 1992, pp.19-20)

However, the SEA does not necessarily ensure that a policy/plan/programme is sustainable, without the use of appropriate evaluation techniques which ensure:

(a) Alternative policy options (including the choice of doing nothing) are taken into consideration at an early stage of policy development;

(b) Provision of a system that develops consistency between different policy sectors;

(c) All impacts - cumulative, and secondary impacts - from that policy as well as from different projects are assessed and taken into considerations in planning process;

(d) Prediction of adverse environmental affects are undertaken and measures to avoid, mitigate or prevent are prepared;

(e) Environmental principles (e.g. sustainability) are integrated into development and selection of policy options;

(f) A proper place is provided for decision-makers to consider environmental, economic, and social aspects (Therivel et al., 1992).

The SEA process is not well developed or commonly agreed upon (Therivel et al., 1992), but the proposed SEA process considered adequate is shown in Fig. 2.5[2]. Therefore, Strategic Environmental Assessment is an important tool in planning for sustainable development because it provides a channel of integration with other policies or programmes and public participation. Moreover, SEA can save time and cost of project assessment where the issue and impacts of the project are assessed at the time of policy/plan/programme development (Therivel et al., 1992).

In planning practice, the need to integrate economic, social, and ecological considerations in decision-making is a principle element in a strategy for sustainable development. This should be carried out at all levels of decision-making, including policy formation, plan/programme/project considerations (ICWE, 1992; Sitarz, 1993). Generally, there are three levels of planning, at national, regional (or sub-national) and local. These levels are also reflected in the type of plan developed along with varying time scales (Stephenson and Petersen, 1991; Rosier, 1992).

Planning at the national level, normally, foresees the direction of development in the country. It is focused on principle or policy with a longest time horizon. To manage water effectively on a national scale is to control it for the benefit of all people as it passes through the natural hydrological cycle from precipitation to runoff or infiltration, and then to the oceans (Stephenson and Petersen, 1991). Therefore, plans at national level should act as a framework for other planning or development within

[2] Based on the US Department of Housing and Urban Development, 1981 and Department of the Environment, 1991 (in Therivel et al., 1992)

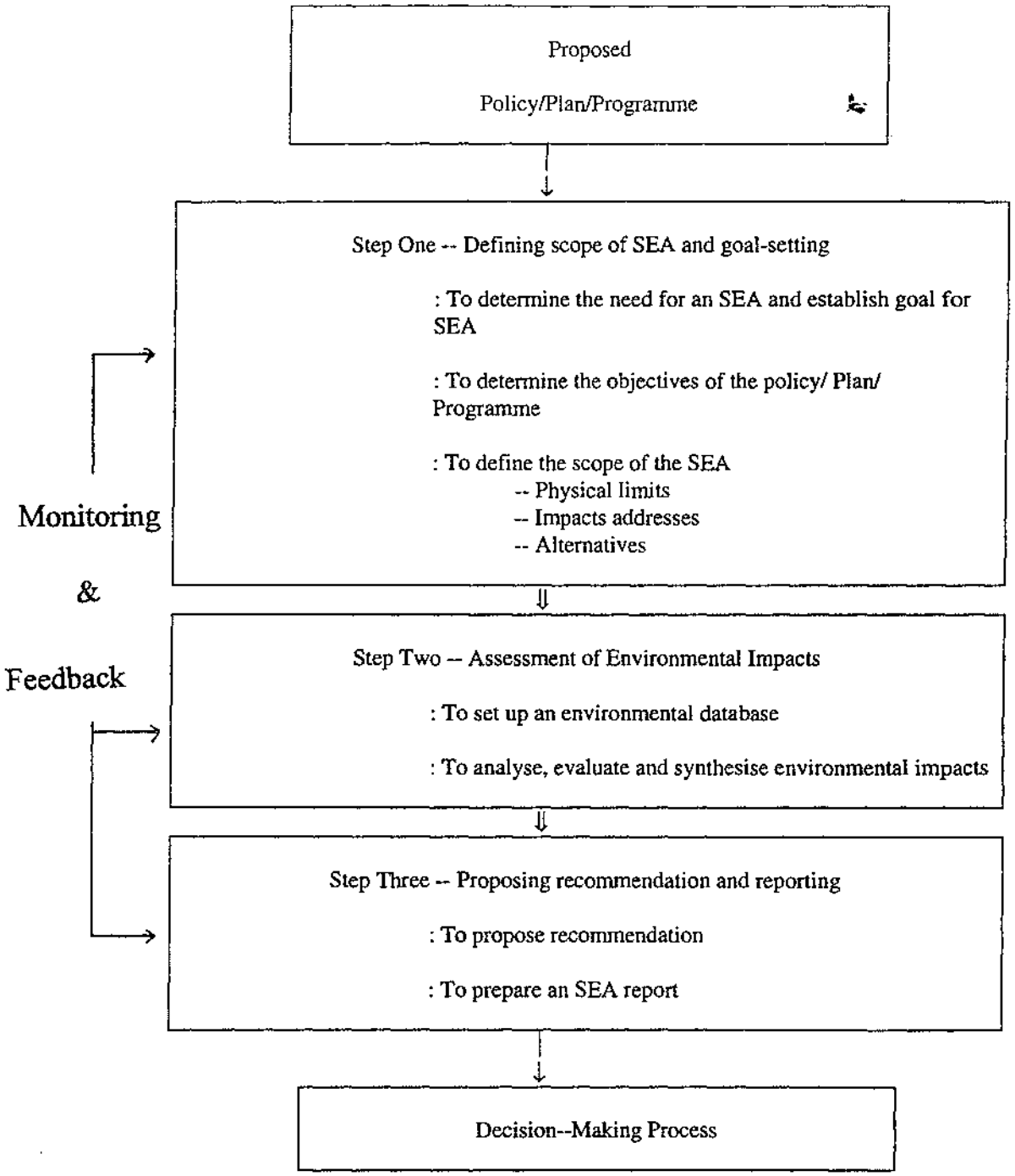

Figure 2. 4 Strategic Environmental Assessment Process

(Adapted from Department of the Environment, 1991 and US Department of Housing and Urban Development, 1981 in Therivel et al. , 1992)

a country. Short-term goals for individual river catchments and local areas should be compatible with national objectives (Ibid.).

WCED (1987) recommends that each nation develop its own policy framework for environmental management based on its unique conditions e.g. available resources and knowledge, types and degree of environmental degradation and priorities of development. Policies and plans in that country should have integration of economic, social and environment planning (Sitarz, 1993). Moreover, national environmental management should be based on preventive rather than curative environmental measures (Ryding, 1992).

Planning at regional level is more specific to an area and in formulation of objectives. Planning is also more detailed than at a national level. It deals, mainly, with strategic issues and covers a shorter time horizon. For the most beneficial water resources planning, it is recommended[3] that a river basin or a set of river basins should be an appropriate unit of water management. It is because river basin acts as a natural, relatively limited area that acts as a unique hydrological system (Petersen, 1984) in which:

> "*A watershed or drainage basin is characterized by its outlet, which is usually the lowest point in the watershed, and by its divide, which may be represented by a connecting line of the highest points of the watershed boundary. It is assumed that all water which falls into the area within the divide line will either result in runoff at the outlet point, infiltrate into the ground, or be lost by evapotranspiration.*" (Krenkel and Novotny, 1980, p.158)

Benefits of planning at river catchment levels are obvious:

(a) To decrease costs of developing and managing water resources through regionalization, control of negative external effects by working together, taking a common approach to solve water pollution problem (Grigg, 1988);

(b) To ensure that priorities of water resources development in a particular river catchment will be achieved (Petersen, 1984);

(c) To ensure that no individual decision limits future use of water resources (Stephenson and Petersen, 1991).

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[3] Krenkel and Novotny, 1980; Petersen, 1984; IUCN/UNEP/WWF, 1991; Da Cunha, 1991; Stephenson and Petersen, 1991; The United Nations, 1991

Three types of planning approaches may be employed to develop regional physical and institutional plans. Rosier (1992) suggests that the developed plans should recognize ecological, sociological, and institutional limits which may influence sustainability of development. The outcome will be action plans for specific area or issues which there contribute to the planning process of the regional jurisdiction (Grigg, 1988). Moreover, the outcome may simply mean formulating priorities for local level planning (Stephenson and Petersen, 1991).

Planning at local level is mainly a project planning within a very specific area. This type of plan includes more detail e.g. budget, mandatory and specific courses of action within a longer framework (Petersen, 1984). Greatest emphasis at this level is on spatial planning and on budgeting for specific projects (e.g. a water treatment plant).

2.4 Implementation Stage

At the implementation stage of any policies/plans/programmes, various instruments may be utilized. Instruments can be divided into three categories including a regulatory approach (e.g. water quality standard, effluent standard), zoning, or economic instruments (e.g. charges, subsidies, marketable permits), or other types of implementation techniques include public works (e.g. on-site treatment plants), Best Management Practices, advocacy to other organisations and provision of information. Each technique or instrument is reviewed against agreed criteria.

Environmental instruments are:

> "*the environmental policy maker's tools in attempting to alter societal processes in such a way that they become and remain compatible with the policy maker's environmental objectives.*" (OECD, 1994, p.14)

Agenda 21 (Sitarz, 1993) and the IUCN/UNEP/WWF (1991) recommend that all governments establish combination of economic, regulatory and voluntary (self-regulatory) approaches to achieve sustainable development. Agenda 21 indicates that environmental laws and regulation alone cannot deal with all environmental and development problems, price, markets and fiscal and economic policies can also apply to change attitudes and behaviour of the people towards the environment (Sitarz, 1993).

Economic instruments have tended to be used as supplements to direct regulations in mixed systems rather than being used as substitutes for regulation (Nicoliasen et al, 1991). The ICWE (1992) suggests that institutional structures should place greater reliance on incentives, prices and markets and less reliance on traditional command-and-control approach. However, the choice of measures depends on systems of management and the legal system in each country.

2.4.1 Regulatory approach

The regulatory approach is an important and well-known instrument in halting and preventing environmental problem. Regulatory approaches may be described as:

> "*institutional measures aimed at directly influencing the environmental performance of polluters by regulating processes or product used, by abandoning or limiting the discharge of certain pollutants, and/or by restricting activities to certain times, area etc., through licensing, setting of standards, zoning, etc.*" (OECD, 1989, p.12)

The regulatory approach determines quantity and nature of pollution able to be discharged into the environment, by specifying a certain level of pollution or abatement, without incurring a penalty. A system of direct control needs to be accompanied by rules. Therefore, the authority concerned can control activities based on set conditions. For instance, an authority may grant permission for a person/company to discharge wastewater into waterways if the concentration of the substances in wastewater is lower than a specified effluent standard. It implies that regulatory approach provides no other choices for polluters, they simply have to comply with the regulation or face penalties in judicial and administrative procedures (OECD, 1989; 1994a).

Four types of tools are generally used in water regulatory regimes - permit systems, water quality standards, effluent standards and zoning. One may be used in conjunction with the other such as discharge permit uses in couple with effluent standards. Each type of measure and its variations in some countries are now described.

Permit System

A license or permit is:

> *"an authorization given by a governmental body to withdraw water or discharge wastewater under specified conditions, e.g., quantity, time pattern, location of withdrawal or discharge, special limitations under drought conditions, requirements for self-measuring/monitoring; analogous to a business permit, e.g., a condition of doing business."* (OECD, 1980, p.38)

In other words, a permit system enables the permit holder to undertake a particular action, generally to discharge pollutants or cause environmental damage (Hodge, 1991). On the other hand, the permit is the yardstick by which compliance is measured (Egan, 1991). It is designed to be an effective legal tool to make enforcement a simple, purely legal matter. The permit acts as a shield against otherwise unavoidable and unacceptable liability. Two types of elements comprise the permit:

(a) The legal contract that contains the terms and conditions that must be met to remain in conformity with the law; and

(b) The license by which business can continue to be conducted.

Ideally, a permit for a pollution source should reflect an administrative decision as to the best method for minimising the pollution from a particular source (Murchison, 1994). Permits for non-point sources would be unlike those for point sources in that they would not specify quality and quantity as well as technology to reduce wastewater. Rather, non-point source permit would specify what activities may or may not be carried out by farmers/landowners or specify limits to the amount of erosion or on quality of sediment entering receiving water. However, it is suggested that the point source permits are more efficient because it is based on actual pollutant discharges, and it is difficult to measure non-point discharges accurately (Harrington et al., 1985).

The authorities concerned with granting a permit should take into considerations the following matters[4], when the permit is formalized:

(a) Ambient water quality standards and the carrying capacity of receiving waters. This ensures that wastewater discharges, both present and future, are

[4] Recommended by Egan, 1991 and Brunton, 1994

not in excess of the natural waste assimilative capacity of the receiving waters;

(b) Total permission discharges are not exceeding the carrying capacity of receiving water;

(c) Seasonal variations - there can be no excuses for any lack of knowledge concerning the relationship between effluent limitations and water quality (Beck and Goplerud, in Solanes, 1989).

(d) Unavoidable malfunctions and equipment failure;

(e) A stipulated lifetime and process for renewing permits;

(f) Provision for modification or amendments to reflect any changes in conditions e.g. new technology;

The advantages of a permit system are that a permit allows a pollution control authority to control the amount of pollution that is discharged into the receiving water. It also informs regulators of the extent of the existing pollution. This is very important, especially when considering the effects of the more harmful pollutants discharged (Holmes, 1992). Moreover, it ensures that the regulated community is able to determine what is required to comply with regulations. From point of view of polluters, compliance with conditions specified in a permits provides a shield against prosecution (Murchison, 1994). However, there are some criticisms. With a regulatory approach, there are no incentives for abatement beyond that required by the standard. This encourages 'minimization' or firm's carrying out minimum abatement to meet each standard (Krenkel and Novotny, 1980; Randall, 1987). There are no incentives for firms to comply with regulation, if there are no significant penalties for failing to comply or if penalties are prescribed but not enforced (Randall, 1987). On the other hand, penalties must affect productivity of the firms.

Implementation of a regulatory approach is often criticised for not being cost-effective, since litigation makes the enforcement process long and drawn out and often inclusive. To carry out a proper monitoring and enforcement is also costly and time consuming (The World bank, 1992). In particular it is difficult to monitor a permit of non-point sources of pollution, because of the diffuse characteristics of pollution itself.

When applying permit system with emission standards, it is important to know the assimilative capacity of the receiving waters, then, calculates a permitted amount of effluent from each firm. This process is time consuming and it is also difficult to anticipate how much assimilative capacity to reserve for future use (Holmes, 1992).

Water Quality Standard

Water quality standards or ambient water quality standards are:

> "*the legal specifications of the minimum conditions which must be met for a given indicator of water quality at a specified location along the stream.*" (Luhr, 1991, p.138).

The IUCN/UNEP/WWF (1991) suggests that water quality standards should combine the requirements for protecting human health and maintenance of ecosystem structure and functioning. It broadly says that:

> "*Pollution by nondegradable substances must not exceed levels that would endanger human health or ecosystem functions. Pollution by biodegradable substances must not exceed the assimilative capacity of receiving bodies of water*" (IUCN/UNEP/WWF, 1991, p.142)

This standard relies upon an assumed capacity of the receiving water body to receive and assimilate a certain amount of pollutants and still be of the quality desired for other uses (Solanes, 1989). It is suggested that an ambient standard is a fundamental measure to control water pollution, since it can account for both point source and non-point source discharge (U.S. General Accounting Office, 1991). Therefore, discharge limits for individual polluters should be strict enough to produce desired ambient water quality standard (Murchison, 1994).

In setting ambient water quality standards, issues of concern are[5]:

(a) Identifications of existing uses and likely future uses;

(b) The capacity of waters to cope with certain levels and types of pollutants;

(c) The dilution factor of receiving water in maintaining a certain concentration of pollutant, or standards in a river for particular uses of the water;

[5] Recommended by Krenkel and Novotny, 1980; Brunton, 1993

(d) Ability to implement and enforce the standards in terms of human resources, equipment, and procedure;

(e) Acceptability to society, as Russell (1991) indicates that any water quality standard should express society's judgements about what should be achieved in terms of water quality conditions.

According to OECD (1980) and other authors[6] water quality standard may have some characteristics as shown in Figure 2.6.

Figure 2.6 Characteristics of Water Quality Standard

1. Different standards are established for various sections of a river due to different uses and varying in assimilative capacities of water bodies and season variations;

2. Standards may be changed as new or add some more conditions;

3. Flow conditions may be specified for ambient standard to be achieved;

4. Ambient water quality standards may be established by different level of organisations both from national or local government;

5. Standard should specify the result of a statistical evaluation of a number of samples taken at various locations, flows, and time[1];

6. Standards should be described in precise, technical, quantitative terms and design for different uses of water (e.g. surface water, bathing water) in order to prevent and control pollution in freshwater[2];

7. A set of minimum standards for water quality is recommended, since maximum concentration implies that thresholds below a set standard are slightly insignificant and beyond that damage is enormous[3]

Source: 1 OECD, 1980; 2 Krenkel and Novotny, 1980; IUCN/UNEP/WWF, 1991; Bourdeau, 1992; 3 Freeman, 1978 in McGartland and Oates, 1985

Some characteristics of water quality standards are shown in standards applied in Japan, United Kingdom and U.S.A. as shown in Figure 2.7.

The advantages of using water quality standards accrue mainly to polluters. To enforce an ambient water quality standard, it is necessary to consider the natural ability to assimilate some waste materials in order to reduce any adverse effect on the future use (Krenkel and Novotny, 1980). Therefore, standards provide an incentive for industries

[6] Krenkel and Novotny, 1980; IUCN/UNEP/WWF, 1991; Bourdeau, 1992; Freeman, 1978 in Mc Gartland and Oates, 1985

to locate in the areas where receiving water are less sensitive to pollution which may lead to reduce cost of pollution control abatement for a firm. It is focused on managing receiving water quality in a way that ensures minimum interference with legitimate uses of waters. It should also take into account both point and non-point sources of pollution. An ambient water quality can also be used for judging the effectiveness of environmental regulation (Russell, 1991).

Figure 2.7 Ambient Water Quality Standard

Classification/Standards	Comments
Japan - standard of surface water for human health protection e.g. Cadmium <= 0.01 mg/l; Lead <= o.1mg/l; Organic phosphorus - not detectable	Uniform type of standards emphasize on protection of human health.
United Kingdom - Class 1A - high water quality standard can be used for potable supply and all other abstractions e.g. DO saturation > 80%, BOD < 3 mg/l; - Class 1B - usable for the same purpose as Class 1A but less high quality e.g. DO saturation > 60%, BOD <5 mg/l	Limiting criteria at 95 percentile, suggested classifications for current potential uses.
USA - standard for Delaware River between river mile 133.4-108.4 e.g. max. geometric average of faecal coliform above river mile 117.81 < 200/100 ml., below river mile 117.81 < 700/100 ml.; DO 24-hr average >= 5mg/l (during 1 April-15 June), >= 6.5 mg/l (16 September-31 December).	Standards are time and location variations.

Source: OECD, 1980

Criticisms of water quality standards emphasise the difficulties of enforcement. The UK Department of Health (in van der Merwe and Grobler, 1990) argues that imposition of water quality standards is not a straight forward method for regulators to apply pollution control measures, because it requires a thorough investigation and understanding of the fate of pollutants in the water environment and their impact on water uses. It is also difficult to distinguish waste assimilative capacity among several dischargers and to find the violators when the ambient water quality standard is exceeded (Krenkel and Novotny, 1980). Krenkel and Novotny argue that if stream classification is involved, the future use of the rivers may be limited. Therefore, an ambient water quality standard tends to become fixed values rather than judgement guides.

Effluent Standard

Effluent standards:

> "*are those which specify the mean or maximum permissible discharge of a pollutants, such as Hg or COD, from one particular source. Effluent standards are requirements set on the quality characteristics of actual discharges, ...*" (Luhr, 1991, p.138).

While Tietenberg defines effluent standard as a legal limit on the amount of the pollutant an individual source is allowed to emit (Tietenberg, 1992). This definition enables agencies to achieve the objective of effluent standards, which is to induce reduced discharges so the ambient standard will be met (OECD, 1980). Effluent standards can be used as supporting tool for direct control of water pollution because they limit the amount of contaminants being discharged to the environment.

Effluent standards may be divided into two categories - direct and indirect effluent standards (OECD, 1980). Both of them can be applied to point sources and non-point sources of pollution with some variations. Regulators may directly control pollutants discharging into the environment through direct effluent standards. However, to apply indirect discharge standards implies the result is in an acceptable quality of discharge (OECD, 1980).

Moreover, to deal with untreatable or costly treated wastewater entering central treatment plants (e.g. municipality wastewater treatment plant), the authority concerned may define pre-treatment standards regulating the quality of the wastewater draining into plants (Tietenberg, 1992). Characteristics of effluent standards are illustrated in Figure 2.8.

Agenda 21 recommends that governments develop standards for the discharge of wastewater and effluent in order to control water pollution (Sitarz, 1993). Examples of effluent standards in Germany and the USA are shown in Figure 2.9.

Figure 2.8 Characteristics of Effluent Standards

1. Direct effluent standards specify quantity or quality of the discharge such as[1]:

(a) discharge per unit of raw material processed or product, e.g. X kg of BOD/barrel of crude petroleum processed, tones of soil loss per acre; or

(b) concentration of specific pollutants contained in discharge, e.g. total suspended solids < Y mg/l, Z kg of BOD/day;

2. Indirect effluent standards[2] express in terms of degree of effluent treatment, technology-based approach e.g.[3]:

(a) Best Practical Control Technology Currently Available (BPT) which is a technology that has a reasonable level of engineering and economic viability at the time of construction or the permission of the control facilities;

(b) Best Available Control Technology Economically Achievable (BAT) which require the development of technology for a particular industry. However, BAT is based on technology other than economic cost consideration;

(c) Best Conventional Control Technology (BCT) which is a less advance technology than BAT but consider an unreasonable of the cost and the levels of pollution reduction from the facilities, but still achieve the goal of water pollution control.

3. Standards can be uniform or time and location variations[3] e.g. based on time of day, week or season;

4. Effluent standards normally apply in conjunction with a permit system and they should be complement water quality standards[4].

Source: 1 OECD, 1980; Harrington et al., 1985; 2 OECD, 1980; Solanes, 1989; 3 OECD, 1980; 4 Beck and Goplerud, 1988 in Solanes, 1989

Uniform effluent standards have advantages in that they are simple and less costly to implement by the regulators. Renshaw (1980) and Hallett et al. (1991) recommend that uniform effluent standards may be appropriate in the areas where pollution problems are severe and widespread because, even though imperfect, it provides a rough and quick measure for polluters to take remedial action. Moreover, if standards are revised frequently to incorporate the best pollution abatement technology, it should have the effect of minimising pollution from point sources (The UK Department of Environment, in Merwe and Grobler, 1990). It is more effective to monitor effluent standard for point source pollution, because end-of-pipe sampling is easy to collect and enforce.

Figure 2.9 Effluent Quality Standards in Germany and USA	
Classification/Standards	Comments
Germany[1] Municipal effluent standard is divided into 5 classes based on population equivalent; - population equivalent < 1000: BOD 40 mg/l, COD 150 mg/l - population equivalent 1000 - <5000: BOD 25 mg/l, COD 110 mg/l - population equivalent 5000 - 20000: BOD 20 mg/l, COD 90 mg/l - population equivalent 20000 - <100000: BOD 20 mg/l, COD 90 mg/l - population equivalent >= 100000: BOD 15 mg/l, COD 75 mg/l	Direct effluent standards specifying quality of discharge per a number of population equivalents
USA[2] - Industrial discharges were required to meet effluent standards based on BPT by 1977 and BAT by 1983; - Publicly owned treatment plants were required to achieve secondary treatment by 1977 and to employed BPT by 1983.	Indirect effluent standards specifying technology-based and degree of treatment within particular time.

Source: 1 Imhoff, 1992; 2 Tietenberg, 1992

The uniform effluent standard approach may be criticised for failing to protect water quality. Uniform effluent standard are focused on effluent and ignore the adverse effects of effluent discharges on the quality of receiving water, especially where there is high background level of pollution from other non-point sources. It is difficult to impose an effluent standard for non-point source pollution from number of sources with various characteristics. Moreover, it is impossible to measure the actual amount of direct discharge to receiving water bodies. Effluent standards based on technology-based approach focus too narrowly on a particular treatment technology rather than on the real objective - to reduce the effects of wastewater discharge (Tietenberg, 1992). As a result there is no guarantee that water quality standards will be met (Hallett et al., 1991). From an economic point of view, effluent standards do not take account of the different costs of abatement by different polluters (Palange and Zavala, 1987, in Solanes, 1989). Finally, it provides no incentive for industries to locate in an appropriate zone.

Zoning

Zoning can be regarded as geographical variations in the application of regulatory approach. Weil et al. (1990) indicate that in stimulating economic growth, some countries use zoning to encourage a dispersion of industry while other zoning schemes encourage concentrated industrial development. Zoning can serve as a measure to eliminate incompatible land uses by designating particular type of uses in a specific

zone, such as an agricultural area, residential area, industrial area (Randall, 1987). Zoning is an indirect pollution control measure because it needs to be combined with planning development especially land use planning.

In an industrial area, zoning regulates the location of polluting and pollutable activities and controls pollution abatement costs through location (Burrow, 1979). In some places, polluters are allowed to pollute without restriction while they cannot do so in the other areas.

The World Bank (1992) suggests that rural zoning may be an effect pollution control measures. Here zoning aims to restrict conversion of agricultural land, and to separate land uses in order to reduce adverse effects from industrial pollution. Britain has moved away from clearly specifying zones as a primary control of development activity towards more flexible measure based on clear statements of policy in development plans (Hipkins, 1989). In Australia, land-use zoning is designed to separate industrial activities from residential areas, or to reserve areas of conservation significance and to set conditions on development approvals (Jenkins, 1992). In Sao Paulo, Brazil, where environmental pollution problems are severe, the governments impose strict industrial zoning and licensing requirements in order to meet environmental quality standards (Weil et al., 1990).

Zoning is advantageous in managing river water quality, if it helps reduce water pollution by locating pollution sources far from rivers. Activities which potentially alter water quality are not allowed to establish upstream of rivers (Burrow, 1979). Moreover, zoning may help limit new sources of pollution e.g. industries are persuaded to locate in less pollution-ridden locations outside the main cities (Thomas, 1985 in Weil et al., 1990). Some countries (e.g. Brazil, Mexico, Thailand) have created **'industrial estates'**, which are located away from major urban areas. Consequently, industrial growth is more manageable in terms of pollution control if authorities concerned provide wastewater treatment plants and other waste disposal for industries in such areas (Leonard, 1985 in Weil et al., 1990).

Abatement costs to individual firms may also be reduced. Administrative cost of monitoring and enforcement of pollution control measures may also be decreased

because authorities can take action to control pollution and regulate in specific areas. Moreover, zoning can help reduce environmental hazard to the people because it separates out activities which may be harmful to human health in specific areas (Randall, 1987).

Zoning is criticised because it involves either the enforced relocation of existing activities or restrictions on the specific location for new activities (Burrows, 1979). However, to relocate existing activities to a new zone, is more costly than to strictly control the new activities locating in specific zone. Moreover, it may affect productivity of affected firms.

2.4.2 Economic instruments

Economic instruments are defined as:

> "*instruments that affect costs and benefits of alternative actions open to economic agents, with the effect of influencing behaviour in a way that is favourable to the environment.*" (OECD, 1991, p.10)

Economic instruments generally operate as financial incentives to polluters, who select the most suitable solution: polluting and paying charges/penalties or investing in pollution control to avoid paying charges/penalties. Therefore, it implies that market mechanisms are used in controlling pollution (Nicoliasen et al., 1991). As recommended in Agenda 21, governments should develop a policy framework that encourages the creation of new markets in pollution control and environmentally sound resource management. Examples are shown in Figure 2.10.

Figure 2.10 A Policy Framework for Environmental Control

- To develop and promote the use of water tariffs and other economic incentives;
- To explore the application of charging water use to encourage efficiency and environmentally sound use of water resources;
- To review existing economic and fiscal incentive to ensure the sustainable development objective;
- To conduct studies to determine how economic instruments, and market mechanisms can be used effectively in the areas such as energy, transportation, agricultural and forestry, water wastes, health and tourism by cooperation among government, business and industries.

Source: Sitarz, 1993

Three types of financial incentives are applied in environmental pollution control. They consist of making the polluters pay in proportion to the pollutants released (by

a charge or taxation), providing a given amount (through a subsidy) where pollution is reduced, and transferring pollution rights among polluters (marketable permits). From an economic point of view, water pollution arises from the fact that water resources are not priced. Moreover, there is no private ownership of water resources rights to usage (Goodman, 1984). It implies that overuse of water resources both for water consumption and other water services (e.g. recreational benefit, navigation and waste assimilation) can be expected. Therefore, the externalities may fall on society at large, not just on the consumer who initially uses the resource. For example, in river basin, downstream water users have to pay the costs of treatment of water which is polluted upstream (Brewster, 1991). In order to avoid these effects, it is recommended that polluters internalize these external costs at the source which means paying for them (Lutz and Young, 1992). The Polluter-Pays Principle has been adopted by the OECD since 1972 as described in Figure 2.11.

Figure 2.11 Polluter-Pays Principle

The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scare environmental resources and to avoid distortions in international trade and investment is the so-called "Polluter-Pays Principle".
This principle means that the polluter should bear the expenses of carrying out the above mentioned measures decided by public authorities to ensure that the environment is in an acceptable state. In other words, the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption. Such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment.

Source: OECD, 1986, p.24

Measures to cope with environmental pollution problems are shifting from command-and-control to using market forces and economic realities and emphasising preventive rather than curative measures (Ryding, 1992). The OECD indicates that:

> "*many economists have advocated the use of economic instruments as they were expected to provide environmental policy-making with flexible, effective and efficiency options in realising its objects...These flexibility and efficiency aspects have frequently been put forward as features which lead to a preference for economic instruments over and above the instruments of direct regulation*" (OECD, 1989, p.9)

Charges

A charge can be defined "*as a 'price' to be paid for pollution*" (OECD, 1989, p.14). Charges should be part of any strategy to prevent environmental pollution. In principle, charges should have the characteristics shown in Figure 2.12.

Figure 2.12 Characteristics of Charges

(a) Be based on quantity and quality of pollution generated and be equal to the cost of the environmental damage[1];

(b) Reflect both the true cost of water consumption and other services (e.g. waste assimilation, in-stream use)[2];

(c) Provide incentives to polluters to change their behaviours and to reduce discharge of waste. It is suggested that charges are more effective if preventive actions are less expensive than cost associated with polluting and paying the charge[3];

(d) Combine with regulatory approach e.g. effluent standards in order to calculate effluent charge[4].

Source: 1 OECD, 1989; Hodge, 1991; Stavins and Whitehead, 1992; 2 ICWE, 1992; 3 Stavins and Whitehead, 1992; 4 OECD, 1989; Brewster, 1991

In practice, there are some variations in charging systems applied in different countries. Five principle types of charges are generally used - effluent, user, product, administrative charges and tax differentiation (OECD, 1989).

Effluent charges are "*charges to be paid on discharges into the environment*" (OECD, 1989, p.15). The charges aim "*to induce individual firms to take pollution control steps, the overall result of which will be attainment of prescribed water quality goals*" (Brewster, 1991, p.285).

User charges have been defined as "*payments for the costs of collective or public treatment of effluent*" (OECD, 1989, p.15). In theory user charge should be high enough to cover total expenditures of such services, otherwise it implies a hidden subsidy (OECD, 1989).

Product charges are "*taxes laid upon the prices of products that are polluting in the manufacturing or consumption phase*" (OECD, 1989, p.55).

Administrative charges "*such as control and authorization fees, are payments for authority services, for instance, for registration of certain chemical or implementation and enforcement of regulations*" (OECD, 1989, p.15).

Tax differentiation "*can be regarded as a special form of product charge*" (OECD, 1989, p.55), since it modifies the relative prices of products by penalising those harmful to the environment.

Characteristics and implications of each type of charges are shown in Figure 2.13. For example, effluent charges in France for household are based on types of pollutants, but the charge is too low to provide incentive for polluters to reduce wastewater discharged.

Subsidies

'Subsidies' is:

> "*a general term for various forms of financial assistance, which must act as an incentive for polluters to alter their behaviour or which are given to firms facing problems in complying with imposed standards.*" (OECD, 1989, p.15)

Subsidies are generally incompatible with the Principle of Polluter-Pays because they spread total pollution control costs so that the community pays (OECD, 1986). However, the OECD also suggests that:

> "*subsidies financed from charge revenues and directed at achieving a higher level of pollution abatement than is possible through direct regulation, are felt to be acceptable and compatible with the 'Polluter-Pays Principle'*" (OECD, 1989, p.82).

Therefore, it is recommended[7] that governments should remove or reduce any subsidies that do not conform with sustainable development objectives (e.g. grants to drain wetland, subsidy for fertilizers). Exceptions may be made in certain circumstances, as recommended, adopted in 1974, by the OECD that:

> "*(a) It should be selective and restricted to those parts of economy, such as industries, areas or plants, where severe difficulties would otherwise occur;*
>
> *(b) It should be limited to well-defined transitional period, laid down in advance and adapted to the specific socio-economic problems associated with the implementation of a country's environmental programme;*

[7] OECD (1989); IUCN/UNEP/WWF (1991); Sitarz (1993)

(c) It should not create significant distortions in international trade and investments." (OECD, 1986, p.27)

In practice, there are three types of subsidies - grants, soft loans, tax allowances are commonly applied. Grants are "*non-repayable forms of financial assistance, provided if certain measures are taken by polluters to reduce their future levels of pollution*" (OECD, 1989, p.15).

Soft loans are "*loans provides to polluters if they take certain anti-pollution measures*" (OECD, 1989, p.15).

Tax allowances are "*tax or charge exemptions or rebates if certain anti-pollution measures are taken*" (OECD, 1989, p.15).

Characteristics and examples of **financial assistance** application are summed up in Figure 2.14. Financial assistance in Denmark is given to farmer in abating nutrient discharge into water resource. This is compatible with the Polluter-Pays Principle since it is a temporary measure and clearly specify target groups.

Marketable Permit

An artificial market can be created where polluters may buy '*rights*' to pollute or they can sell their '*pollution rights*' among other firms. A well-known instrument developed by the market is the marketable permit, which can also referred to as tradable permits, emission trading programmes, credit systems.

By definition, marketable permits are:

"*environmental quotas, allowances, or ceilings on pollution levels that, once initially allocated by the appropriate authority, can be traded subject to a set of prescribed rules.*" (OECD, 1991, p.17)

Marketable permit system are created by authorities by defining a total level of pollutants and specifying trading conditions. Polluters then acquire the right to pollute through the emission permits under a normal system. If they discharge less pollution than the allowable limit, they can sell the excess allocation. On the other hand, if they want to discharge more than the allowable limit, they have to buy the right from other firms with excess capability (OECD, 1989).

Figure 2.13 Application of Economic Instruments: Charges

Characteristics	Comments
Effluent charge	- suitable for stationary pollution control (e.g.households, industries)[1] - combine with regulatory approach[2] - effectively internalise external costs and reduce water pollution; compatible with PPP[3]
France: pollution charges for household based on 4 types of pollutants calculated by municipalities; pollution charges for other sources based on 6 types of pollutants including N and P.	- incentive is very low because of too low charge rate[4].
Germany: charges for municipalities and industries are based on 6 groups of pollutants e.g. oxidising substances, mercury, cadmium; charges reduction relates to the degree of compliance with standards e.g. charge rate factor is 1 when effluent level equals to minimum standard, charge rate factor is 0.5 when effluent level equal 0.75 of minimum standard.	- provide incentives because of variation in charge rate; compatible with PPP but does not cover all costs and damage costs; combine with effluent standard[5].
The Netherlands: effluent charges, based on BOD, COD; user charges for households and all firms, which discharge wastewater into treatment plants, based on flat rate for households and size and specific substances reduced when pre-treatment is applied for firm.	- provide strong incentive on certain industries e.g. food, beverages; revenue raising are used for environmental control programme[6]; combine with pre-treatment criteria.
Poland: charges are based on types and concentration of pollutants and the quality of receiving water; charges are differentiated regionally; in industrialized areas are higher than in other areas.	- receiving water quality and location difference are taken into account[7]

Source: 1 OECD, 1991; 2 OECD, 1989; Brewster, 1991; 3 OECD, 1989; Brewster, 1991, Meister and Sharp, 1993; 4-6 OECD, 1989; 7 Bochniarz, 1991.

Figure 2.13 Application of Economic Instruments: Charges (continued)

Characteristics	Comments
User Charge	- compatible with PPP - provide high effectiveness and acceptability towards polluters[1]
Sweden: charge consists of a fixed and a variable charges, based on water use and varies in region	- incentives are provided because industries try to reduce water use; households pay quite low charge in some areas, it implies hidden subsidies[2]
USA: charge for households is volumetric charge based on a fixed rate and on water use; - charge for firms are volumetric charge, which based on volume of waste of water use, or a strength charge or both.	- volumetric charge provide small incentive, but it decreases water use rather than reduce pollutants discharge; strength charges provide no incentive[3]
Product Charge	- apply to products consumed in large quantity and in diffuse patterns (N, P, active ingredient in pesticides)[4]; - provide less incentive impact on pollution control but raise revenue for pollution control programmes; compatible with PPP[5]
Norway: charges are levied on fertilizers and pesticides	- revenues could be used for environmental control programme in agricultural sector[6]
Sweden: product charge on fertilizers is calculated from weight of N, P in product; product charge for pesticides are generated from weight of active ingredient and surface area where pesticides are applied	- revenue are used in research and development for agricultural and forestry sectors[7]
Administrative Charge	- relate to regulatory approach; - compatible with PPP - provide less incentive to pollution reduction[8]
Denmark: charges are levied on producers and importers of pesticides.	- revenues are used for expenditures for approval and control activities; no incentive provided[9]
Sweden: charges are levied on point source operators who apply for license for their polluting activities; applications for new active substances in pesticide production as well as yearly charge for each pesticide registered product.	- total revenue nearly covers total expenditures for registration and control; provide some incentives, since number of registered product decreased.

Source: 1-3, 5-8 OECD, 1989; 4 OECD, 1991

Figure 2.14 Application of Economic Instruments: Financial Assistance

Characteristics	Comments
Financial Assistance	- incompatible with PPP except in certain circumstances[2]
Denmark - subsidies to farmers in abating discharges of nutrients from farmlands	- temporary measure, clearly specify target groups.
France - grant or soft loan to contribute industries for water pollution control measures	- closely linked to charge systems because revenues raised are used to support pollution control measure[3].
Germany - soft loan for most small firms that face financial problem and for speeding up the implementation of environmental programme	- helpful for firms, since the Germany environmental standards are relatively strict[4].
India[1] - loan with lower interest rate and investment allowance for installing pollution control plant and machinery; - depreciation of income tax due to install pollution control devices; - exempting tax on relocation of plant from built-up areas or overcrowded cities.	- different from other countries, since they offer for installation of pollution control devices and relocation of plants.
Italy - support municipalities and industries to construct and replacement of wastewater treatment plant to meet the objectives of the Water Pollution Law.	- well-defined transitional period, these financial assistance were terminated in 1989, however, the government still provides the assistance for solid waste recycling[5].
The Netherlands - grant to industry and to promote compliance with regulations - grant to industry to promote research on, and provide availability of pollution control equipment and clean technology.	- grants are aimed to assist a firm that face financial problems[6]. well-defined target group.

Source: 1 Tyagi, 1991; 2-6 OECD, 1989

In the USA, emission trading is mainly applied in the field of air pollution, and is known as the 'Bubbles' and 'Offset' programmes, as shown in Figure 2.15. But the tradable permit system is not so well-developed in water pollution control in the USA or in other countries. In the field of water pollution control, the US EPA tries to apply point source/non-point source trading, concentrated on phosphorus loading reduction. This programme allows a higher phosphorus discharge from a point source (e.g. wastewater treatment plants), if discharges from non-point sources are reduced.

Figure 2.15 Tradeable Permit System

(a) Bubbles which is a system where two existing stationary sources of pollution are permitted to readjust their assigned emission limits as long as total emission limit equals or less than specified limits;

(b) Offset programmes which are allowed entering or expanding of polluting activities in a geographical area where an increase in pollution levels is prohibited. Under the 'Offset' programme the firm wishing to increase its emissions can buy pollution permits from existing firms, which must reduce their emissions in order to maintain the ambient environmental level.

Source: OECD, 1989

The OECD (1991) believes that marketable permits are still potentially applicable in all media and economic sectors. Economic instrument provides various advantages as described. This system provides choices for polluters as it facilitates economic actions through the market system but the actual action is left to the polluters (OECD, 1989). A firm has an incentive to select the least cost method of reducing pollution which suit its own system (Malueg, 1989; Hodge, 1991). For example, by reducing production levels, by changing production methods, by introducing pollution control measure or by relocating to less sensitive areas. Revenues arising from economic measures e.g. administrative charge or user charges may help local governments or organisations concerned to handle environmental protection activities or pollution abatement programme (Bochniarz, 1991; Brewster, 1991).

The use of economic instruments lead to a saving of time and money from judicial processes. In the case of economic incentives, polluters do not look for excuses for pollution, but for ways to reduce emissions in order to pay less charges (Bochniarz, 1991). Economic instruments (especially a system of charges) require less information to implement than other approaches, therefore, they are usually considered appropriate for application in developing countries who generally lack funds and comprehensive

information networks (Malueg, 1989; Brewster, 1991). However, it could also be argued that governments need to invest in comprehensive monitoring systems to complement the use of economic instruments.

Effluent charges seem to be the most effective means of internalising external costs, and reducing water pollution especially from stationary sources (e.g. households, industries) where costs of abatement vary among polluters (OECD, 1991).

Subsidies may help environmental improvement in various ways such as improving environmental losses, facilitating availability of wastewater treatment equipment and plant, contributing to pollution control programmes, and supporting relocation of industries[8].

OECD believes that marketable permit systems may reduce the cost of compliance by specifying rules of trade to ensure achievement of environmental goals as trades occur (OECD, 1991). Moreover, there are several advantages for using tradeable permits[9]. Possible reduction of each allocation for pollution abatement in individual firms, and minimisation cost of abatement aim to reduce emissions to the point where the marginal cost of emission reduction just equals the price of an emission credit. Marketable permits reunite economic development with environmental protection, by allowing new firms to set up in a given area without increasing the total amount of polluting emissions within the area.

However, Forrest and Morrison (1991) argue that under present economic system, environmental protection cannot be left to market forces alone because of two reasons. Damage to the environment tends not to occur immediately both in time and to those who cause it. Therefore, the benefits of environmental protection are too far from polluters to accept the cost. The market system takes account only of values that can be converted into monetary term, hence, governments should intervene in order to ensure that adverse environmental impacts are taken into account. It is suggested that some circumstances such as where there is danger to health, sudden health

[8] Walsh, 1982 in Meister and Rosier, 1992; OECD, 1989; Brewster, 1991; Tyagi, 1991

[9] Keeler, 1991; Marin, 1991; Malueg, 1989; Tietenberg, 1992

emergencies, or no adequate monitoring device (e.g. soil erosion, pesticides, etc.) application of market based techniques are inappropriate (Meister, 1990). Moreover, Baumol and Oates (1979) argue that rising prices do produce inequities both for present and future generations because the poor may not be able to use the high price resources and there is no reason to expect the market system to work perfectly in preserving resources for the future.

2.4.3 Other types of policy instruments

This section deals with other kinds of environmental policy instruments which aim to reduce pollution at the source for both point and non-point sources of pollution. These measures seem to be supportive measures to other measures. These measures are for example, public works or on-site treatment plants, Best Management Practices, and provision of information and services by the government sector and an environmental impact assessment.

Public Works e.g. On-site Treatment Plant

In relation to pollution control, public works include wastewater treatment plants which are normally provided by government sectors throughout the world (the World Bank, 1992). To achieve the ultimate goal of wastewater management which is "*the protection of the environment in a manner commensurate with public health, economic, social, and political concerns*" (Metcalf and Eddy, Inc., 1991, p.1), wastewater should be treated to a zero pollution level or, at least, an acceptable level by the operation of on-site treatments or through municipal wastewater systems, where they are available (Lee (1983), in Weil et al., 1990),

Wastewater treatment methods were initially developed to deal with public health concerns and the adverse effects caused by the discharge of wastewater to the environment. It aimes to remove BOD, suspended solids, and pathogenic organisms. Moreover, the removal of nutrients such as nitrogen and phosphorus, began to address problems in inland waters. At present, pathogenic organisms, toxic and trace compounds e.g. heavy metals and refractory organic are of greater concern. A major effort is being made to be more effective in the treatment of wastewater to reduce impacts on human health and ecosystems, and to improve the quality of freshwater and coastal waters (Metcalf and Eddy, Inc., 1991).

Selection of wastewater treatment process or the sequence of processes depends upon various factors for examples, characteristics of wastewater (e.g. pH, concentration of COD, SS), required effluent quality, cost and availability of land, and possible future of water quality standards (Ramalho, 1983). Sequences of wastewater treatment process are divided into three levels of wastewater treatment - primary, secondary and tertiary treatments (Eckenfelder, Jr., 1980; Ramalho, 1983; Ryding, 1992), as shown in Figure 2.16.

Figure 2.16 Characteristics of Wastewater Treatment Process

Primary Wastewater Treatment:
- employed mechanical and/or chemical process for removing suspended solids and floating materials;
- may be applied as neutralization and/or equalization processes for conditioning the wastewater for either discharge to receiving water or to a secondary treatment process[1];
- the effluent from primary treatment contains organic matter which requires the proceeding process of treatment[2].

Secondary Wastewater Treatment:
- based on the knowledge that many types of organic matters, suspended solids can be removed because microorganisms are able to breakdown organic matter in wastewater and result in stabilization of organic wastes[3];
- consists of conventional biological treatment processes and their variations[4], both aerobic and aerobic;
- some pollutants (e.g. phosphorus, nitrogen, heavy metals) may exceed allowable limit to discharge into water bodies which may require treatment at tertiary process.

Tertiary Wastewater Treatment:
- employed physical chemical process to eliminate the remaining pollutants, for example Nitrification-Denitrification process (nitrogen removal), chemical precipitation process (phosphorus removal), carbon adsorption (organic removal), ion exchange (metals removal)[5].

Source: 1,4 Ramalho, 1983; 2,5 Metcalf and Eddy, Inc., 1991; 3 Eckenfelder Jr., 1980

The Agenda 21 suggests that environmentally sound treatment of domestic and industrial effluent is important (Sitarz, 1993). This includes promotion of primary treatment of all sewage discharged into rivers, estuaries, and the seas. While some areas must apply more stringent treatment, including nutrient removal, where they are specified as areas at risk of eutrophication (Zabel and Miller, 1992).

Advantages of on-site wastewater treatment plants are that they can reduce pollutants in the forms of toxic substances e.g. heavy metals, pesticides, plant nutrients - nitrogen and phosphorus. In addition to the reduction of pathogenic organisms which may

cause waterborne diseases and deaths, particularly in developing countries, There is also a reduction in adverse effects on fisheries (the World Bank, 1992; Zabel and Miller, 1992). Therefore, many developed countries provide wastewater treatment plants as one of the measures to cope with water pollution especially in large cities and where construction of wastewater treatment plants are too costly for small-scale industries and households to construct individually. However, discharge from central treatment plants may cause serious effects on receiving waters because of the loading of plant nutrients (e.g. nitrogen and phosphorus) especially where or when a river has low flows (Ryding, 1992; Zabel and Miller, 1992).

Due to high costs of construction, operation and maintenance and energy requirements, 'end-of-pipe' technology should not be the only available measure to cope with water quality degradation. Niemczynowicz (1992) and Ryding (1992) suggest that wastewater management should be integrated with other types of preventive environmental measures within the catchment, for example, pre-treatment of some source of pollution connection to central or municipal treatment plant, use of economic measures (e.g. charges based on strengths of effluent), and restrictions on the products used in households (e.g. limit the amount of phosphates in detergents). Moreover, natural process as self-purification capacity by using wetland can also help filter and clean up water pollutants at low-cost and low-maintenance biological treatment for primary and secondary effluent (Ryding, 1992).

Best Management Practices

Once non-point pollution occurs, it is difficult to control because of natural variability associated with weather conditions and natural process. Moreover, to monitor such problems (e.g. discharge from agricultural activities) seems impossible, due to the numbers of sources and the diffused character of the pollution (Braden and Segerson, 1991 in Xepapadeas, 1992). Therefore, Best Management Practices (BMPs) is one option which may deal with non-point sources of pollution because it aims to reduce environmental impacts before pollutants reach water bodies.

Best Management Practices (BMPs) is defined, by US EPA regulations as:

> "*Those methods, measures, or practices to prevent or reduce water pollution and include but are not limited to structural and nonstructural controls, and operation and maintenance procedures. BMPs can be applied before, during, and after*

> *pollution - producing activities to reduce or eliminate the introduction of pollutants into receiving waters. Economic, institutional, and technical factors shall be considered in developing BMPs.*" (US. EPA Regulation in Brown et al., 1993, p.3)

The characteristics of BMPs are that pollution is prevented or controlled at source which have or may have the potential to cause diffuse pollution to water bodies. Activities including agriculture, urban runoff, construction sites and forest areas are prime targets for use of BMPs.

BMPs can be either structural or nonstructural management practices (Urbonas, 1994). Nonstructural practices include a variety of institutional and educational initiatives including land use planning, land development and redevelopment process, imposition of regulations, and clean up programmes. Other programmes emphasize education or regulation of the public to modify behaviour that contributes to discharge of pollution (Myers et al., 1985; Urbonas, 1994). Structural management practices, including the use of grass buffer stripes, porous pavement, infiltration basins, constructed wetland, may also be useful (Myers et al., 1985; Ellis, 1989; Urbonas, 1994).

To apply BMPs in agriculture Kincheloe (1994) varies the BMPs concept as meaning:

> "*those practices that have been proven in research and tested through farmer implementation to give optimum production potential, input efficiency, and environmental protection.*" (Kincheloe, 1994, p.44)

Kincheloe also suggests that BMPs in agriculture may be very site specific, they differ with crops, soils and climates. Epp and Shortle (1985) believe that control of agricultural non-point sources should be focused on field management, considering what to plant and how to plant. These measures are illustrated in Figure 2.17.

Figure 2.17 Best Management Practices

Agricultural Practice[1]
- Cultural practices e.g. crops rotation, conservation tillage;
- Pest management e.g. use of resistant cultivars, integrated pest management;
- Water management and conservation e.g. crop selection, eco-farming;
- Sound fertility programs e.g. use of manures, sludge.

Urban stormwater runoff[2]
- Structural management practices include to provide soakaway and on-site storage facilities for roof runoff, temporary storage on impermeable surface within suburban residential areas, to control and maintain oil interceptors to prevent spillage and seepage to stormwater sewer system;
- Nonstructural management practices include car parking controls and street zoning restricts, to clean street and road gully as well as to flush sewer during weather, to ensure that effective street and sewer sanitation is maintained in commercial and industrial areas, good housekeeping practices, educational programmes.

Construction site[3]
- Good site planning;
- Vegetation control through seeding and mulching;
- Construct detention basins;

Forested area[4]
- To protect buffer strips along perennial and intermittent streams;
- To prohibit logging during excessively wet periods.

Source: 1 Ribaudo, 1992; Kincheloe, 1994; 2 Myers et al., 1985; Ellis, 1989; Urbonas, 1994; 3 Myers et al., 1985; 4 Lynch et al., 1985

Best Management Practices are generally implemented on a voluntary basis. Harrington et al. (1993) recommend that the voluntary approach alone cannot effectively reduce non-point pollution. It should be combined with other measures (e.g. financial incentives). Examples of various application include provision of education programmes to farmers or landowners (e.g. BMP manuals, seminars, mailing, and personal contacts), provision of technical assistance, and subsidies or tax incentives for adopting plans or practices that will have a positive effect on water quality (Brown et al., 1993; Epp and Shortle, 1985; Harrington et al, 1985).

BMPs are ideal instruments for preventing pollution over the long term especially from non-point sources. BMPs are compatible with Polluter-Pays Principle, if the costs of damage are borne by the farmers or landowners because currently, the costs of water pollution damages are borne by downstream users and society in general (Epp and Shortle, 1985). It is also suggested that the cost-effectiveness of BMPs to meet water quality standards depends on how well BMPs are chosen for given conditions.

The more carefully they are specified for a given site, the more efficiently water quality standards will be met (Brown et al., 1993). Therefore, BMPs are ideal measures to implement at the lowest level of organisation, as Myers suggests that "*it is ultimately the responsibility of the local agencies to set priorities for nonpoint-source problems and implement management programs*" (Myers et al., 1985, p.18). Brown et al. (1993) report the results of a survey in the USA which indicates that where forest managers have implemented BMPs, water quality is usually within acceptable standards.

As BMPs are mainly based on a voluntary approach, success depends on individual farmer's or landowner's practices. BMPs require strong incentives (e.g. higher returns or a subsidy) for adopting good practice. Epp and Shortle (1985) argue that once farmers plant particular crops applying specified techniques of BMPs, they have little control over the actual amount of pollutants reaching to water bodies. Rainfall is a major contribution to pollution. Moreover, costs associated with implementing BMPs in agricultural production either by farmers, or tax payers or shared with the government, may affect food production costs. This may adversely affect the competitive position of the nation in the world markets for agricultural products.

BMPs for stormwater control in urban areas may also be expensive especially in constructed areas, while non-structural controls are limited in pollutant-removal effectiveness.

Advocacy and Provision of Information

Jones (1991) indicates that availability of information about the causes of environmental damage can itself help in the solution and prevention of environmental problems. The IUCN/UNEP/WWF (1991) suggests that information expands opportunities. To provide information is one of the principle means of empowering people, as long as the information is disseminated in a form that are easily understood by the people concerned. As Bothe (1980) and Ryding (1992) suggest that environmental information should easily understood and to have a suitable form to accommodate the levels of understanding of different target groups.

Therefore, to implement environmental management effectively requires information transfer to the public and related organisations so each group understands the causes and effects of activities on the environment as well as the potential strategies for dealing with them. Public environmental education is therefore a principle means to achieve environmental objectives (Preston, 1987; Sitarz, 1993). Rosier (1994) also advocates advocacy but recommends it be applied in conjunction with regulation because the advocacy itself does not control the final outcome of the environmental objectives or people's actions. Moreover, Agenda 21 suggests that advocacy programmes (e.g. specialized training or workshops) should be developed for public officials in providing effective monitoring and enforcement of laws and regulations (Sitarz, 1993).

Buckley (1991) and Rosier (1994) describe two types of advocacy approach - statutory advocacy and non-statutory advocacy. Statutory advocacy involves promoting specific strategies for inclusion in statutory documents such as introduction of environmental education in school and university curricula as well as training programmes for officials. Non-statutory advocacy deals with encouraging individuals and groups to undertake particular voluntary activities such as creating and distributing leaflets, or posters, and participating in radio and television programmes (Buckley, 1991). Both formal and informal education are able to change people's attitudes. Agenda 21 suggests that environmental education is crucial for achieving environmental and ethical awareness of the values, attitudes and behaviour of people which will be necessary for sustainable development (Sitarz, 1993).

Preston (1987) indicates that traditionally governments are more active in providing public education, however, non-governmental organisations may assist in carrying out this role. Agenda 21 also suggests that non-formal education should be encouraged at the local, regional and national levels by supporting the efforts of non-governmental organisations (Sitarz, 1993). Moreover, it is suggested that governments should establish and develop local and national databases in order to meet the needs of the local data users and the government should guarantee free availability of environmental information and regard environmental data as a public resource, not as a financial asset (IUCN/UNEP/WWF, 1991; Sitarz, 1993).

Educational programs provide some advantages in that they may be used to encourage public awareness and individual responsibility for environmental protection and preservation of human life-support systems (Preston 1987; Egan 1991). This can be an opportunity to make people aware of their actions or impacts on the environment. It can promote understanding of the concept of sustainable development among people and encourage them to get involved in planning process, and in the management of their own natural resources (Jones, 1991; Ryding, 1992).

Critics of advocacy and provision of information argue that while agencies are delegating formal action, environmental damage may increase (Rosier, 1992). However, if used correctly, the only disadvantage is cost, given that results are difficult to evaluate for effectiveness.

Project Environmental Impact Assessment

Definitions of an EIA are given by Wathern (1994) as:

> "*EIA can be described as a process for identifying the likely consequences for the biogeophysical environment and for man's health and welfare of implementing particular activities and for conveying this information, at a stage when it can materially affect their decision, to those responsible for sanctioning the proposals.*" (Wathern, 1994, p.6)

Environmental Impact Assessment (EIA) is an important tool for decision-makers to ensure that environmental management synonymous with economic development, as Ryding (1992) and Therivel et al. (1992) suggest that major public or private development projects in agriculture, industry or infrastructure should be subject to comprehensive environmental evaluation prior to development of projects.

There are various suggested processes for a project Environmental Impact Assessment. One example, recommended by Wathern (1994) is shown in Figure 2.18. The process is divided into three stages - scoping, preparing the EIA and implementing the project including monitoring and auditing the EIA and the project.

First stage is to scope the EIA process. It consists of defining proposal and evaluate initial environmental impact. Then to formulate the scope of the environmental impact which will be studied. It is suggested that EIA should be carried out in depth that go beyond physical impacts of the project to the environment, social and economic

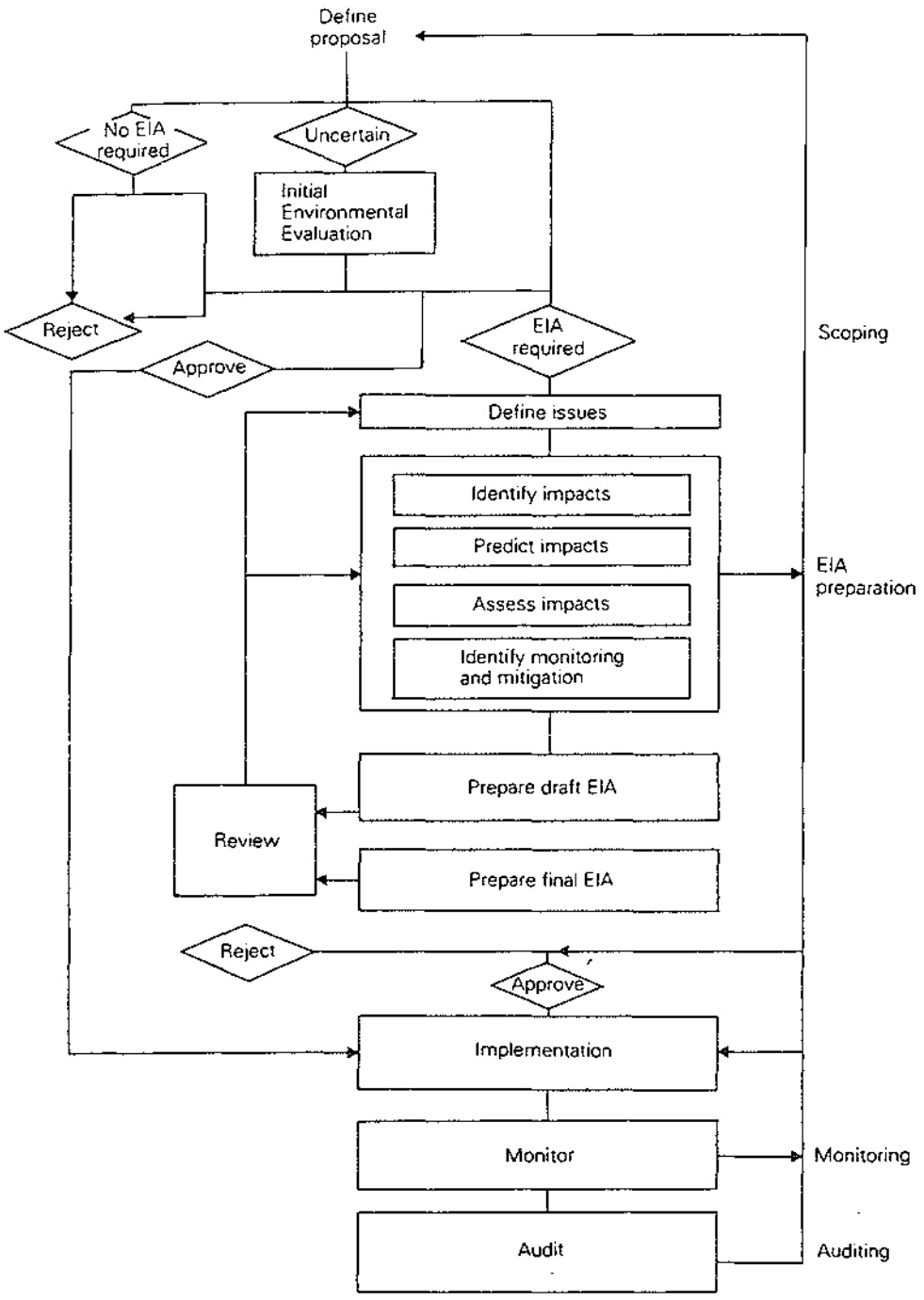

Figure 2.18 Components of an EIA System

Source: Wathern, 1994

impacts, an mitigatory measures of the impacts of the project (Ahmad and Sammy, 1985; IUCN/UNEP/WWF, 1991).

Second Stage is to prepare an EIA by identifying issues, predicting and assessing impacts, identifying monitoring and mitigation measures, preparing draft Environmental Impact Statement (EIS), reviewing draft and preparing final EIS. If the EIS is not satisfied, the reviewers may identify issues, predict and assess the impact again.

The third stage is to implement the project. As the project performs, an authority concerned should monitor and audit the original EIA to ensure that all the promised conditions are complied with.

Therefore, to integrate an EIA into planning process effectively, an official EIA system established through regulations should be established. Some other forms are non-mandatory EIA guidelines, ad hoc basis for specific large-scale development project. The effectiveness of these forms varies considerably (Therivel et al., 1992). This requires a framework specifying elements as shown in Figure 2.19.

An EIA provides some advantages as suggested by IUCN/UNEP/WWF (1991) and Wathern (1994) in that it provides an indication for decision-makers, about the environmental consequences of a proposed project and its alternatives. It recognises the limitations that the environment imposes on development, a channel for taking into considerations of environmental, social, economic impacts of the project into decision-making process before the investment will be committed, as well as incorporating the public to get involved in resource management and decisions about their environment. However, Therivel et al. (1992) argue that an EIA deals with development proposals rather than anticipating their impacts. It only allows two choices for decision-makers - to accept or to reject such project. Moreover, a project EIA does not adequately consider the cumulative impacts of more than one project. These impacts may be caused by various sources e.g. small projects which do not require EIA, combination of impacts on environmental system, pollutant are exceeded the carrying capacity of the environment induced impact from the primary project.

Figure 2.19 A framework for an EIA Process

Indication	Comment
(a) A statement indicating when an EIA is necessary, which projects require, or do not require an EIA.	- An EIA should be conducted at the early stage of the project e.g. at the pre-feasibility or feasibility stage[1] - Projects requiring an EIA depends on magnitude of environmental change, the extent of impacts on affected areas, significant of an impact, its impact on a special sensitive areas, the expected duration of the effects and irreversibility of natural system towards the impacts.[2] - Projects requiring an EIA are all proposed development projects[3], or any development projects which are likely to have significant effect on social, economic and the environment[4], or major development projects which may potentially have the impacts on water resources[5];
(b) An indication of what the EIA must contain.	- An EIA should contain, at least, a description of the proposed action, the results of the scoping exercise, a summary of the baseline study, a presentation of alternatives which are available for a project based on their potential environmental impacts and economic cost and benefits in the overall project evaluation, and the results of the comparison of alternatives, including clear recommendations for action.[6]
(c) A section specifying mandates for organisations	- Organisations which are responsible for reviewing or making decision on a development project and judging when a dispute arises should be specified[7]; - In case where decision-making is in the hands of development supporters requires a neutral environmental organisation. If the decision-makers themselves are policy-makers, they require to take consideration of two aspects - to consider the policy implications of the recommendation made and to make an appropriate decision for action; - To judge the dispute requires an independent organisation which can hear objections and make reasonable decisions within an appropriate time.
(d) Provision for full public participation, including all groups that might be affected by the project.	- The framework should provide for a good communication and information transfer between government, industry and the public through public meeting, submission, information brochure, and make availability of information[8] - The public should be allowed to get involved in many stages, for example, to demonstrate their views on the development at the planning stage, to have the right to appeal in respect of some scale of development at approval phase, to get involved in monitoring phase after the decisions are made[9];
(e) Provision of a comprehensive monitoring programme	- To ensure that the environmental safeguards proposed during the planning and decision-making phase are actually implemented[10]
(f) An indication of the legal/administrative sanctions, if the guideline or regulation dealing with EIA is not complied with.	- It is indicated that monetary fines are not always appropriate sanctions towards an EIA breaching[11] If the developers conduct the projects with uncompleted EIA, two types of sanctions may be imposed which are the control authorities should halt the proposed action until the necessary EIA has been conducted, or the authorities may conduct the EIA themselves at the developers' cost. If the EIA is not complied with after the project have been performed, the authorities concerned should have the power to shut down of a project which falls too far from the agreement on the original project EIA.

Source: 1, 2, 6, 7, 11 Ahmad and Sammy, 1985; 3 Sitarz, 1993; 4 IUCN/UNEP/WWF 1991; 5 UN 1991; 8 The Commission for the Environment 1985; Buckley, 1991; 9, 10 Preston, 1987

A project EIA involves various constraints e.g. finance, timing and other made decisions which may lead the project EIA to address alternatives, measure for mitigation of impact in an limited manner or it may be prepared in a limited time. For example, mitigatory measure for the impacts and alternatives considerations are made after the major decision, dealing with the project, - location, type, scale -have been made. Some other factors such as financial and time constraint will limit preparation

of a project EIA especially for study baseline situation in terms of data collection and analysis. It is suggested that a project EIA should be applied with Strategic Environmental Assessment in the policy or plan development (Therivel et al., 1992).

2.5 Post-Implementation Stage

The post-implementation stage of water quality management consists of an enforcement system along with monitoring and reporting systems. After a plan or policy instrument is adopted, these mechanisms ensure that organisations involved are responsible in their mandates including enforcing regulations, monitoring changes to the environment and compliance with any consents. In addition, any individual project may be required to conduct an Environmental Impact Assessment to ensure that effects on the environment are considered. This section deals in detail with measures to be used after a plan has been adopted and the selected criteria to be analyzed in the comparative study.

2.5.1 Monitoring in water resource management

One of the mechanisms for environmental pollution control is the establishment of a monitoring system, because management of environmental quality requires predictive information about conditions so unnecessary uncertainties for decision-makers are reduced (Ryding, 1992). In most cases, the information needed to assist decision-makers is derived from the monitoring system (Reckhow and Chapra, 1983 in Reinelt, et al., 1992). A monitoring system can be associated with the enforcement mechanisms to ensure that polluters comply with regulatory conditions as well as to ensure that organisations concerned are responsible for implementation of policies. This section deals with characteristics of monitoring and reporting system including matters to be monitored, and advantages and critics of the system.

The environmental management framework should provide for monitoring various aspects of the environment. However, because it is not possible to compile data to cover all systems in the environment, indicators and indices need to be developed. Forrest and Morison (1991) define '*indicator*' and '*indices*' as:

> *Indicators are data that are broadly indicative of the condition of a number of environmental constituents, being representative of or analogous to that group. They are used to reflect gain or loss in human welfare from a change in the condition of the environment and are regarded as the most efficient way to*

achieve cross-sectoral environment reporting and to link the environment and human activities. Indices are another abbreviation used to express analysis of environmental elements ... (Forrest and Morison, 1991, p.57)

IUCN/UNEP/WWF (1991) and Agenda 21 (Sitarz, 1993) recommend to monitor three categories of data dealing with water quality management, as shown in Figure 2.20.

Figure 2.20 Matters to be Monitored

Administrative and legislative measures include:
- context, resources available to implement and enforce, its acceptability to societies, compliance with consent conditions.

Water quality and ecosystems include:
- physical, chemical and biological indicators of water column, sediment, fish tissues.

Social impacts include:
- changes in public behaviours and attitudes towards water quality, imposed policy, progress towards achieving sustainable development in terms of economic, social, environmental well-being, and quality of life.

Source: IUCN/UNEP/WWF, 1991; Sitarz, 1993.

In many countries, various organisations compile data dealing with water quality management. However, not all the data is consistent, compatible, assessable and complete. This requires environmental monitoring to be extended across all relevant public organisations by conducting an ongoing programme for the systematic collection of data which can be used to assess environmental conditions in the natural resource base and to assist understanding of all the factors influencing environmental quality. Therefore, national or regional water quality centres and surveillance centres may be established to evaluate the health of aquatic ecosystems for the whole country or for specific areas. Therefore, a sound management system should provide for monitoring with the following characteristics[10] as shown in Figure 2.21.

Comprehensive systems of monitoring and reporting system provide some advantages for decision-makers and the public[11], which are upgraded facilities and procedure for data collection and data processing and a regular reporting system. Therefore, effective decision-making should be achieved. It can ensure that the laws and regulations are

[10] Recommended by IUCN/UNEP/WWF, 1991; ICWE, 1992; Ryding, 1992; Sitarz, 1993

[11] Indicated by Castenssen et al., 1990 in Reinelt et al., 1992; Barrett and Therivel, 1991; US General Accounting Office, 1991; ICWE, 1992; Reinelt et al., 1992; Russell, 1992

effective in actual practice. It is also useful for detecting violation of environmental legislation (Kaplow and Shavell, 1994) e.g. by assessing whether permit conditions are complied with. In addition, it can assess the effectiveness of policy implementation through assessment of current environmental quality and trends (e.g. annual pollutant loading of sediment and nutrients from point and non-point sources of pollution) (Reinelt et al., 1992).

Critics of comprehensive monitoring systems argue that to undertake full monitoring and the SOE reporting is demanding in terms of time, budget, and personnel. Therefore, data collected by different organisations can be used, but compatibility of data system may be questionable (Ryding, 1992). In adiition, it is possible to monitor impacts of non-point source of pollution on the environment, because non-point discharges of pollution are episodic and unpredictable (Harrington et al., 1993). Therefore, to monitor the compliance with standards using Best Management Practices may be measured instead.

Figure 2.21 Elements of Monitoring System

Indication	Comment
(a) To establish a clear objective of monitoring system	-There is a need to link between the results of the monitoring programme and subsequent decisions[1]
	- The system should determine present and future environmental problems, to support information with practical implications for environmental protection measures and to provide information for decision-makers especially for environmental planning[2]
	-The system should be systematic, continuous, long-term, flexible, consistent, complete and easily updated.
(b) To set up a sound system of data collection and analysis	- Information quality should be high, complete and precise where practicable at all levels of monitoring, be compatible with information derived for planning and decision-making processes of an adjoining area, be comprehensible to the public and cost effective and it may be extended to the global scale where rivers provide major input of pollutants to seas and oceans.
	- The result should be able to assist in understanding the factors affecting environmental quality;
(c) To report regularly in an appropriate way to decision-makers, interested people and the public in general.	- The report for decision-makers may be in form of a State of the Environment (SOE) report including environmental description, social and cultural characteristics and assessment of performance in achieving targets for improved environmental quality and standard of living.
	- Data to be used in SOE report should accurately describe environmental conditions, enabling monitoring to change, predict the effects of human interaction, and assist informal decisions about when and in what kind of controls should be imposed[3]
	- Information for the public should be timely and truthful in plain language with less scientific 'jargon'[4]
(d) Provision of a training programme for personnel involved.	- An ideal administration of a sound environmental monitoring system requires a training programme throughout the monitoring chain from personnel carrying out field activities or laboratory practices to personnel responsible for data interpretation, and reporting. Analytical quality control and inter-laboratory comparisons are ways of ensuring proper analytical methods through the enhancement of national or regional reference laboratories and observatories.

Source: 1 Reinelt et al., 1992; 2 Ryding, 1992; 3 Forrest and Morison, 1991; 4 Goodman, 1984

2.5.2 Enforcement

As laws and regulations are among the most important instruments for transforming environmental and development policy into action, an important key to success in water quality management is the enforcement system (Tietenberg, 1992). Moreover, legislative support is essential for any water quality management organisation to enforce water protection measures and to ensure that organisations are responsible.

Enforcement consists of both administrative and judicial functions. Therefore, it should be clear who is responsible when a problem arises (RMLR, 1988a). Good enforcement needs effective and consistent statutory powers, and the resources available to use such powers when required, while compliance is obedience to legislation, regulations, consents, etc. The enforcement system should provide for the right to be heard and judicial protection of the people against executive power. It is suggested that everyone who is or may be affected by an act of the executive should have the opportunity to express their opinions on that act before the act is decided upon. In addition to judicial protection against executive power can be seen as supplementary towards the right to be heard. It enables individuals to appeal their rights to a neutral organisation for review of all acts which may be affected their rights (Bothe, 1980).

Compliance is a means of encouraging people, business and organisations to comply with the statutory requirements and authority ordinances; and on encouraging consent holders to act in accordance with the conditions of consent. Inadequate enforcement results in variable levels of compliance. There are three main mechanisms to achieve compliance - voluntary, economic, and regulatory mechanisms. It is suggested that people respond better to positive incentives and inducement rather than penalties (RMLR, 1988a). Therefore, economic mechanisms are usually recommended. However, negative instruments (e.g. fines) should be available. Whenever possible, voluntary control mechanism should be applied e.g. internal controls, voluntary compliance, and self-monitoring. Comprehensive system for enforcement should consist of elements as shown in Figure 2.22. And some applications of water pollution enforcement system are shown in Figure 2.23.

The World Bank (1992) argues that to administer the law is costly and time consuming, especially for monitoring and enforcement. In developing countries, the inability to enforce regulations has been an important reason for the ineffectiveness of the most stringent environmental laws. According to Tyagi (1991), there are some obstacles to implementation of environmental law and regulation. For example, it is not easy to quantify environmental damage, or to set convincing standards, to detect and measure violation and to differentiate between offenses and traditional ways of life. The use of fines also requires an investigation to assess responsibility for the violation or measures for remedying the environmental damage, not preventing it.

Financial fines do not generally cover the cost of damage, because not all damages can be converted into monetary values.

Figure 2.22 Elements of Enforcement System

Indication	Comment
(a) Methods to detect violations	- Methods includes consent conditions, effluent standards or imposing strict liability in case of hazardous substances accidents.[1]
(b) Severe penalty to deter non-compliance as well as to provide a significant deterrent.	- Various types of penalties can be applied e.g. fines for violation; compensation for environmental damage; cancellation of consent; or imprisonment[2], penalties should be based on sound social, ecological, economic and scientific principles;
(c) Provision of public participation.	- An insurance or other financial provisions should be established to guarantee adequate and rapid compensation for an environmental damage to cover economical losses by other uses of such resource, ecological and intangible losses or punitive damages which may be imposed where restoration is impossible.
(d) Provision of authorization.	- The public can be watchdogs towards environmental pollution. which can be encouraged by provision of information or knowledge in judicial and administrative procedures.
	- An individual should have the right to be heard, appeal against any act of the executive e.g. policy, plan, regulation[3].
	- Organisations which are responsible for implementation and enforcement of environmental law should be empowered to be accountable for their actions. These powers can be centralized or decentralized as specified by law.
	- In case of severe environmental damage arises, enforcement officers require the power to gain an immediate assess and inspection of pollution sources[4].

Source: 1 Hobby, 1990; 2 Randall, 1987; RMLR, 1988a; 3 Bothe, 1980; 4 RMLR, 1988a

All stages of river water quality management require institutions to be responsible for their roles in integrating economic development and environmental management. WCED (1987) indicates that the principle institutional challenge of the 1990s is the integration of ecological considerations into economic, trade, energy, agricultural, industrial, and other dimensions at all levels of governments and companies. This section deals with characteristics and roles of organisations, including national, regional and local levels of administrative structure.

Figure 2.23 Characteristics of Enforcement System

Characteristics	Comment
Australia[1]: - New South Wales Water Act, 1970: enforcement consists of penalties for a license holder who breaches the licence conditions and person who discharges without license, fine up to $A 125,000 for a firm and $A for an individual; - The Victorian Water Act, 1989: liable to pay damage cost to injured person or for damage property, fine up to $A 20,000 and $A 8,000 for each day of continuing offense, for intentional offence - fine up to $A 1,000,000 for a firm, and $A 250,000 or 7 years imprisonment (or both) for an individual.	- Enforcement systems vary between states.
Canada - Canadian Environmental Protection Act, 1988: - Strict liability offenses, fines up to $C 1,000,000 per day; imprisonment of up to 5 years, cost of repairing the damage, repay any profits resulting of breaching the law; - Provincial regulators are empowered for enforcement of environmental standards, which federal government reserve the right to take action if it is insufficient[2], government organisation may be liable for non-enforcement of environmental legislation[3].	- Tough sanction towards violators; decentralized enforcement mechanism.
India[4] - Water Act, 1988: - Severe punishment of fines and imprisonment and strict liability offenses, a long judicial process, prosecution for continuous violation per day, no compensation for environmental damage.	- Less effective of environmental law due to delay and mild punishment in practice.
USA[5] - Clean Water Act: - Negligent violation: fine up to $ A 25,000 per day and 1 year imprisonment (for first conviction), fine up to $ A 50,000 per day and 2 years imprisonment (for subsequent conviction); - Intentional offence and cause damage to human health: fine up to $ 250,000 and 15 years imprisonment for the individual and a fine up to $ 1,000,000 for a firm.	- Penalty are more severe for the case of harmful to health[4].

Source: 1 Brunton, 1994; 2 Hoberg, 1993; 3 Hobby, 1990; 4 Tyagi, 1991; 5 Egan, 1991.

Organisations which are responsible for environmental management are generally either a special environmental organisation or an existing organisation. National environmental organisations have been established in the USA and England and Wales as the United States Environmental Protection Agency (US EPA) and England and Wales established the National Rivers Authority (NRA), respectively. The IUCN/UNEP/WWF (1991) also advocate a single environmental agency to be established for environmental management.

Existing organisations with integrating mechanisms, on the other hand, can play important roles in achieving environmental management[12]. The United Nations (1991) recommends that an existing organisation facilitate integration among different sectors by appointing a lead agency e.g. Ministry of the Environment, National Environmental Board or Council to co-ordinate development activities. Redclift (1992) recommends that:

> "*coordinating mechanisms to replace sectoral responsibilities will fail if the sectoral mandates of different government agencies remain unchanged. The answer is not to try to abolish sectoralism by inventing new, overarching institutions, but to change the mandate of and procedures for each sector so that institutions behave cross-sectorally. In particular, the rewards for staff within sectoral institutions should reflect both their commitment to these coordination functions and their own, narrow sectoral responsibilities.*"(Redclift, 1992, p.258)

Therefore, organisations which are responsible for environmental management should have the following characteristics. Adequate powers and resources are needed to enforce high standard performances for control of pollution. Effective organisations are generally those which have '*functional autonomy*' to draw up environmental protection and control strategies, to develop programmes of work, to secure required budgets, to lay down and revise water quality standards and to develop and retain their manpower (The UN, 1991);

Co-ordinating mechanisms between sectoral organisations are crucial. A sound water resource management requires coordination and consistency among levels of government and organisations especially organisations which are responsible for land and water management. Therefore, each organisation responsible for a particular policy requires to work together to reduce the impact on the other areas (Da Cunha, 1991;

[12] Advocated by the United Nations, 1991; Redclift, 1992; Brunton, 1993

Bulkley, 1992). The integration can be conducted at Pre-Implementation and Implementation Stages of the planning process. Moreover, the mechanism should cover the shaping of the formal and informal linkages between government agencies, and beyond government to business, and voluntary or community sectors (Carley and Christie, 1992).

In some cases, separation of the operators and regulator organisation is needed so that agencies whose activities are potentially harmful to the environment do not have sole responsibility for monitoring their own compliance with environmental protection measures (Forrest and Morison, 1991).

It is important to share responsibilities among national and local organisation. Agenda 21 indicates that many problems and solutions have their roots in local activities (Sitarz, 1993). Therefore, it is important to place responsibility for environmental management and protection with local authorities by promoting and encouraging the use of local authority powers and self-reliance (Anon, 1990; IUCN/UNEP/WWF, 1991). The US EPA shares an authority with state governments, as it delegates the permitting and enforcement responsibility to state governments while monitoring their activities (Hallett et al., 1991). In Canada, enforcement of standards set for water pollution control are delegated to provincial regulators (Hoberg, 1993). In Europe, the planning, operation, maintenance, and management of water and wastewater systems are responsible by regional or municipal authorities (Espinoza, 1991). Some authors[13] recommend to establish organisations which are responsible for catchment management.

Provision of the public and private sector to participate in environmental management. Some authors[14] suggest that it is necessary for communities to get involved in the decision-making and actual control of water resources to ensure that the decision-makers at all levels take into account the need of the public. It, also, helps ensure that

[13] IUCN/UNEP/WWF, 1991; ICWE, 1992; Sitarz, 1993

[14] Goodman, 1984; Anon, 1990; Da Cunha, 1991; Stephenson and Petersen, 1991; Carley and Christie, 1992; Sitarz, 1993

societies are responsible for economic development while protecting the resource base and environment for the benefit of the present and future generations.

The public may participate in planning process through the following methods[15]:

(a) Large group meetings (e.g. public hearing to certify proposed policy/plan and discuss related issues);

(b) Small group meetings (e.g. presentation to the community groups, workshop to facilitate identifying community concerned, informing citizens about the policy, plan, issues, pollution control techniques);

(c) Use of media (e.g. information pamphlets, brochures, summary reports); or

(d) Direct response to the public or conduct of a survey to determine the values and positions of the public on specific issues.

Public participation provides some advantages[16] such as:

(a) Identification of local needs, preferences, and priorities;

(b) Identification of sensitive issues and ways of preventing or reducing adverse impacts;

(c) Dealing with conflicts and reaching a consensus if possible when there are different points of view with respect to plan components, particularly when multiple objectives are involved;

(d) Identification and clarification of all impacts of various alternatives and recommendation of programmes for different groups and individuals;

(e) Identification of legal requirements, funding limitations, or other constraints or to ensure that the plan or policy is compatible with other community objectives;

(f) Provision of opportunities for those affected by water resource development to influence decisions regarding development;

(g) Promotion of understanding and support for identified objectives and solutions proposed; and/or

(h) Facilitating advantage of technical expertise which may be available in the community.

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[15] Glasser et al., 1975 in Goodman, 1984

[16] Goodman, 1984; Stephenson and Petersen, 1991

Figure 2.24 ROLES of ORGANISATIONS and PUBLIC

Pre-Implementation	Implementation	Post-Implementation
National Organisation: - To incorporate the principle of sustainable development as an ultimate goal for national economic policy/plan and in the mandates and policies of sectoral agencies; - To create integration mechanism among different ministries, and national and sub-national levels, to place responsibilities on the lowest level of public authority, except in inter-jurisdictional waters and when water quality is a matter of national concern or local organisation fails to take action; - To establish national guideline or policy for water resource management including setting priority for high-risk basins; - To provide a system of SEA and EIA to ensure that any policy, plan, programme or individual project are taken into account environmental impacts.	- To facilitate and promote implementation of river basin authority/committee or local agencies through planning process and technical advisory; - To develop and apply regulatory approach in combine with economic instrument through national water quality criteria or standards, effluent standards and effluent charge and other measures.	- To establish an enforcement mechanism and national monitoring programme to control point and non-point source of pollution; - To enforce environmental regulation with special attention to the matters of national important and perform activities when serious environmental problems occur and/or where local organisations fail to do their functions; - To review administrative and legislative measures regularly; - To conduct SOE and regularly review of the state of economic, social condition and national resources, to support decision-making process effectively.
Regional and Local Organisations - To oversee planning process by extending a national policy or plan to regional plan and to integrate a wide range of decisions; - To establish local environmental policies, plans which are joint projects of government and people who live in that region; and to assist an implementation of national environmental policies.	- To implement various types of policy instruments which are suitable for them e.g. permit system, water quality and effluent standards and effluent charges or service charges, BMPs; - To manage revenues arising from pollution charges for pollution control programme; - To encourage and provide channels for the public to get involved in implementation of the plan.	- To develop or take part in national environmental monitoring programmes to assess water quality and impacts of any national policy/plan; - To enforce local regulations as appropriate; - To monitor and review the measures of environmental control programme regularly.
Public: - To get involved in planning process e.g to express community concerns.	- To be responsible for performance required by the regulatory and voluntary approach as far as possible e.g. paying for charges, performing BMPs, establishing wastewater treatment plants; - To express their point of views on any plans or projects development especially on the plans/projects which are likely to cause adverse affects on local people.	- To get involved in monitoring and enforcement mechanisms as provided by the local organisations;

Therefore, roles of organisations both at national and regional and local levels should be reviewed and rearranged to include the following responsibilities which are shown in Figure 2.24.

2.6 Conclusion

The evaluation of the New Zealand and the Thai water management systems in Chapters Three and Four will be based on the same structure as Figure 2.25 and each of the criteria will be reproduced to facilitate the reader.

Figure 2.25 Selected Criteria

Sustainable development	(a) To conserve and enhance the resource base; (b) To take into consideration the need of present and future generations; (c) To integrate environmental and economic in the decision-making process at all levels of administration; (d) To analyze the whole water cycle.
National Planning	(a) Long-term objectives for sustainable development and medium and short-term for conservation and enhancement of resources; (b) Provision of a framework for integrated development in river catchment; (c) Indication of national priorities; (d) Provision for public participation; (e) Provision for Strategic Environmental Assessment for the policies and plans; (f) To provide consistency of the plan at different levels of planning
Regional Planning	(a) Planning at river catchment plan within national framework; (b) Establishment of priorities for local plans; (c) Provision for public participation; (d) Conduct Strategic Environmental Assessment for plans and policies.
Local Planning	(a) Plans for specific areas especially upstream river catchment; (b) Plan within national framework as well as river catchment planning framework; (c) Provision of public participation.
Permit system	(a) Decision should be made at lowest level of organisation; (b) Consent process should be clear and streamlined including lifetime, process of renewing permits, provision for amendment of consent conditions; (c) Permit system should take into consideration environmental factors and unavoidable malfunction and equipment failure including water quality standards, carrying capacity of receiving waters, total permission discharges, seasonal variations, assessment of environmental impacts.

Figure 2.25 Selected Criteria (Continued)

Water Quality Standards	(a) Different standards are established for various sections due to different uses, assimilative capacity, seasonal variation and/or flow rate; (b) Standards may be changed or added more conditions; (c) Specifying the result of statistical evaluation; (d) Descriptio of standards in precise, technical and quantitative terms; (e) Application of minimum standards.
Effluent Standards	(a) Direct effluent standards are established; (b) Effluent standards can be uniform or time or location variation by taking into consideration carrying capacity of receiving water and water quality standards; (c) Effluent standards should be applied in conjunction with a permit system and be complement water quality standards.
Zoning	Should be combined with land use planning and regulatory approach such as: (a) To locate pollution sources far from river and not allow to locate pollution upstream; (b) To locate pollution source away from major urban areas; (c) To establish industrial zone with provision of wastewater treatment facilities.
Charges	(a) Based on quantity and quality of pollution generated; (b) Reflecting both true cost of water consumption and other services; (c) Providing incentives to change polluters' behaviours; (d) Combined with regulatory approach e.g. effluent standards.
Subsidies	(a) Selective and restricted to specific groups otherwise severe difficulties may occur; (b) Well-defined transitional period; (c) Where market distortions may be created.
Public Works e.g. wastewater treatment facilities	(a) The facilities should provide for domestic and industrial waste treatment; (b) wastewater treatment facilities should be provided at least secondary treatment.
Best Management Practices	(a) To adopt BMPs to control pollution at sources; (b) BMPs should combined with other measures e.g. financial incentives.
Provision of advocacy and information	(a) Provision of advocacy: (i) Statutory advocacy through environmental education in school, university, training programme for officials; (ii) Non-statutory advocacy with regulatory and non-governmental organisation; (c) Provision of availability of environmental information as a public asset.
Project Environmental Impact Assessment	(a) To integrate an EIA in the planning process; (b) The EIA should cover the impacts on the environment, social and economic and mitigatory measures of the impacts of the project; (c) The framework should provide for a statement indicating when an EIA is necessary and which project requires an EIA, an indication of what the EIA must contain, the section specifying mandates for organisation concerned, provision for full public participation, provision of a comprehensive monitoring programme, an indication of the legal and administrative sanctions.
Monitoring system	(a) To monitor three types of matters - administrative and legislative measures, water and ecosystem and social impacts; (b) Provision of a systematic monitoring system with clear objective, sound system of data collection and analysis, regularly report to decision-makers and public,,provide a training programme.
Enforcement system	(a) Methods of detecting violations e.g. consent conditions, water quality standards; (b) Severe penalties including fine for violations, compensation for environmental damage, cancellation of consent, imprisonment; (c) Provision of public participation; (d) Provision of authorization e.g. immediate assess and inspection when environmental pollution occurs.

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CHAPTER THREE

CHAPTER THREE

NEW ZEALAND FRAMEWORK FOR RIVER WATER QUALITY MANAGEMENT

3.0 Objective: To review river water quality management in New Zealand based on selected criteria.

3.1 Introduction

New Zealanders have traditionally regarded their country as being abundantly supplied with high quality water resources (Feeney, 1985). However, as water passes through catchments, desirable quality is reduced because of a wider range of water use than in the past. The major uses of water in New Zealand are for domestic, agricultural, industrial, recreational, cultural and in-stream purposes.

Domestic and industrial uses result in water being changed in quantity and quality. For example, Hamilton City takes its water supply from the Waikato River and discharges the City's treated wastewater back to the Waikato further downstream (Feeney, 1985). Many industrial activities in New Zealand require water for production processes and discharge waste back into air, land or water (e.g. pulp and paper mills, dairy factories, meat works and canneries).

Agricultural practices contribute to water pollution mainly through non-point sources of pollution such as runoff from soil erosion, or leachate of fertilizers, pesticides or herbicides. Recreational activities may also pollute water bodies through discharge from crankcase or gaseous emission from boat engine (Kuss et al., 1990). In-stream use is less polluting than others. However, it can also contribute both positive and adverse effects on water quality. For example, periphyton provides oxygen during day time and consume oxygen during night time. Therefore, it may cause oxygen deficiency in water bodies during the night (Ibid.).

The water management regime provided in the Resource Management Act 1991 aims to ensure New Zealand has sustainable management of water resources to serve both

users of the water resource and the capacity of water to assimilate waste, along with protection of the intrinsic values of water.

In this chapter, the New Zealand framework for river water quality management system will be evaluated against the criteria selected throughout Chapter Two. This chapter is structured along the same lines as Chapter Two. It is divided into three sections. The first section deals with sustainable management of natural resources, including river water quality. The second section deals with three stages in planning process provided from the RMA - pre-implementation, implementation and post-implementation stages. Pre-implementation stage consists of planning at national, regional and local levels. The implementation stage consists of measures employed in implementing plans in order to achieve sustainable management. These measures include the regulatory approach (e.g. permit system, water quality standards, effluent standards, zoning); economic instruments (e.g. charges and subsidies); and other measures (e.g. Best Management Practices, education and advocacy and Environmental Impact Assessment). The post-Implementation stage comprises of monitoring and enforcement systems. The last section contains conclusion about the New Zealand framework of river water quality management system.

3.2 Sustainable Development or Management

Natural resources management in New Zealand (outside lands controlled by the Conservation Act 1987 or the Fisheries Act 1983) is managed principally under the provision of the Resource Management Act 1991. Sustainable development is partly adopted by the New Zealand resource management regime in order to achieve integration of environmental policies and economic development. However, the New Zealand has departed from the WCED's concept of sustainable development (see Chapter Two) in that the purpose of the Resource Management Act is to achieve sustainable management.

"**Sustainable Management**" means:

> *managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well being and for their health and safety while --*

(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment. (s.5(2), RMA, 1991)

Selected principles which underpin the achievement of sustainable development shown in Figure 3.1 may also be found in the Resource Management Act 1991.

Figure 3.1 Criteria for Achieving Sustainable Development

(a) To conserve and enhance the resource base;

(b) To take into consideration the need of present and future generations;

(c) To integrate environmental and economics in decision-making process at all levels of administration;

(d) To analyze the whole water cycle.

The first two strategies are to conserve and to enhance the resource base; and to take into considerations the needs for present and future generations. These are clearly expressed in section 5 - the purpose of the Act that is to promote the sustainable management of natural and physical resources. The third strategy is to integrate environment and economics in decision-making at all levels of administration. This is implicitly included, because all decision-making under the Act that must be consistent with its purpose. An integration of environmental and economic factors can be achieved as it is implied that national policy statement, regional policy statement, regional plan, district plan and all the consent decisions made under them must be consistent with the purpose of promoting sustainable management (Gow, 1991).

An integrated approach is also considered to be an important aspect in achieving sustainable management of natural and physical resources at regional level. The Regional Policy Statement (RPS) is the principle document for achieving integration (s.59 RMA 1991) in two ways. Firstly, the RPS provides integrated of management of all natural and physical resources within a region. Secondly, the RPS provides co-ordination and a consistent approach to resource management within a water

catchment by ensuring that all resources management decisions made within the catchment are consistent with the RPS objectives and policies (Sheppard, 1991).

The fourth strategy which is to understand the whole water cycle, from upstream freshwater to coastal water, which is recognised in the Resource Management Regime, since '**water**' in the RMA:

> *(a) Means water in all its physical forms whether flowing or not and whether over or under the ground:*
>
> *(b) Includes fresh water, coastal water, and geothermal water:*
>
> *(c) Does not include water in any form while in any pipe, tank, or cistern:* (s.2 RMA 1991)

However, management of freshwater is different from coastal water in that it is governed by various policy statements and plans. Freshwater management is generally voluntary, as summed up in Figure 3.2.

Figure 3.2 Policy Instrument at Different Levels

Level	Freshwater Management	Coastal Management
National	National policy statement (voluntary)	New Zealand coastal policy statement (compulsory)
Regional	Regional policy statement (compulsory) Regional plan (voluntary)	Regional policy statement (compulsory) Regional coastal plan (compulsory)
Local	District plan (compulsory)	District plan (compulsory)

Therefore, it seems that the New Zealand framework provides a integrated framework to achieve sustainable development of water resources by providing the framework for implementation of all four strategies.

3.3 Pre-Implementation Stage - Planning Process

Three levels of organisations - national, regional, local - are involved in the planning process dealing with river water quality management in New Zealand. The contents will be outlined based on selected criteria, developed in Chapter Two and summarised here in Figure 3.3.

Figure 3.3 Criteria for Planning Process

At national level, the planning process should provide for national policy for water which has:

(a) Long-term objectives for sustainable development and medium- and short-term objectives for conservation and enhancement of resources;
(b) Provision of a framework for integrated development in river catchments;
(c) Indication of national priorities;
(d) Provision for public participation;
(e) Provision of Strategic Environmental Assessment for the policies and plans;
(f) Provide for consistency of the plan at different levels of planning.

Planning at regional levels:

(a) Planning at river catchment plan within national framework;
(b) Establishment of priorities for local plans;
(c) Provision for public participation;
(d) Conduct Strategic Environmental Assessment for plans and policies.

Local level of planning:

(a) Plans for specific areas especially upstream river catchment;
(b) Plan within national framework as well as river catchment planning framework;
(c) Provision of public participation.

At the national level, the New Zealand water resource regime provides a national framework which serves some of selected criteria as discussed below. There are two types of policies which are employed at the national level - New Zealand Coastal Policy Statement (NZCPS) and National Policy Statement (NPS). A NPS may directly control river water quality management in the country by setting parameters for quality.

By contrast the NZCPS is compulsory. The NZCPS is important in water resource planning because as river water containing pollutants passes through rivers and flow into coastal areas, it may cause coastal and marine pollution. In New Zealand, the coastal management system is managed firstly through the NZCPS the contents which specified in section 56.

Policy 5.1.1 of the NZCPS requires rules to be made as soon as possible in relation to rivers with the objective of enhancing water quality in the coastal environment (DOC, 1994). It is suggested that rules could be in regional plans, where a discharge affects water quality downstream in the coastal environment (DOC, 1994).

To consider whether preparation of a NPS is required, the Resource Management Regime provides guideline for the Minister for the Environment in section 45(2) as shown in Figure 3.4.

Figure 3.4 Matters to be Regarded in Preparation of a NPS

In determining whether it is desirable to prepare a national policy statement, the Minister may have regard to--

(a) The actual or potential effects of the use, development, or protection of natural and physical resources:

(b) New Zealand's interests and obligations in maintaining or enhancing aspects of the national or global environment:

(c) Anything which affects or potentially affects any structure, feature, place, or area of national significance:

(d) Anything which affects or potentially affects more than one region:

(e) Anything concerning the actual or potential effects of the introduction or use of new technology or a process which may affect the environment:

(f) Anything which, because of its scale or the nature or degree of change to a community or to natural and physical resources, may have an impact on, or is of significance to New Zealand:

(g) Anything which, because of its uniqueness, or the irreversibility or potential magnitude or risk of its actual or potential effects, is of significance to the environment of New Zealand:

(h) Anything which is significant in terms of section 8 (Treaty of Waitangi):

(i) The need to identify practices (including the measures referred to in section 24(h), relating to economic instruments) to implement the purpose of this Act:

(j) Any other matter related to the purpose of a national policy statement.

Source: Section 45(2) RMA, 1991

If the Minister for the Environment decide to prepare for a NPS, it can also be served some selected criteria which will be discussed.

Provision of a framework for integrated development in river catchment is not directly provided by the Act. It implies planning on a river catchment basis, as regional councils statutory areas are based on river catchment boundaries (RMLR, 1988b). A NPS may be used as a framework for specific resources management issues for regional councils and territorial authorities such as allocation and quality of freshwater, land management, flood and drainage control. Planning at different levels are

mentioned, for example, that regional plan and district plan cannot be inconsistent with any NPS, as it is stated in s.55 that:

> *In achieving the purpose of this Act, on receipt of a national policy statement, or a change to, or revocation of, a national policy statement, where the national policy statement deals with any matter relevant to the exercise of a local authority's functions, powers, or duties under this Act, the local authority shall--*
>
> *(a) Where there is any inconsistency or conflict between the national policy statement as so issued, changed, or revoked and any local authority statement or plan, in accordance with the First Schedule initiate all necessary changes to the policy statement or plan in order to remove that inconsistency or conflict:*
>
> *(b) Take all such other action as may be necessary in order to implement the national policy statement as so issued or changed, including--*
>
> *(i) Initiating a change to any policy statement or plan of that local authority in accordance with the First Schedule (or, in the case of a regional council, preparing a regional plan), to address any issue or achieve any objective of the national policy statement:*
>
> *(ii) Taking such other action as may be specified in the national policy statement.* (s.55(1) RMA, 1991).

Indication of national priorities may be provided in the NPS, but it is not necessary to do so. As a NPS is only a guideline for local authorities to prepare their policies or plans, it leaves local authorities to establish their own priorities in resource management.

The process provides for the public to be involved in two ways - by submission and participation in a hearing. The persons may make the submission to the board of inquiry on the proposed NPS notified by s.48, s.49(1) and they may state wishes to be heard in respects of their submissions (s.49(2)). Moreover, any person who made a submission under s.49 shall have the right to be heard at any such inquiry (s.50).

The Resource Management Regime provides a system of Strategic Environmental Assessment of policy, plan and regulations or rules relating to those policies or plans at all levels of planning process - national, regional and local levels as shown in Figure 3.5.

Planning at regional level may employ two types of policy instruments - the compulsory Regional Policy Statement (RPS) and optional Regional Plan (RP). The RMA provides the framework for preparing the RPS and RP by specifying in ss. 59, 60 and 61 and the First Schedule (shown in Appendix B). Sheppard (1991) indicates that:

> *In contrast to regional policy statements which will provide an overview of all resource management issues within regions regional plans will concentrate on specific resource management issues...*
> *... the role of regional plans is crucial in achieving sustainable management. This is because it is only through plans that rules can be developed. Rules and the flexibility that the Act provides for their development and application are the principal regulatory means by which sustainable management will be achieved.* (Sheppard, 1991, p.161)

In preparation and change of regional policy statements, section 60 specifies that:

> *(1) There shall at all times be for each region one regional policy statement prepared by the regional council in the manner set out in the First Schedule.*
>
> *(2) A regional policy statement may be changed in the manner set out in the First Schedule, at the instigation of a Minister of the Crown, the regional council, or any territorial authority within or partly within the region.* (s.60 RMA 1991)

Figure 3.5 A Framework for SEA in the New Zealand System

Section 32 RMA 1991

(1) In achieving the purpose of this Act, before adopting any objective, policy, rule, or other method in relation to any function described in subsection (2), any person described in that subsection shall-

(a) Have regard to--
(i) The extent (if any) to which any such objective, policy, rule, or other method is necessary in achieving the purpose of this Act; and
(ii) Other means in addition to or in place of such objective, policy, rule, or other method which, under this Act or any other enactment, may be used in achieving the purpose of this Act, including the provision of information, services, or incentives, and the levying of charges (including rates); and
(iii) The reasons for and against adopting the proposed objective, policy, rule, or other method and the principal alternative means available, or of taking no action where this Act does not require otherwise; and

(b) Carry out an evaluation, which that person is satisfied is appropriate to the circumstances, of the likely benefits and costs of the principal alternative means including, in the case of any rule or other method, the extent to which it is likely to be effective in achieving the objective or policy and the likely implementation and compliance costs; and

(c) Be satisfied that any such objective, policy, rule, or other method (or any combination thereof)--
(i) Is necessary in achieving the purpose of this Act; and
(ii) Is the most appropriate means of exercising the function, having regard to its efficiency and effectiveness relative to other means.

(2) Subsection (1) applies to--

(a) The Minister, in relation to--
(i) The recommendation of the issue, change, or revocation of any national policy statement under section 52 and 53:
(ii) The recommendation of the making of any regulations under section 43:

(b) The Minister of Conservation, in relation to--
(i) The preparation and recommendation of New Zealand coastal policy statement under section 57:
(ii) The approval of regional coastal plans in accordance with the First Schedule:

(c) Every local authority, in relation to the setting of objectives, policies, and rules under Part V.

(3) No person shall challenge any objective, policy or rule in any plan or proposed plan, regional policy statement or proposed regional policy statement, or proposed national policy statement or proposed New Zealand coastal policy statement, on the grounds that subsection (1) has not been complied with, other than--

(a) In a submission made under the First Schedule; or

(b) In a request made under clause 21 of the First Schedule; or

(c) In a submission made under section 49 or section 50 on a proposed national policy statement; or

(d) In a submission made under section 57 on a proposed New Zealand coastal policy statement.

Source: s.32 RMA 1991 (1993 Amendment)

Moreover, section 65(3) provides the guideline for regional council to consider the desirability of preparing a regional plan, shown in Figure 3.6.

Figure 3.6 Circumstances to Consider in Preparing a Regional Plan

Without limiting the power of a regional council to prepare a regional plan at any time, a regional council shall consider the desirability of preparing a regional plan whenever any of the following circumstances or considerations arise or are likely to arise:

(a) Any significant conflict between the use, development or protection of natural and physical resources or the avoidance or mitigation of such conflict:

(b) Any significant need or demand for the protection of natural and physical resources or of any site, feature, place, or area of regional significance:

...

(d) Any foreseeable demand for or on natural and physical resources:

...

(f) The restoration or enhancement of any natural and physical resources in a deteriorated state or the avoidance or mitigation of any such deterioration:

(g) The implementation of a national policy statement or New Zealand coastal policy statement:

(h) Any use of land or water that has actual or potential adverse effects on soil conservation or air quality and water quality:

(i) Any other significant issue relating to any function of the regional council under this Act.

Source: s.65(3) RMA 1991

A regional plan (RP) concerned with water quality or quantity should accompany by rules relating to water quality and quantity. These rules may be applied using classes or standards about the quality of water in those water as specified in the Third Schedule (shown in Appendix D) or new classes or standards which are more stringent than specifying in the Third Schedule (s.69 RMA 1991).

A regional plan may be accompanied by rules which prohibit, regulate or allow activities. These will be explained in a permit system in subsequent section. The presumption at a regional level is that rules may facilitate activities which have less adverse effects on water than anticipate in the RMA. Both regional policy statement (RPS) and regional plan (RP) need to be reviewed at a maximum of ten year intervals (s.79(1) RMA 1991).

A RPS and a RP can serve some selected criteria in that planning at river catchment should be within national framework. The Act expresses the purpose of regional policy statement and regional plan in section 59 and section 63 in that the purpose of

regional policy statement (RPS) is to achieve the purpose of the Act by providing an overview of the resource management issues of the region and policies and methods to achieve integrated management of the natural and physical resources of the whole region (s.59 RMA 1991). While the purpose of regional plan is to assist a regional council to carry out any of its function to achieve the purpose of this Act (s.63(1) RMA 1991).

Moreover, both RPS and RP cannot be inconsistent with any national framework as stated in s.62(2) and any other policy instrument as stated in s.61(2) as shown in Figure 3.7.

Figure 3.7 A Framework for Regional Policy Statement

A regional policy statement shall not be inconsistent with any national policy statement, New Zealand coastal policy statement, or water conservation order.[1]

In addition to the requirements of section 62(2), when preparing or changing a regional policy statement, the regional council shall have regard to–

(a) Any--
(i) Management plans and strategies prepared under other Acts; and
...
(iv) Regulations made under this Act, including regulations made under section 43--
to the extent that their content has a bearing on resource management issues of the region; and

(b) The extent to which the regional policy statement needs to be consistent with the policy statements and plans of adjacent regional councils.[2]

Source: 1 s.62(2) RMA 1991; 2 s.61(2) RMA 1991

While regional plan should be within national and regional framework as stated in s.67(2) and any other policy instrument stated in s.66(2), as shown in Figure 3.8.

Part I of the Second Schedule specifies matters that may be provided for in RPS and RP, as shown in Appendix C. Examples of such matters include the control of discharges of contaminants into or onto land, air, or water, and discharges of water into water, use of land for the purpose of the maintenance and enhancement of the quality of the water in water bodies.

Figure 3.8 A Framework for Regional Plan

A regional plan shall not be inconsistent with--

(a) Any national policy statement or New Zealand coastal policy statement; or

(b) Any water conservation order; or

(c) The regional policy statement or any other regional plan of the region concerned.[1]

In addition to the requirements of s.67(2), when preparing or changing any regional plan, that regional council shall have regard to--

(a) Any proposed regional policy statement in respect of the region; and

(b) The Crown's interests in land of the Crown in the coastal marine area; and

(c) Any--
(i) Management plans and strategies prepared under other Acts; and
(ii) Relevant planning document recognised by an iwi authority affected by the regional plan; and
...
(iii) Regulations relating to the conservation or management of taiapure or fisheries; and
(iv) Regulations made under this Act, including regulations made under section 43,--

to the extent that their content has a bearing on resource management issues of the region; and

(d) The extent to which the regional plan needs to be consistent with the regional policy statements and plans, or proposed regional policy statements and proposed plans, of adjacent regional councils[2].

Source: 1 s.67(2) RMA 1991; 2 s.66(2) RMA 1991 (1993 Amendment)

It is stated in the First Schedule (shown in Appendix B) that the local authority shall consult the public and the tangata whenua of the area who may be so affected, or it may consult anyone else. Moreover, any person may make a submission on the proposed RPS or regional plan to a local authority as stated in public notice issued by the local authority under Clause 5 of Part I of the First Schedule.

Submissions may be made at two stages of planning. The first submission shall state whether or not the person making the submission wishes to be heard in respect of the submission, the decision that person wishes the local authority to make; and any other matters (Clause 6 Part I First Schedule RMA 1991). A further submission can be conducted only in support of or in opposition to those submissions made on a proposed PS or plan (Clause 8 Part I First Schedule RMA 1991 (1993 Amendment).

Every person who made a submission and who requested to be heard, has the right to participate in a hearing arranged by the regional council. Any person may request the preparation of a regional plan as well as propose a change to a regional plan (including regional coastal plan) or district plan (Clause 22 Part II First Schedule).

It is the duty of a territorial authority to prepare a district plan for each district (s.73 RMA 1991). District plan is a plan for specific area as stated in s.72 the purpose of the district plan is to assist territorial authorities to carry out their functions in order to achieve the purpose of this Act (s.72 RMA 1991). A district plan should be accompanied by district rules which prohibit, regulate or allow activities. This will be explained in a permit system. District plan needs to be reviewed at a maximum of 10 years after the plan become operative (s.79(2) RMA 1991). The district plan should be prepared within national and river catchment framework (s.75(2)) and other policy instrument (s.74(2)), as shown in Figure 3.9. Provision of public participation for planning at the local level is the same to explanation in planning at regional level. The presumption at the District levels is that land use cannot be controlled unless there are adverse effects on the environment.

Figure 3.9 A Framework for District Plan

A district plan shall not be inconsistent with--

(a) Any national policy statement or New Zealand coastal policy statement; or

(b) Any water conservation order; or

(c) The regional policy statement, or any regional plan of its region in regard to any matter of regional significance or for which the regional council has primary responsibility under Part IV.[1]

In addition to the requirements of section 75(2), when preparing or changing a district plan, a territorial authority shall have regard to--

(a) Any proposed regional policy statement or regional plan on a matter of regional significance in respect of its district; and

(b) Any--
(i) Management plans and strategies prepared under other Acts; and
(ii) Relevant planning document recognised by an iwi authority affected by the district plan; and
...
to the extent that their content has a bearing on resource management issues of the district; and

(c) The extent to which the district plan needs to be consistent with the plans or proposed plans of adjacent territorial authorities.[2]

Source: 1 s.75(2) RMA 1991; 2 s.74(2) RMA 1991 (1993 Amendment)

3.4 Implementation Stage

There are various measures employed at implementation stage. These are regulatory approach (e.g. permit system, water quality standards, effluent standards, zoning); economic instruments (e.g administrative charges, grants and loans); other measures (e.g. Best Management Practices, education and advocacy). Detail of each measure provided by the RMA will be explained. However, the RMA provides the evaluation and consideration that instrument or in combination is satisfied in achieving of the purpose of the Act (s.32 RMA 1991).

3.4.1 Regulatory Approach

Four types of regulatory measures are provided by the Resource Management Act. These measures are permit system, water quality standards, effluent standards and zoning. Permit system and water quality standards are explicitly expressed by the RMA, while effluent standards and zoning can be imposed. Detail of each will be explained.

New Zealand Permit System

Selected criteria for a permit system are shown in Figure 3.10.

Figure 3.10 Criteria for Consideration of a Permit System

(a) Decision should be made at the lowest level of organisation;

(b) Consent process should be clear and streamlined including lifetime, process of renewing permits, provision for amendment of consent conditions;

(c) Permit system should take into consideration environmental factors and unavoidable malfunction and equipment failure including water quality standards, carrying capacity of receiving waters, total permission discharges, seasonal variations, assessment of environmental impacts.

Under the RMA, the use of water is prohibited unless allowed by the Act or expressly allowed by a rule in a regional plan or a resource consent. The permit system for water resources is generally controlled by a regional council but central government is empowered in case of applications for use of water with national significance. The Act allows uses of water in s.14(3):

> *A person is not prohibited by subsection (1) from taking, using, damming, or diverting any water, heat, or energy if--*

(a) The taking, use, damming, or diversion is expressly allowed by a rule in a regional plan and in any relevant proposed regional plan or a resource consent; or

(b) In the case of fresh water, the water, heat, or energy is required to be taken or used for--
(i) An individual's reasonable domestic needs; or
(ii) The reasonable needs of an individual's animals for drinking water,--
and the taking or use does not, or is not likely to, have an adverse effect on the environment; or
...

(e) The water is required to be taken or used for fire-fighting purposes. (s.14(3) RMA 1991(1993 Amendment)).

A rule in a regional plan may classify activities dealing with uses of water resources into five categories - permitted activities, controlled activities, discretionary activities, non-complying activities, prohibited activities. Some of these activities require a consent as Milne indicates that the classification of activities is designed to ensure that the effects of an activity are reflected in the consent issuing process (Milne, 1992). Each type of activity and its conditions are illustrated in Figure 3.11.

Figure 3.11 Activities Specifying in the RMA

Permitted activities	allowed by a regional or district plan; no consent is required.
Controlled activities	specified in a plan as a controlled activity, a consent is required, a consent can be granted with some specified conditions.
Discretionary activities	specified in a plan as a discretionary activity, a consent is required , a consent can be granted or refused, if granted conditions may be imposed.
Non-complying activities	not allow by a rule in a plan but not prohibited, a consent is required, a consent authority should be satisfied that the environmental impact are minor or the activity will not be contrary to the objectives and policies of the plan, a consent can be granted or refused, if the consent is granted conditions may be imposed.
Prohibited activities	specified in a plan as a prohibited activity, no consent can be sought.

Source: s.88, s.105 RMA 1991 (1993 Amendment)

At the national level, the Minister for the Environment is empowered to call in applications of national significance (s.140(1) RMA 1991). Section 140(2) provides factors, both characteristics and their effects of the proposal, for considering that the proposal is national significance as shown in Figure 3.12.

Figure 3.12 Factors for consideration of national significance

In considering whether a proposal is of national significance, the Minister may have regard to any relevant factor including whether the proposal--

(a) Has aroused widespread public concern or interest regarding its actual or likely effect on the environment (including the global environment); or

(b) Involves or is likely to involve significant use of natural and physical resources; or

(c) Affects or is likely to affect any structure, feature, place, or area of national significance; or

(d) Affects or is likely to affect more than one region; or

(e) Affects or is likely to affect or is relevant to New Zealand's international obligations to the global environment; or

(f) Involves or is likely to involve technology, processes, or methods which are new to New Zealand and which may affect the environment; or

(g) Results or is likely to result in or contribute to significant or irreversible changes to the environment (including the global environment); or

(h) Is or is likely to be significant in term of section 8 (Treaty of Waitangi).

Source: s.140(2) RMA 1991

When an application is called in the consent authority's powers are replaced with those of a board of inquiry, appointed by the Minister for the Environment (Milne, 1992). Moreover, even though the consideration of the call in proposal is separated, but should be a parallel process to ordinary consent (Ibid.). So far, the Minister has only "called in" one project dealing with the Electricity Corporation of New Zealand proposed Taranaki combined cycle power station which applied for a consent for discharging contaminants to air from the cooling tower.

Section 88 specifies content of an application for a resource consent in that:

(4) Subject to subsection (5), an application for a resource consent ... shall be in the prescribed form and shall include--

(a) A description of the activity for which consent is sought, and its location; and

(b) An assessment of any actual or potential effects that the activity may have on the environment, and the ways in which any adverse effects may be mitigated; and

(c) Any information required to be included in the application by a plan or regulations; and

(d) A statement specifying all other resource consents that the applicant may require from any consent authority in respect of the activity to which the application relates, and whether or not the applicant has applied for such consents; and

(e) Where the application is for a subdivision consent, the information specified in section 219.

(5) The assessment required under subsection (4)(b) in an application for a resource consent relating to a controlled activity, or a discretionary activity over which the local authority has restricted the exercise of its discretion, shall only address those matters specified in a plan or proposed plan over which the local authority has retained control, or to which the local authority has restricted the right to exercise its discretion, as the case may be.

(6) Any assessment required under subsection (4)(b) or subsection (5)--

(a) Shall be in such detail as corresponds with the scale and significance of the actual or potential effects that the activity may have on the environment; and

(b) Shall be prepared in accordance with the Fourth Schedule.
... (s.88 RMA 1991, (1993 Amendment))

Part IV of the Act provides the process of getting a permit as shown in Figure 13. The permit system under the RMA is a considerable improvement on previous systems under various New Zealand Acts. In some cases, applicants applied for up to 45 separate permits (e.g. for aquaculture project).

The lifetime of the permit is provided for in s.123 and it should not exceed 35 years from the date of granting. If no period is specified in a consent condition, it is five years from the date of commencement of the consent under s.116 (s.123 RMA 1991). While renewing process is not clearly specified by the RMA.

The RMA empowers a consent authority to change or amend a permit condition (s.128(1)). Moreover, a resource consent holder may also apply for changing or cancellation of consent conditions (s.127). Section 128(1) provides circumstances when consent conditions can be reviewed. S.131(2) provides matters to be considered in review. These are shown in Figure 3.13.

Figure 3.13 Consideration to Review a Resource Consent Conditions

Circumstances when consent condition can be reviewed[1]

A consent authority may, in accordance with section 129, serve notice on a consent holder of its intention to review the conditions of a resource consent--

(a) At any time or times specified for that purpose in the consent for any of the following purposes:
(i) To deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at the later stage; or
(ii) To require a holder of a discharge permit or a coastal permit to do something that would otherwise contravene section 15 to adopt the best practicable option to remove or reduce any adverse effect on the environment; or
(iii) For any other purpose specified in the consent; or

(b) In the case of a water, coastal, or discharge permit, when a regional plan has been made operative which sets rules relating to maximum or minimum levels or flows or rates of use of water, or minimum standards of water quality or ... and in the regional council's opinion it is appropriate to review the conditions of the permit in order to enable the levels, flows, rates, or standards set by the rule to be met; or

(c) If the information made available to the consent authority by the applicant for the consent for the purposes of the application contained inaccuracies which materially influenced the decision made on the application and the effects of the exercise of the consent are such that it is necessary to apply more appropriate conditions.

Matters to be considered in review[2]

Before changing the conditions of a discharge permit or a coastal permit to do something that would otherwise contravene section 15 (relating to the discharge of contaminants) to include a condition requiring the holder to adopt the best practicable option to remove or reduce any adverse effect on the environment, the consent authority shall be satisfied, in the particular circumstances and having regard to--

(a) The nature of the discharge and the receiving environment; and

(b) The financial implications for the applicant of including that condition; and

(c) Other alternatives, including a condition requiring the observance of minimum standards of quality of the receiving environment--

that including that condition is the most efficient and effective means of removing or reducing that adverse effect.

Source: 1 s.128(1) RMA 1991 (1993 Amendment); 2 s.131(2) RMA 1991

The permit system in New Zealand also takes into consideration environmental factors and unavoidable malfunctions and equipment failure as shown in s.104(3) in that:

> *Where an application is for a discharge permit or coastal permit to do something that would otherwise contravene section 15 (relating to discharge of contaminants), the consent authority shall, in having regard to the actual and potential effects on the environment of allowing the activity, have regard to--*

(a) The nature of the discharge and the sensitivity of the proposed receiving environment to adverse effects and the applicant's reasons for making the proposed choice; and

(b) Any possible alternative methods of discharge, including discharge into any other receiving environment. (s.104(3)(a) RMA 1991)

In addition s.108(8) specifies that, before imposing a condition requiring holder to adopt the best practicable options, a consent authority should have regard to:

(a) The nature of the discharge and the receiving environment; and

(b) Other alternatives, including any condition requiring the observance of minimum standards of quality of the receiving environment--

the inclusion of that condition is the most efficient and effective means of preventing or minimising any actual or likely adverse effect on the environment. (s.108(8) RMA 1991)

While s.107(1) states that a consent authority shall not grant a discharge permit which may cause the impact exceeded the statutory water quality standards. This will be explained through water quality standards. The Assessment of Environmental Effect (AEE) is compulsory as specified in s.88(4),(5),(6) and the Fourth Schedule which will be explained in the section dealing with an AEE process.

It has been found that total permission discharges, seasonal variation and unavoidable malfunction and equipment failure are not explicitly provided for by the RMA. However, sections 330, 330A and 331 of the RMA 1991 (1993 Amendment) provide for emergency works where there is equipment or other failures. Once the emergency is over the person or authority concerned is required to obtain the appropriate permits and remedy any damage to people or the environment.

Water Quality Standard

Water quality standards are controlled using the RMA and are specified by minimum water quality standards in s.70 and s.107 and the Third Schedule. Section 70 and 107 are statutory minimum water quality standards required by the RMA. These standards apply everywhere in New Zealand, even where there is no regional plan exists (van Rossem, 1992). The standards are provided for a regional council and a consent authority to take into account any effects on receiving waters which may occur from rules or any activities. Section 70 requires that a regional council cannot make a rule

allowing a contaminant discharge as a permitted activity. While s.107 requires that a consent authority cannot grant a permit, if it causes any of the adverse effects in receiving waters after reasonable mixing. Description of s.70 and s.107 are shown in Figure 3.14, and the Third Schedule is shown in Appendix D.

Figure 3.14 Description of Sections 70 and 107 of the RMA

Section 70. Rules about discharges[1] :

(1) Before a regional council includes in a regional plan a rule that allows as a permitted activity--

(a) A discharge of a contaminant or water into water; or

(b) A discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water,--

the regional council shall be satisfied that none of the following effects are likely to arise in the receiving waters, after reasonable mixing, as a result of the discharge of the contaminant (either by itself or in combination with the same, similar, or other contaminants):

(c) The production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

(d) Any conspicuous change in the colour or visual clarity:

(e) Any emission of objectionable odour:

(f) The rendering of fresh water unsuitable for consumption by farm animals:

(g) Any significant adverse effects on aquatic life.

Section 107. Restriction on grant of certain discharge permits[2]:

(1) Except as provided in subsection (2), a consent authority shall not grant a discharge permit or a coastal permit to do something that would otherwise contravene section 15 allowing–

(a) The discharge of a contaminant or water into water; or

(b) A discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water,--

if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

(c) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

(d) Any conspicuous change in the colour or visual clarity:

(e) Any emission of objectionable odour:

(f) The rendering of fresh water unsuitable for consumption by farm animals:

(g) Any significant adverse effects on aquatic life.

(2) A consent authority may grant a discharge permit or a coastal permit to do something that would otherwise contravene section 15 that may allow any of the effects described in subsection (1) if it is satisfied--

(a) That exceptional circumstances justify the granting of the permit; or

(b) That the discharge is of a temporary nature; or

(c) That the discharge is associated with necessary maintenance work--

(3) In addition to any other conditions imposed under this Act, a discharge permit or coastal permit may include conditions requiring the holder of the permit to undertake such works in such stages throughout the term of the permit as will ensure that upon the expiry of the permit the holder can meet the requirements of subsection (1) and of any relevant regional rules.

Source: 1 Section 70 RMA 1991; 2 Section 107 RMA 1991 (1993 Amendment)

Therefore, whenever a discharge is allowed under the provisions of the Act, the above standards must be complied with or there must be a rule in a RP facilitating adverse effects allowed. Section 69 provides that if a regional council decides to prepare a regional plan, it may impose water classifications and water quality standards, as specified in the Third Schedule, in a regional plan. Providing that these standards or classes are not adequate or appropriate, regional council can impose more stringent or specific standards or create different classes and standards from the Third Schedule (s.69(2) RMA 1991).

Moreover, water quality standards can be managed by national and regional organisations. At the national level, the RMA specifies in s.43(1) that 'National Environmental Standard', including water quality standard, may be set from time to time. So far, no national environmental standard has been established.

Figure 3.15 Recommended Water Quality Standards

(a) Different standards are established for various section due to different uses, assimilative capacity, season variation and/or flow rate;

(b) Standards may be changed or added more conditions;

(c) Specifying the result of statistical evaluation;

(d) Description of standards in precise, technical and quantitative terms;

(e) Application of minimum standards.

Water quality standards should have the characteristics as shown in figure 3.15.New Zealand has chosen a different regime to manage water quality. The RMA 1991 provides for different minimum standards of water quality in water managed for various purposes. Both minimum water quality standards (the Third Schedule) and statutory minimum water quality standards (s.70, 107) are usually in narrative form (e.g. the water shall not be rendered unsuitable for bathing by the presence of contaminants). Where there is sufficient scientific information, the standards are translated into numeric form (e.g. the concentration of dissolved oxygen shall exceed 80 % of saturation concentration) (Rutherford et al, 1994). In addition, the Third Schedule can be imposed through regional plan. It depends mainly on each regional council to manage quality of river water in their jurisdiction. Therefore, a regional council may change or add more conditions in rules related to water quality to

establish the standards based on assimilative capacity, season variations, precise, technical, quantitative forms as well as specifying the result of statistical evaluation.

It has been recognised by the Manawatu-Wanganui Regional Council that freshwater river is used for the region contact recreation (e.g.swimming). The Regional Policy Statement proposes that within 15 years, all rivers are moderately safe for swimming at low flows. Therefore, water quality standards of the Manawatu Catchment are now specified by rules (Manawatu-Wanganui Regional Council, 1994). The numeric of water quality standards for the Manawatu Catchment are shown in Appendix E. For example, the daily average concentration of particulate organic matter shall not exceed 5 grammes per cubic metres. Existing discharges shall comply with this Standard by 1 June 2004.

The use of numeric standards for the Manawatu Catchment is crucial, as it provides certainty for water users, simplifies processing of resource consents and simplifies performance monitoring (Garrett, 1993).

Effluent Standards

RMA regime does not provide explicitly for effluent standards. However, regional councils may impose effluent standards through rules in a regional plan. Milne (1993) believes that s.68 is general enough to allow regional councils to adopt effluent quality rules in regional plans, as s.68(3A) states that where a rule in a regional plan or proposed regional plan provides for a controlled activity the rule shall state the standards and terms that the activity shall comply with. In addition, s.68(3B) states that where a rule in a regional plan or proposed regional plan provides for a discretionary activity, the rule may state the standards and terms that the activity shall comply with (s.68(3A)(3B) RMA 1991 (1993 Amendment)).

While s.108 allows indirect type of effluent standards to be established by a discharge permit or a rule in a regional plan (van Rossem, 1992). It is specified that a resource consent may include a condition requiring a holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment of the discharge and other discharges (if any) made by the person from the same site or source (s.108(1) RMA 1991 (1993 Amendment)).

Milne (1993) indicates that to impose the best practical option method may cause dischargers to adopt more efficient and often more expensive methods of wastewater treatment. However, s.108(8) specifies circumstances, to which the consent authority should have regard to before deciding to impose best practical option on granting a discharge permit:

> *(a) The nature of the discharge and the receiving environment; and*
>
> *(b) Other alternatives, including any condition requiring the observance of minimum standards of quality of the receiving environment--*
>
> *the inclusion of that condition is the most efficient and effective means of preventing or minimising any actual or likely adverse effect on the environment.* (s.108(8) RMA 1991)

Zoning

In New Zealand territorial authorities are responsible for land use management, as specified in s.31:

> *Every territorial authority shall have the following functions for the purpose of giving effect to this Act in its district:*
> ...
> *(b) The control of any actual or potential effects of the use, development, or protection of land,...* (s.31(b) RMA 1991 (1993 Amendment)).

At a regional level, a regional council has the power to make rules relating to land use for the purpose of maintenance and enhancement of water quality (Taranaki Regional Council, 1992) as shown in s.30(1).

> *Every regional council shall have the following functions for the purpose of giving effect to this Act in its region:*
> ...
> *The control of the use of land for the purpose of--*
> *(i) Soil conservation:*
> *(ii) The maintenance and enhancement of the quality of water in water bodies and coastal water:*
> *(iii) The maintenance of the quantity of water in water bodies and coastal water:...*
> (s.30(1)(c) RMA 1991)

Zoning is, imposed by rules in a district plan or a regional plan. Zoning in New Zealand differs from systems in other countries because rather than particular activities being prescribed for a zone, district rules are likely to set limits on the scale of effects that may occur in defined areas (Milne, 1992). Zoning is not combined with permit

system and no industrial zones are provided under the resource management regime as in Thailand.

3.4.2 Economic instruments

Currently, there are limits to the ability to use economic instruments in the New Zealand Resource Management Regime. According to Ward and Scarf (1993), the RMA does not particularly emphasise the need to encourage water resource management through economic incentives. The RMA does provide for two types of economic instruments - administrative charges and subsidies.

At national level, section 24(h) specifies that the Minister for the Environment may consider and investigate the use of economic instruments (including charges, levies, other fiscal measures, and incentives) to achieve the purpose of the RMA. However, it is not clear how s.24(h) will ultimately be applied (Milne, 1992). In terms of subsidies, s.26(1) provides that the Minister for the Environment may make grants or loans on appropriate conditions to any person to assist in achieving the purpose of the RMA.

The RMA allows local authorities to fix administrative charges (s.36(1) RMA 1991), which are, in theory, providing incentives for pollution reduction. Such charges can be either specific amounts or varying amounts, depending the amount of work carried out by the local authorities. Section 36(1) allows a local authority to fix charges for items shown in Figure 3.16.

Figure 3.16 Administrative Charge Allowed by the RMA

A local authority may from time to time, subject to subsection (2), fix charges of all or any of the following kinds:

(a) Charges payable by applicants for the preparation or change of a policy statement or plan, for the carrying out by the local authority of its functions in relation to such applications:

(b) Charges payable by applicants for resource consents, for the carrying out by the local authority of its functions in relation to the receiving, processing, and granting of resource consents (including certificates of compliance):

(c) Charges payable by holders of resource consents, for the carrying out by the local authority of its functions in relation to the administration, monitoring, and supervision of resource consents (including certificates of compliance), and for the carrying out of its resource management functions under section 35:

...

(e) Charges for providing information in respect of plans and resource consents, payable by the person requesting the information:

(f) Charges for supply of documents, payable by the person requesting the document:

(g) Any kind of charge authorised for the purposes of this section by regulations.

Charges fixed under this subsection shall be either specific amounts or determined by reference to scales of charges or other formulae by the local authority.

Source: s.36(1) RMA 1991

Manawatu-Wanganui Regional Council imposes administrative charges towards discharge permit holders of applications for discharge permits for controlled and discretionary activities, changing or cancelling discharge permits, changing the plan, comprehensive monitoring programmes, impact monitoring (Manawatu-Wanganui Regional Council, 1994).

Seven criteria should be taken into account in setting the charges and subsidies are shown in Figure 3.17. It is found that the administrative charges set under New Zealand's Resource Management Act 1991 do not meet all the theoretical criteria of an ideal charges system. It aims to recover the reasonable costs incurred by the local authority in respect of the activity to which the charge relates (s.36(4)(a) RMA 1991). Moreover, an administrative charge may incur to a consent holder for any condition set by consent authority in accordance with s.36 (s.108(1)(d) RMA 1991 (1993 Amendment).

Figure 3.17 Criteria for Setting Charges and Subsidies

Charge should be:

(a) Based on quantity and quality of pollution generated;
(b) Reflecting both true cost of water consumption and other services;
(c) Providing incentives to change polluters' behaviours;
(d) Combined with regulatory approach e.g. effluent standards.

Subsidy should not provide except:

(a) Selective and restricted to specific group otherwise severe difficulties may occur;
(b) Well-defined transitional period;
(c) Where market distortions may be created.

3.4.3 Other Measures

Other measures which are applied in the Resource Management Regime are Best Management Practice and education and advocacy. These measures are supplement to regulatory and economic approaches mentioned above and a project Environmental Effect Assessment (EEA).

Best Management Practices (BMPs)

The RMA recognised BMPs for any activity relating to the discharge of contaminants by allowing a regional council to adopt a rule requiring the adoption of the best practicable option (BPO) to prevent or minimise the adverse effects on the environment. However, the BPO should take into account the efficiency and effectiveness of that means in preventing or minimising environmental effects of the activity (s.70(2) RMA 1991). The RMA does not provide for other means for BMPs, but it leave for a regional council to determine this measure. It is shown in the Bay of Plenty Regional Council (1993) states that - soil conservation and erosion and discharge of sediments are two major issues which are best dealt with by using BMPs. Water and soil conservation issues require promotion of good land management practices that protect the soil and minimise contamination of natural waters by suspended sediments, nutrients, harmful micro-organisms or other pollutants from surface run-off (Environment BOP, 1993a; 1993b).

Erosion and discharge of sediment can be prevented, mitigated and remedied using variety of methods including site management plans for large scale earthworks,

education and advocacy for other sediment producing activities (e.g. stock grazing). The policy formulated for this issue includes:

> *"6.5.3 (b) The Regional Council will address with relevant industries the methods of mitigating the movement of sediment and nutrients into streams and water bodies.*
>
> *6.5.3 (c) The Regional Council will also address with relevant industries (asappropriate) methods of mitigating adverse on-site effects caused by particular combinations of some classes of farmed animals and grazing regimes on specific susceptible land classes."* (Environment BOP, 1993b, p.38)

Advocacy and Provision of Information

To provide for an education and advocacy the system should provide for the selected criteria as shown in Figure 3.18.

Figure 3.18 Criteria for Advocacy and Provision of Information

(a) Provision of advocacy
(i) Statutory advocacy through environmental education in school, university, training programm for officials;
(ii) Non-statutory advocacy through creation of leaflets, poster, media;

(b) Advocacy in combination with regulation and non-governmental organisation;

(c) Provision of availability of environmental information as a public asset.

The RMA provides for the dissemination of environmental information in s.35(3):

> *Every local authority shall keep reasonably available at its principal office, information which is relevant to the administration of policy statements and plans, the monitoring of resource consents, and current issues relating to the environment of the area, to enable the public--*
>
> *(a) To be better informed of their duties and of the functions, powers, and duties of the local authority; and*
>
> *(b) To participate effectively under this Act.* (s.35(3) RMA 1991)

Information to be kept by a local authority is shown in Figure 3.19.

Figure 3.19 Information to be kept by a Local Authority

(a) Copies of its operative and any proposed policy statements and plans including all requirements for designations and heritage orders, and all operative and proposed changes to those policy statements and plans; and

(b) All its decisions relating to submissions on any proposed policy statements and plans which have not yet become operative; and

(c) In the case of a territorial authority, copies of every operative and proposed regional policy statement and regional plan for the region of which its district forms part; and

(d) In the case of a regional council, copies of every operative and proposed district plan for every territorial authority in its region; and

(e) In the case of a region council, a copy of every Order in Council served on it under section 154(a); and

(f) Copies of any national policy statement or New Zealand coastal policy statement; and

(g) Records of each resource consent granted by it, including any transfer of a resource consent; and

(h) Records of all extensions of time periods and waivers granted by it under section 37 in relation to applications under section 10 (which relates to existing uses), section 125 (which relates to lapsing of consents), and section 184 (which relates to lapsing of designations) during the preceding 5 years; and

(i) A summary of all written complaints received by it during the preceding 5 years concerning alleged breaches of the Act or a plan, and information on how it dealt with each such complaint; and

...

(k) Any other information gathered under subsections (1) [relating to research] and (2) [relating to monitoring system].

Source: s.35(5) RMA 1991 (1993 Amendment)

To promote good land management, the Bay of Plenty Regional Council has undertaken a certain amount of institutional and non-institutional education through general press releases and displays at Agricultural and Pastoral shows as well as provision of education packs to high school libraries in the region. The Council aims to promote the objectives of their plans to all sectors of the regional community and to recognise community initiatives (Environment BOP, 1993b).

Relevant policies relating to this issue state:

"*9.2.3 (b) The Regional Council will support initiatives and programmes of other organisations and individuals that meet the following criteria:*
- They include objectives and policies that conform with the concept of sustainable management and with Council policies; and
- The initiatives have demonstrate community support...

9.2.3 (c) The Regional Council will work with schools and educational organisation to develop and support a programme of education that advances the concept of sustainable management of land and practical aspects of it. This support and education may include initiatives that are already in place provided they conform with Council policies." (Environment BOP, 1993b, p.60)

Project Environmental Impact Assessment

The New Zealand project environmental impact assessment procedures may be assessed against selected criteria, as shown in Figure 3.20.

Figure 3.20 Criteria for an Environmental Impact Assessment

(a) To integrate an EIA in the planning process;

(b) The EIA should cover the impacts on the environment, social and economic and mitigatory measures of the impact of the project;

(c) The framework should provide for a statement indicating when an EIA is necessary and which project requires an EIA, an indication of what the EIA must contain, the section specifying mandates for organisation concerned, provision for full public participation, provision of a comprehensive monitoring programme, an indication of the legal and administrative sanctions.

The term 'Assessment of Environmental Effect (AEE)' is applied in the RMA, instead of the well-known word 'Environmental Impact Assessment (EIA)', since it is considered that the term 'Effect' includes:

(a) Any positive or adverse effect; and

(b) Any temporary or permanent effect; and

(c) Any past, present, or future effect; and

(d) Any cumulative effect which arises over time or in combination with other effects--

regardless of the scale, intensity, duration, or frequency of the effect, and also includes--

(e) Any potential effect of high probability; and

(f) Any potential effect of low probability which has a high potential impact. (s.3 RMA 1991 (1993 Amendment))

A project EEA is required every time an application for a resource consent is made (MfE, 1991). Under the RMA, a resource consent is integrated in the planning process as mentioned in a permit system section. The EEA must be as detailed as required to

analyses effects. Therefore, some statements for minor activities are brief. The Fourth Schedule requires that EEA includes assessment of ecosystem, socio-economic and cultural effects (in Appendix F).

The types of projects which generally require a detailed EEA are stated in resource consents relating to controlled activities, or discretionary activities which are mentioned in the permit system (s.55(5) RMA 1991). An indication of what the EEA must contain is stated in Clause 1 of the Fourth Schedule. Participation of community groups and individuals is provided for in normal consent procedures (see Post-Implementation Stage).

3.5 Post-Implementation Stage

After the plan has been implemented, it requires monitoring system and enforcement to ensure that all the measure are effectively implemented and better environmental quality will be achieved. This part deals with monitoring and enforcement system provided for by the Resource Management Act.

3.5.1 Monitoring system

Environmental management system should provide for a monitoring system which consists of selected criteria shown in Figure 3.21.

Figure 3.21 Criteria for Monitoring System

(a) To monitor three types of matters - administrative and legislative measures, water and ecosystem, and social impacts;

(b) Provision of a systematic monitoring system with clear objective, sound system of data collection and analysis, regularly report to decision-makers and public, provide a training programme.

The New Zealand Resource Management Regime provides administrative and legislative measures dealing with monitoring water pollution but does not explicitly provide for monitoring the impacts on the environment and societies. Although, monitoring of plans and policy instruments would require this to be carried out.

At the national level, the Minister for the Environment has the function of monitoring the effect and implementation of the RMA, including any regulations in force under it, the relationship between the functions, powers, and duties of central government

and local authorities under Part IV of the RMA as well as any matter of environmental significance (s.24(f)(g)(ga) RMA 1991 (1993 Amendment)). The Minister of Conservation also has the function to monitor the effect and implementation of New Zealand coastal policy statements and coastal permits granted by the Minister of Conservation (s.28(d) RMA 1991 (1993 Amendment).

Section 35 of the RMA provides for monitoring at regional and local levels, of administrative and legislative measures in that:

"Every local authority shall monitor--

(a) The state of the whole or any part of the environment of its region or district to the extent that is appropriate to enable the local authority to effectively carry out its functions under this Act; and

(b) The suitability and effectiveness of any policy statement or plan for its region or district; and

(c) The exercise of any functions, powers, or duties delegated or transferred by it; and

(d) The exercise of the resource consents that have effect in its region or district, as the case may be,--

and take appropriate action (having regard to the methods available to it under this Act) where this is shown to be necessary." (s. 35(2) RMA 1991)

Section 84 states that while a policy statement or a plan is operative, the regional council or territorial authority concerned, and every consent authority, shall observe and, to the extent of its authority, enforce the observance of the policy statement or plan (s.84(1) RMA 1991).

Data collection and analysis, report system to the decision-makers and public and provision of training programme are not explicitly provided for by the New Zealand framework. However, data collection is specified in s.35(3) so that every local authority should keep information related to their administrative measure e.g. the monitoring of resource consent to enable the public to be better informed of duties, function, power of the local authority as well as to participate effectively under the RMA.

3.5.2 Enforcement system

Enforcement system should provide for four selected criteria as shown in Figure 3.22.

Figure 3.22 Criteria for Enforcement System

The framework should provide for:

(a) Methods of detect violations e.g. consent conditions, water quality standards;

(b) Severe penalties including fine for violations, compensation for environmental damage, cancellation of consent, imprisonment;

(c) Provision of public participation;

(d) Provision of authorization e.g immediate assess and inspection when environmental pollution occurs.

The RMA provides the concept of 'strict liability', as it is stated in s.341 that it is not necessary to prove that the defendant intended to commit the offence, in any prosecution for an offence of contravening or permitted a contravention of any of sections 9, 11, 12, 13, 14, and 15 (s.341(1) RMA 1991).

The RMA facilitates various methods of detecting violations. These are specified in s.338:

(a) Rules in a district plan or a proposed district plan relating to restriction on use of land (s.9);

(b) Rules relating to restriction on use of coastal marine area (s.12) in a regional plan or a proposed regional coastal plan or a resource consent and other regulations;

(c) Rules in a regional plan or a proposed regional plan relating to uses of beds of lakes and rivers (s.13), waters (s.14), and discharges of contaminant into the environment (s.15).

The RMA provides three levels of penalties. These are summed up in Figure 3.23.

The RMA provides for reimbursement or compensation for emergency works where any public work, project or work in any local areas causes or is likely to cause as adverse effect on the environment or loss of life, injury or serious damage to property, a local authority or consent authority may take any preventive or remedial action as as emergency work (s.330 RMA 1991 (1993 Amendment). Cost of undertaking such action can be reimbursed or compensated from the person of its actual and reasonable

cost (s.331 RMA 1991 (1993 Amendment)). Moreover, an enforcement order issued by the Planning Tribunal may require the complete restoration of any natural and physical resources to the state it was in before the adverse effect occurs (s.314(4) RMA 1991).

Figure 3.23 Penalties provided by the RMA 1991

Cause	Penalty	Section
Violation against ss.9, 12, 13, 14, 15 which impose duties and restrictions in relation to land, the coastal marine area, the beds of certain rivers and lakes, water, and discharges of contaminants; any enforcement order, any abatement notice, any water shortage direction.	Imprisonment not exceeding 2 years, or fine not exceeding $ 200,000 and fine not exceeding $10,000 per day for continuing violation.	s.339(1)
Breaching s.22 (relating to failure to provide information to an enforcement officer), any order (other than enforcement order) of the Planning Tribunal.	Fine not exceeding $10,000 and fine not exceeding $ 1,000 per day for continuing violation.	S.339(2)
Offenders who wilfully obstructs, hinders, resists, or deceives any person in the execution of powers conferred under the Act, non-attendance or refusal to co-operation with the Planning Tribunal, failure to give evidence in response to a summons or order made under the Act.	Fine not exceeding $ 1,500.	s.339(3)

Source: Section 339 (1), (2), (3) RMA 1991

Cancellation of consent is implicitly provided for in the RMA except s. 314 (1)(e) states that the Planning Tribunal may change or cancel a resource consent if the information made available to the consent authority by the applicant contained inaccuracies relevant to the enforcement order sought which materially influenced the decision to grant the consent. However s.108(7) authorizes the consent authority to establish conditions related to cancellation of consent (s.108(7) RMA 1991).

Section 315 of the RMA 1991 (1993 Amendment) provides for public to participate in enforcement scheme in that any person may apply to the Planning Tribunal in the prescribed form for an enforcement order of a kind specified in paragraph (a) to (d) of section 314(1), or in section 314 (2) in that:

> *"(1) An enforcement order is an order made under section 319 by the Planning Tribunal that may do any one or more of the following:*
>
> *(a) Require a person to cease, or prohibit a person from commencing, anything done or to be done by or on behalf of that person, that, in the opinion of the Tribunal,--*

(i) Contravenes or is likely to contravene this Act, any regulations, a rule in a plan, a rule in a proposed plan, ... or section 20 (certain existing lawful activities allowed); or

(ii) Is or is likely to be noxious, dangerous, offensive, or objectionable to such an extent that it has or is likely to have an adverse effect on the environment:

(b) Require a person to do something that, in the opinion of the Tribunal, is necessary in order to--

(i) Ensure compliance by or on behalf of that person with this Act, any regulations, a rule in a plan, a rule in a proposed plan, ..., or a resource consent; or

(ii) Avoid, remedy, or mitigate any actual or likely adverse effect on the environment caused by or on behalf of that person:

(c) Require a person to remedy or mitigate any adverse effect on the environment caused by or on behalf of that person:

(d) Require a person to pay money to or reimburse any other person for any actual and reasonable costs and expenses which that other person has incurred or is likely to incur in avoiding, remedying, or mitigating any adverse effect on the environment, where the person against whom the order is sought fails to comply with--

(i) An order under any other paragraph of this subsection; or
(ii) An abatement notice; or
(iii) A rule in a plan or a proposed plan or a resource consent; or
(iv) Any of that person's other obligations under this Act:

(da) Require a person to do something that, in the opinion of the Tribunal, is necessary in order to avoid, remedy, or mitigate any actual or likely adverse effect on the environment relating to any land of which the person is the owner or occupier:

...

(f) Where the Tribunal determines that any one or more of the requirements of the First Schedule have not been observed in respect of a policy statement or a plan, do any one o more of the following:

(i) Grant a dispensation from the need to comply with those requirements:

(ii) Direct compliance with any of those requirements:

(iii) Suspend the whole or any part of the policy statement or plan from a particular date (which may be on or after the date of the order, but no such suspension shall affect any Court order made before the date of the suspension order).

(2) For the purposes of subsection (1)(d), "actual and reasonable costs" include the costs of investigation, supervision, and monitoring of the adverse effect on the environment, and the costs of any actions required to avoid, remedy, or mitigate the adverse effect." (s.314(1)(2) RMA 1991 (1993 Amendment)

"*An abatement notice may be served on any person by an enforcement officer--*

(a) Requiring that person to cease, or prohibiting that person from commencing, anything done or to be done by or on behalf of that person that, in the opinion of the enforcement officer,--

(i) Contravenes or is likely to contravene this Act, any regulations, a rule in a plan, or a resource consent; or

(ii) Is or is likely to be noxious, dangerous, offensive, or objectionable to such an extent that it has or is likely to have an adverse effect on the environment:

(b) Requiring that person to do something that, in the opinion of the enforcement officer, is necessary to ensure compliance by or on behalf of that person with this Act, any regulations, a rule in a plan or a proposed plan, or a resource consent, and also necessary to avoid, remedy, or mitigate any actual or likely adverse effect on the environment--
(i) Caused by or on behalf of that person; or
(ii) Relating to any land of which the person is the owner or occupier:
..." (s.322 RMA 1991 (1993 Amendment).

The RMA 1991 specifies broad powers of entry onto land, inspection, and seizure of samples and other items. Any enforcement officer may be authorized by a local authority to enter onto land or any structure at any time without warrant or prior notice for inspection to determine whether the Act, or any obligation complied with (s.332(1) RMA 1991; Grinlinton, 1992). Moreover, an enforcement officer may take samples of water, air, soil or organic matter (s.332(2) RMA 1991 (1993 Amendment)), as well as a sample of any substance that the enforcement officer has reasonable cause to suspect is a contaminant of any water, air, soil, or organic matter (s.332(2A) RMA 1991 (1993 Amendment)).

3.6 Conclusion

The New Zealand framework of river water quality management does achieve sustainable development in many ways and river water is provided in only one principal Act the '**Resource Management Act 1991**'. A summary of New Zealand system of river water quality management is shown in Appendix N.

The system of management provides for three approaches towards achievement of sustainable development which are to conserve and enhance the resource base, to take into consideration of the needs for present and future generations and to analyses the whole water cycle from freshwater to coastal water management.

The planning process is systematic, consistent at all levels of organisation and provides for public participation. Moreover, the system provides for a Strategic Environmental Assessment (SEA) even though the assessment system is not yet fully developed. The river water quality is emphasised on river catchment which is an appropriate boundary for the river management. However, planning for freshwater quality is based on voluntary basis for each regional council. If any regional council decided to manage freshwater quality properly, there are various policy instruments to be employed.

Regulatory approaches provided for in the RMA are the permit system, water quality standards and zoning. The permit system is administered at the regional level and taken into consideration of the carrying capacity of receiving water. Some types of resource consents require the assessment of the environmental impacts. Water quality standards include minimum water quality standards as specified in s.70, and s.107 applying through out the country and the standards and classification specified in the Third Schedule which may be imposed through a regional plan. The Act also provides for the national government to establish national water quality standards. Zoning is allowed by the RMA and controlled by a territorial authority and regional plan in respect of maintenance and enhancement of the quality of water.

Availability of economic instruments is limited in the RMA. It is clearly expressed two types of economic instruments which are administrative charges and subsidy. The administrative charge can be administered at the local level, while subsidy are provided by the national government.

Other measures including Best Management Practices, educational and advocacy and a project Environmental Effect Assessment are provided for by the RMA. BMPs is partly provided by the RMA in that the RMA provides for the Best Practical Option

instead of BMPs. BPO includes not only the best means to minimise or prevent water pollution, but also efficiency and effectiveness of that means.

Education and advocacy are provided in the form of availability of information for the public to access and non-statutory advocacy which various policy instruments e.g. national policy statement, resource consent. Educational programme and statutory advocacy are leave for a regional council and territorial authority to provide them.

A project Assessment of Environmental Effect (AEE) is required in couple with a permit system which is integrated in planning process. The assessment of the impacts of a project under the RMA goes beyond physical impact including environment, social and cultural effects. The RMA provides the statement indicating when an EIA is required, which project require an EIA, what must contain in an EIA, mandates for organisation concerned and monitoring scheme for a resource consent. But it does not provide for full public participation and legal sanctions.

A monitoring system is provided for in the RMA which aims to monitor administrative and legislative measures (e.g. the effect and implementation of the RMA, exercise of the resource consents). But it does not explicitly provide for monitoring the impacts on the environment and society. Although, this may be carried out in 'State of the Environment' reporting.

The enforcement system under the RMA is based on the concept of strict liability, in which it is not necessary to prove that the defendant intended to commit the offence. The RMA provides guideline for method of detecting violations such as rules in regional plan and district plan relating to uses of water and discharge of contaminants. Penalties provided by the RMA are severe. They includes fines for a conviction, continuing offenses and imprisonment and compensation for the environmental damages. Enforcement officers are authorized for immediate access into suspected pollution sources and are able to take samples to determine pollution problems.

It is shown that various policy instruments are provided for by the RMA 1991, however, the purpose of the management may be difficult to achieve since there is lack of national guidelines for management of the country. The system assumes that

every regional council is able to undertake their measures in order to achieve the purpose if the Act which is to promote the management of natural and physical resources. It leaves for each regional council and district council to develop their own policies to achieve the purpose of the Act. New Zealand water resources management regime provides that policy statement or plan at regional and local levels cannot be inconsistent with any national framework. However, so far some types of instruments which should be developed at national level have not been provided, such as National Policy Statements, or national environmental quality standards. A regional policy statement is also vague, as it is not provided for priorities management of the region.

The New Zealand management should make use of monitoring system to evaluate and develop policy instruments at national, regional and local levels. A monitoring system including environmental quality monitoring programmes should be developed at the cost responsible by the central government, since it can assess the effectiveness of policy implementation through the present and trends of an environmental quality.

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CHAPTER FOUR

CHAPTER FOUR

THAI FRAMEWORK FOR RIVER WATER QUALITY MANAGEMENT

4.0 Objective: To review river water quality management in Thailand based on selected criteria derived in Chapter Two.

4.1 Introduction

Thailand is a tropical country located in Southeast Asia between latitudes 5 and 21 North, longitude 97 and 105 East covering the area of 513,115 square kilometre (Office of the Prime Minister, 1991), about 46 percent of this is under cultivation. The country is divided into four main regions - the mountainous north, the semi-arid plateau in the northeast, a fertile plain of the central region and the isthmus of the south.

Thailand has a population of approximately 58.1 millions in 1993[17]. More than 60 percent live in urban areas, the rest are scattered in rural areas. The Thai way of living depends mostly on freshwater, as shown by enormous benefits derived from rivers such as industry, fisheries, agriculture, domestic consumption etc. The country has seven large rivers namely - the Chao Phraya, Thachin, Maeklong, Bangprakong, Pasak, Phet and Pranburi Rivers. The largest river of the country is the Chao Phraya River which drains an area of approximately 178,000 square kilometre. It is formed from four smaller rivers - the Ping, Wang, Yom, and Nan Rivers in the northern part of Thailand. They meet at Nakorn Sawan in the middle of the country. The outfall of the Chao Phraya River is at Samut Prakarn which makes it about 380 kilometre long. Most of the water consumption occurs in Bangkok, where about 6 millions of people, are largely dependent on the Chao Phraya River. There are also commercial establishments which get the most benefit from both sides of the river both in terms of aesthetic values and water consumption including restaurants, hotels, condominiums and piers (Muttamara and Sales, 1994).

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[17] Office of the Prime Minister and Ministry of Foreign Affairs, 1994

The administrative system of Thailand influences economic development and natural resource management. The administrative system is structured into three principle levels - central administration, provincial administration and local administration (shown in Appendix H) (Department of Local Administration, 1994). The central administration consists of 15 ministries e.g. the Office of the Prime Minister, the Ministries of Interior, Agriculture and Cooperatives, Industry, Public Health, Science, Technology and Environment. Each ministry comprises departments and divisions. A ministry is headed by a politically appointed minister who is elected or designated and sits in the cabinet. The head of each ministry is a permanent secretary who has administrative control over the departments in the ministry, each ministry permanent secretary and Director-General are career civil servants.

The provincial administration level comprises of 75 provinces (changwat), 688 districts, and large numbers of subdistricts and villages (Ibid.). The province is a juristic entity designated under the *National Public Administration Act 1991*. Each provincial consists of a number of districts which varies on geographic and number of population. In terms of people who are responsible for administering at the province level, each province comprises a provincial governor, who is designated by the central government (the Minister of Interior) to govern the provincial jurisdiction, and other civil servants, who have been delegated some of the powers and authorities from each ministries according from related laws and regulations.

The second tier of the provincial administration structure is the district or its equivalent, a minor district. Each district or its equivalent consists of a number of subdistricts and villages. In terms of people in charge at the district level, there is a District Chief Officer, who is appointed by the Minister of Interior and is responsible for policies from central administration and the provincial administration. Other civil servants are also delegated the duties and powers from various ministries and departments. Some ministries e.g. Public Health appoint their delegates to responsible for special task from central, provincial and district levels at subdistrict level.

The third tier of the provincial administration structure is subdistrict headperson, who works under the direction of the district chief officer. The lowest level of the

provincial administration is the village which is headed by an elected Village Headperson.

Local administrative consists of two types of administration. The general type, which can be seen in every province, comprises of 135 municipalities, 962 sanitary districts and 74 Provincial Administration Organisations (excluded BMA). Municipality is one type of local government agency in Thailand. Each municipality is established in urban areas where it's size depends on number of population, development and the annual revenue which comes from property taxes, local service charges and funds from the central government. It is headed by an elected Mayor and elected municipal council. Sanitary district are smaller communities with less extent in terms of population and development and revenues. If sanitary district has the annual revenue more than 5 million baht (approximately NZ $ 312,500). It's headed by and some of the committee will be elected. If the revenue is lower a district chief officer will be nominated to be the chairperson. The rest of the administrative committee are usually government officials. Each province has a Provincial Administration Organisation which covers the area outside the municipality and sanitary district. It is headed by the provincial governor to work with an elected council which is comprised of 18-36 members depending on the number of population.

Another type of local administration is the special local self government unit - the Bangkok Metropolitan Administration (BMA) and the City of Pattaya. The Bangkok Metropolitan Administration is headed by an elected Bangkok Governor, elected executive committee and the Permanent Secretary for the BMA and their staff who are civil servants. To implement the duties and functions, the Bangkok Metropolitan Administration has divided into 38 districts (in 1994) in which each district is managed by an elected committee. The other city which has a special type of local administration is the City of Pattaya in Chonburi province which is administered by a hired manager and a Pattaya City Council which is headed by an elected Mayor.

The Thai economy has grown rapidly in the past three decades, yielding significant benefit to the country and their people. On the other hand, an economic growth has led to an imbalance in infrastructure, income disparities as well as deterioration of natural and physical resources and environmental quality. An expansion of economic

development, industrial activities in particular, has resulted in serious pollution problems such as contaminated rivers and coastal waters. Industrial waste and rapid urbanisation also contributes to water pollution problems, since water pollution is caused mainly from domestic waste and toxic waste are from industrial activities. This has resulted in serious adverse effects on major rivers, especially the Chao Phraya and Thachin Rivers, which have deteriorated below acceptable levels of pollution (NESDP, 1992). Moreover, indirect impacts such as lower quality of life for the people and a potential slowing down of economic development in the future are also considered to be serious threats.

The framework which governs management of environmental quality in Thailand, consists of five policy documents - the Enhancement and Conservation of the National Environmental Quality Act (EQA 1992), the Factory Act 1992 (FA 1992) and the Public Health Act 1992 (PHA 1992), the five-year National Economic And Social Development Plan (NESDP) and the Environmental Quality Management Plan (EQMP). Whether implementation of the Acts and Plans is effective depends mainly on the structure of the Thai administration as mentioned above and the provision of policy measures to deal with an environmental pollution. During 1992-1996, the fundamental role of the government will generally shift from that of a "controller and regulator" to a "supporters, promoters and facilitator" of development[18]. These goals are expressed in the aims of all principle Acts enforced in 1992 and the main objectives of the Seventh National Economic and Social Development Plan and Environmental Quality Management Plan as shown in Figure 4.1.

In this chapter, the Thai framework for river water quality management system will be outlined, and analyzed against the criteria selected in Chapter Two. It is divided into three parts. The first part deals with sustainable development of natural resources including quality of river water. The second part deals with three stages in planning process provided by the Thai framework - pre-implementation, implementation, and post-implementation stages. The pre-implementation stage consists of planning at national and local levels. The implementation stage consists of measures employed or provided as a guideline in implementing plan in order to cope with river water

[18] Office of the Prime Minister and Ministry of Foreign Affairs, 1994

Figure 4.1 Objectives and Aims of Principle Acts and Plans in Thailand

Aims of the EQA 1992

(1) To promote public and non-governmental organisation to get involved in enhancement and conservation of environmental quality;

(2) To reorganise the environmental management system in accordance with the principle of environmental management;

(3) To promote co-ordination and co-operation among government agencies, state enterprises and local governments in order to enhance and conserve environmental quality and recommend practical performance in the areas which there are no agencies responsible for;

(4) To establish pollution control measure by providing facility for treatment of polluted air and wastewater or for disposal of any other wastes, wastewater treatment plant, waste disposal facility and other instrument or equipment to solve environmental pollution problems;

(5) To assign duty and function to persons and organisation dealing with environmental problems;

(6) To specify financial support and other supportive measures to motivate practising in environmental conservation.

Aims of the Factory Act 1992

(1) To encourage an engagement in factory business by modifying the permission process to strictly control a factory which is or likely to cause an adverse effect on the environment and community, while loosen a control on smaller businesses;
(2) To provide severe penalties in terms of fines and term of imprisonment terms and to cover other person who are involved in the factory business, besides an owner.

Aims of The Public Health Act 1992

(1) To strengthen the measure dealing with prevention and protection of the environmental health from any activity which is or, is likely to have an effect on community health;
(2) To provide more powers to authorities concerned and more severe penalty towards polluters.

Objectives of the Seventh NESDP (1992-1996)

(1) To maintain economic growth rates at appropriate levels to ensure sustainability and stability;
(2) To redistribute income and decentralize development to the regions and rural areas more widely;
(3) Accelerate the development of human resources, and upgrading quality of life, the environment and natural resource management.

Aims of the EQMP

(1) To implement of the national policy and plan for enhancement and conservation of environmental quality;
(2) To provide a framework for all government organisations concerned to ensure that actions to be taken will achieve the enhancement and conservation of environmental quality.

pollution. Typical measures include the regulatory approach (e.g. permit system, water quality standards, effluent standards), zoning, economic instruments (e.g. charges and subsidies), and other measures (e.g. public works, Best Management Practices,

advocacy and provision of advocacy, and individual project Environmental Impact Assessment). The post-implementation stage comprises of monitoring and enforcement systems. The conclusion highlights the priorities of environmental management in Thailand. This chapter prepares a further basis for the comparison of the Thai and New Zealand frameworks.

4.2 Sustainable Development of Water Resource

Sustainable development is not explicitly expressed as an individual objective in the Acts of the Thai framework, except in the objectives of the NESDP which are to increase attention to income distribution and protection of environment to ensure sustainability of future development. However, in defence of the framework some clues about the importance of achieving stainable development are provided by the framework, because objectives and aims of the principle Acts and plans reflect the criteria for sustainable development identified by the WCED 1987 and ICWE 1992. The WCED 1987 and the ICWE 1992 list four principle criteria to determine sustainable development.

Criteria one "*to conserve and enhance the resource base*" is expressed in the purpose of the EQA 1992 in that the government wishes to enhance and conserve national environmental quality by promoting public and non-governmental organisations to get involve in enhancement and conservation of environmental quality.

Moreover, the NESDP provides the framework for upgrading a system of management of the natural resources including land resources, forestry resources, water resources which aims to conserve the natural resources, the national heritage for later generations, and to utilize the resources in such a way as to strengthen foundation of the national economy to promote sustainable development (NESDP, 1992).

Criteria two is "*to take into consideration the need of present and future generations*". It is clearly specified in two of the objectives for the development of human resources, quality of life and environment of the NESDP as to:

> *"Reduce negative impacts on the quality of life from environmental degradation caused by rapid urbanization, industrialization and deterioration of natural resources.*

Encourage and support development of the quality of life in line with the nature of problems and needs of the various age groups, from childhood, youth, working age to the old age, by providing life-long education." (NESDP, 1992, p.144)

Criteria three is "*To integrate environmental and economics in decision-making process at all levels of administration*". One of the purposes of enactment of the EQA 1992 is to promote co-ordination and co-operation among government agencies, state enterprises and local governments in order to enhance and conserve environmental quality. It is not exactly aimed at integrating environmental and economic considerations into decision-making process.

Criteria four which is "*to analyze the whole water resource cycle*" from upstream freshwater to coastal water is implicit expressed in the Thai framework except in the tourist destination where severe pollution occurred. The NESDP provides targets for environmental development for better quality of life by reducing BOD loadings discharges into coastal areas and tourist destinations e.g. Pattaya, Phuket (NESDP, 1992).

Therefore, it seems that the Thai framework does not provide a clear, integrated framework to achieve sustainable development of water resources based on four selected criteria. Although, it implicitly includes similar general objectives.

4.3 Pre-Implementation Stage - Planning Process

Two levels of organisations - national and local organisations - are involved in planning processes dealing with river water quality management in Thailand. All government agencies and private sectors are responsible for preparing the national plans - NESDP. The Ministry of Science, Technology and Environment (MOSTE) is the principle organisation in preparing the EQMP.

Planning at provincial level, some provinces are required to prepare the plan while some provinces may voluntary prepare for the provincial action plan.The provisions for planning process are summed up in Figure 4.2.

Figure 4.2 Plan at Different Levels of Administration		
National level	Seventh NESDP	all governmental agencies
	EQMP	MOSTE, other government agencies
Local level	CAP (compulsory for provinces which have environmental protected areas, pollution control areas; voluntary for other provinces)	provincial governors

These plans are evaluated against selected criteria derived from Chapter Two which are shown in Figure 4.3.

Figure 4.3 Criteria for Analysing Suitability of Planning Processes

At national level, the planning process should provide for national policy for water resources which has:

(a) Long-term objectives for sustainable development and medium- and short-term objectives for conservation and enhancement of resources;

(b) Provision of a framework for integrated development in river catchments;

(c) Indication of national priorities;

(d) Provision for public participation;

(e) Provision of Strategic Environmental Assessment for the policies and plans;

(f) Provide for consistency of the plan at different levels of planning.

Planning at regional levels includes:

(a) Planning at river catchment plan within national framework;

(b) Establishment of priorities for local plans;

(c) Provision for public participation;

(d) Conduct Strategic Environmental Assessment for plans and policies.

Local level of planning includes:

(a) Plans for specific areas especially upstream river catchment;

(b) Plan within national framework as well as river catchment planning framework;

(c) Provision of public participation.

Planning at the national level is the responsibility of all the government agencies as stated by the NESDP and the EQA 1992 which specify responsibilities of the MOSTE and all government agencies concerned. Section 35 (EQA 1992) states that:

> *"The Minister [of Science, Technology and Environment] shall, with the approval of the National Environmental Board, formulate an action plan called "Environmental Quality Management Plan" for implementation of the national policy and plan for enhancement and conservation of environmental quality determined by virtue of section 13(1).*
> ...
> *It shall be the duty of all government agencies concerned to take actions within their powers and functions that are necessary for effective implementation of the Environmental Quality Management Plan and in order to ensure that actions are taken to achieve the objectives and goals as prescribed ...* "(s.35 EQA 1992)

The EQA 1992 provides that the Environmental Quality Management Plan pursuant to section 35 may be short, intermediate or long-term plan, as appropriate (s.36 EQA 1992).

The NESDP 1992-1996 specifies the target for upgrading management of the water resources in river catchment unit in that to systematize development of all the water resources nation-wide to cover all the 25 river basins by recommending the measures as shown in Figure 4.4.

Figure 4.4 Guidelines for River Catchment Management System

"(1) To prepare budgetary allocation plan for development of all the water resources in the form of groups of projects arranged by river basin systems, by setting priorities according to the nature of problems.
(2) To require medium-scale water resource development projects to consider from the planning stage hydrological suitability, geographical conditions, and environmental impacts. ...
(3) To allocate budget for small-scale water resources development, while ensuring that they are dispersed in all geographical areas, emphasizing areas with relatively less rain and areas outside irrigation systems.
...
(5) To accelerate setting up of a national organization under the law to formulate plans for administration and management of water resources, emphasizing water resources management of river basins.
(6) To formulate work programs for procurement of water resources for water supply production, and formulate measures controlling water quality to cope with growth of communities."

Source: NESDP, 1992, p.194

The NESDP provides an indication of priority by stating that some policies should be developed to achieve the objectives for development of human resources, quality of life and environment, including:

> *"4.1 Increase role of the government in development of human resources, quality of life and environment ... This includes ... allocation of budget or subsidies for prevention and solution of environmental problems as a matter of high priority.*
>
> *4.2 Improve and relax rules and regulations in order to increase efficiency and to attract greater private investment in developing human resources, quality of life and environment. This includes ... the application of the "polluter-pays-principle" during the Seventh Plan period, etc.*
>
> *4.3 Support mobilization of efforts among the family institution, communities, private organizations, religious institutions and the government in preventing and solving environmental problems, ... In this respect, it will be necessary to .. set up tripartite organization, comprising communities, enterprises and the government to monitor and maintain environmental quality at an acceptable level."* (NESDP, 1992, pp.144-145)

The NESDP also provide the target areas for freshwater quality development for better quality of life in that to:

> *"Reduce BOD (Biological Oxygen Demand) loadings discharged into water resources not to exceed 4 milligrams per litre in the following target areas.*
>
> *(1) The lower part of the Chao Phraya river from the estuary to kilometre 100, which is within the boundaries of Bangkok Metropolis and vicinity towns.*
>
> *(2) The lower part of Tha-Chin river from the estuary to kilometre 150, which is within the jurisdiction of Nakhon Pathom and Samut Sakhon.*
>
> ...
>
> *(4) Canals, ditches, ponds, lakes and other water resources in regional urban centres with critical water pollution problems, such as Sakhon Nakorn, Khon Kaen, Hat-Yai, Songkhla, Chiengmai etc."* (NESDP, 1992, p.177-178)

Public participation and Strategic Environmental Assessment for the policies and plans are not provided for by the national Thai framework for water quality management.

Consistency of the plans at different levels is not a specific requirement of the EQA 1992. However, the NESDP provides guidelines for improvement of development mechanisms, administration and management of the environment by:

> *"(1) Encouraging formulation of plans and systematic coordination of urban environmental development plan, together with clear definition of the respective roles of the central, regional and local authorities, and encouragement of private sector participation.*

(2) Improving organizations responsible for policy formulation and coordination at the central and local levels, and set up national and local organizations for the supervision and coordination of rehabilitation and development policies concerning environmental conditions (for Bangkok Metropolis and vicinity towns, and each province)." (NESDP, 1992, p.184)

In the Thai water quality management, there is no regional plans which influence management. Planning at local level in Thailand mainly applies to the jurisdiction area of provinces and localities established in the National Public Administration Act 1991. Planning at this level is the responsibility of the Governor of each province. Some areas may be designated as environmentally protected areas according to s.43 of the EQA 1992, or as pollution control areas according to s.59 of the EQA 1992. Responsibility for plans is provided in s.37 of the EQA 1992. However, if the province fails to get the approval of an action plan e.g. Changwat Action Plan (CAP), then the MOSTE has to prepare a plan under the Prime Minister's order (s.41 EQA 1992). In any province where no locality is designated the governor may also prepare a CAP within the national framework of, and in conformity with, the requirement of the Environmental Quality Management Plan (s.37 EQA 1992).

It is compulsory to formulate an action plan for environmental quality management at local level for any area designated as a environmentally protected area according to s.43 (EQA 1992) (e.g. an upstream river catchment area), or as a pollution control area according to s.59 (EQA 1992). While any province in which no locality is designated as mentioned above may also prepare a CAP (s.37 EQA 1992).

Public participation is not explicitly provided for in the Thai framework for water resource management. Pressure groups exist and campaign for improvements informally. These campaigns may lobby at provincial or national level e.g. Num Chone Dam (Hirsch and Lohmann, 1989).

4.4 Implementation Stage

After the plan has been implemented, the Thai framework provides for various types of policy instruments to be employed. These are mostly regulatory techniques (e.g. permit system, water quality standards, effluent standards), zoning, economic instruments (e.g. administrative charges, user charges, loans, grants, tax exemption), other measures (e.g. public works, Best Management Practices, advocacy).

4.4.1 Regulatory approach

Four types of regulatory measures are provided for by the Thai framework. These measures are permit system, water quality standards, effluent standards and zoning. Water quality standards, effluent standards and zoning are well-developed by the Thai system, while a permit system is not well-developed.

Thai Permit System

The permit system for discharging wastewater into the environment in Thailand is governed by the Factory Act 1992 and Public Health Act 1992. Factories under the Factory Act 1992 are divided into three groups based on the size of machinery to be used and workers employed. These three groups of industries differ from the others in terms of their application for operating and extension of their business as specified in ss.10, 11 and 12. Moreover, the ministerial rules issued by the Ministry of Industry according to s.8 of the Factory Act, specify some criteria for establishment of various types of factory. These are shown in Figure 4.5.

Figure 4.5 Factory Specification under the Factory Act 1992

Group 1	no consent is required, must comply with the criteria specified in the ministerial rules and the notification of the MOI according to s.8[1], not allow to establish in residential area, far from institutions e.g. school, hospital and conservation areas at least 50 metre[2].
Group 2	no consent is required, but must notify the authority concerned before operation[3], except that factory is established in an industrial areas[4], must comply with the criteria specified in the ministerial rules and notification of the MOI according to s.8[5], not allow to establish in residential area, far from institutions e.g. school, hospital and conservation areas at least 50 metre[6].
Group 3	consent is required[7], must comply with the criteria specifying in the ministerial rules and notification according to s.8, except that factory is established in an industrial area[8], and the ministerial notification according to s.32[9], not allow to establish in residential area, at least 100 m. far from institutions e.g. school, hospital, should be established in suitable area in order not to cause any adverse effect or nuisance on the other people and their property[10], including factory controlled under s.32[11].

Source: 1 s.10; 2, 6, 10 2nd Ministerial Rule; 3, 5 s.11; 4 s.30; 7, 9 s.12; 8 s.30; 11 s.7

Theoretically, small industries should have less pollution. However, section 32 of the Factory Act 1992 empowers the Minister of Industry to specify a number and sizes

of each types of factory to be allowed or be prohibited from being established or expanded in any area for the purposes of economy, conservation of environment and safety of the country.

Under the Public Health Act 1992 the Minister of Public Health may specify that any kind of business, which harms or is likely to harm to human health, to be a controlled business (ss.6 and 31 PHA 1992). Then, there is the responsibility of local authorities -municipality and sanitary district to notify some or all of businesses to be controlled in their jurisdiction, and to specify criteria or conditions for operating such businesses (s.32 PHA 1992). These businesses require a permit from the authority before undertaking their activities (s.33 PHA 1992). So far, there is no notification of business subjected to be controlled under the PHA 1992. The Minister of Public Health is working on specifying what kinds of business to be announced.

The Thai permit system is reviewed based on selected criteria developed in Chapter Two. These criteria are shown in Figure 4.6.

Figure 4.6 Criteria for Consideration of a Permit System

(a) Decision should be made at the lowest level of organisation;

(b) Consent process should be clear and streamlined including lifetime, process of renewing permits, provision for amendment of consent conditions;

(c) Permit system should take into consideration environmental factors and unavoidable malfunction and equipment failure including water quality standards, carrying capacity of receiving waters, total permission discharges, seasonal variations, assessment of environmental impacts.

The NESDP provides guidelines for industrial decentralization to the regions as to decentralize administrative and decision-making authority to government agencies at regional and provincial levels to increasingly represent central agencies in handling various responsibilities, such as authority to grant and renew industrial licenses to promote operational flexibility (NESDP, 1992). A permit for engaging in factory business under the FA 1992 is issued by the national organisation and head of provincial industrial office.

The license of any business controlled by PHA 1992 is issued by the local authority of such area (s.56 PHA 1992). However, the types of business to be controlled are

specified by the Minister of Public Health, and control relates to effects on community health issues. The license of the person be employed as a Monitoring Control Operator or as a Service Contractor for operation of wastewater treatment system can be obtain from the local official. However, the rules, procedures and conditions are stipulated by Ministerial regulation (s.73 EQA 1992).

The NESDP indicates that an administrative system and licensing procedure should be improved in order to cut down on delays to ensure faster, move convenient and fairer services to the people and business sector (NESDP, 1992, p.204). It is specified in s.14 (FA 1992) that:

> *"A permit shall be valid until the last day of the fifth calendar year as from the year of commencement of the engagement in the business except in the case of moving of the factory under Section 27 or of dissolution of the engagement in the factory business, such permit shall be deemed to expire on the date of issuance of a new permit or of dissolution of the factory business.*
>
> *If it is appropriate to cease the engagement in the business in a near future, the Grantor, upon approval of the Minister may issue a permit of a shorter periods than that provided for in paragraph one. The permit issued in this case may not be renewed."* (s.14 Factory Act 1992).

To renew a permit, s. 15 (FA 1992) provides that:

> *"In renewing a permit, a recipient of a permit shall file an application prior to the expiration of a permit. Upon such application, the applicant shall be deemed to be the recipient of a permit until a final order refusing a renewal of a permit is given* ... "(s.15 Factory Act 1992)

While the license issued under the PHA 1992 is valid for one year (s.55 PHA 1992), license may be renewed. The renewal process is specified by the local authority (s.55 PHA 1992).

The Factory Act also allows Minister of Industry to amend permit conditions through ministerial rules in s.8 (FA 1992). While the PHA empowers local authority statements defining the type of industry and permit conditions to be dealt with in the permit system (ss.54, 55 PHA 1992). An industry controlled by s.32 (the Factory Act 1992) has to obtain a permit before undertaking their business. Control of such businesses is implicitly aimed at conservation of the environment. Conservation of the environment may also be specified by the Minister of Industry as an explicit criteria to evaluate appropriate for permits.

Water Quality Standards

Water quality standards in Thailand are controlled by the EQA as specified by s.32 that:

> *"For the purpose of environmental quality enhancement and conservation, the National Environmental Board shall have the power to prescribe by notifications published in the Government Gazette the following environmental quality standards:*
>
> *(1) Water quality standards for river, canal, swamp, marsh, lake, reservoir and other public inland water sources according to their use classifications in each river basin or water catchment..."* (s.32(1) EQA 1992).

The water quality standards prescribed pursuant to s.32 are shown in Appendix I. Moreover, the NEB has the power to prescribe special, more stringent standards than standards those in s.32 for the protection of conservation or environmentally protected areas or designated areas according to s.44 or pollution control areas designated according to s.58 (s.33 EQA 1992).

Theoretically, water quality standards should have the characteristics as shown in figure 4.7.

Figure 4.7 Recommended Water Quality Standards

(a) Different standards are established for various section due to different uses, assimilative capacity, season variation and/or flow rate;

(b) Standards may be changed or added more conditions;

(c) Specifying the result of statistical evaluation;

(d) Description of standards in precise, technical and quantitative terms;

(e) Application of minimum standards.

Freshwater in Thailand is classified into five classes depending on purpose of water use (e.g. human consumption, fisheries, or recreation). Moreover, the Chao Phraya, the Thachin, the Bangprakong, the Nakornnayok, and the Maklong Rivers each has an individual range of classification. Different sections of rivers may be classified based on different uses as mentioned above. The standards of the river water quality in all major Thai rivers are shown in Appendix J.

Section 34 (EQA 1992) empowers the NEB to modify and improve the prescribed environmental quality standards pursuant to s.32, based on the light of scientific and technological progresses and changes in economic and social conditions of the country (s.34 EQA 1992).

Some parameters in the water quality standards are specifying with statistic evaluation. Parameters include consideration of dissolved oxygen (20 percentile), BOD, total coliform bacteria and faecal coliform bacteria (80 percentile). The standards of surface water quality, almost, are set with precise, technical and quantitative terms except colour, odour and taste; temperature and water quality in Class 1 which are specified as naturally. In addition, temperature of water in class 2, 3 and 4 is specified as natural but changing by not more than 3 C. No time period is specified. Besides specifying the standards as percentile value, the water quality standards are minimum standards which specifying maximum allowance of receiving water. For example, maximum allowance of lead (Pb) concentration in Class 3 is 0.05 mg/l.

Effluent Standards

Effluent standards are governed by the EQA and the Factory Act. S.55 (EQA 1992) empowers the Minister of Science, Technology and Environment to publish notification in the Government Gazette prescribing effluent standards from point sources of pollution (s.55 EQA 1992), and types of point sources to be controlled (s.69 EQA 1992). So far, effluent standards pursuant by s.55 (EQA 1992) are Building Effluent standards which are shown in Appendix K.

Section 8(5) (FA 1992) empowers the Minister of Industry to prescribe the ministerial rules dealing with the standards and methods of controlling the discharge of wastes, pollutants or anything that affects the environment as a result of the engagement in a factory business (s.8(5) Factory Act 1992). These standards are shown in Appendix L. In addition, more stringent effluent standards can also be imposed by a provincial governor to control pollution in the area designated by s.59 (EQA 1992) in which

there is a tendency for pollution problems to cause health hazards for the public or have an adverse impact on environmental quality[19] (s.58 EQA 1992).

Effluent standards applied in Thailand should comply with the criteria shown in Figure 4.8.

Figure 4.8 Criteria for Effluent Standards

(a) Direct effluent standards should be applied;

(b) Effluent standards can be uniform or time or location variations by taking into consideration carrying capacity of receiving water and water quality standards;

(c) Effluent standards should be applied in conjunction with a permit system and be complement water quality standards.

Both effluent standards under the EQA 1992 and Factory Act 1992 are direct effluent standards, as they prescribe the quality of discharges to the environment.

According to industrial effluent standards (shown in Appendix L), these standards are not uniform. They are based on:

(a) Types of industries such as BOD concentration, oil and grease, heavy metals e.g. zinc, chromium. cadmium;
(b) Dilution ratio of wastewater and receiving water e.g. suspended solids;
(c) Salinity of receiving water e.g. dissolved solids.

The rest of the parameters are uniform with quantitative terms except for discharge standards for tar, insecticides, radioactive, colour, odour which are in narrative forms.

While Building Effluent Standards are based on types and sizes of building to be controlled with six types of parameters - pH, BOD, solids, nitrogen. and fat, oil and grease. There are six types of building to be controlled - condominium, hotels, dormitories, massage parlours, hospitals and schools, colleges, universities or institutes, each type is divided into 2-3 different sizes. It implies that smaller size of the building produces less water pollution. Therefore, a smaller size of each type of building is

[19] Environmental Quality means the balance of nature, being composed of animals, plants, natural resources and man-made objects which is for the benefit of subsistence of mankind and the sustenance of human-being and nature (s.4 EQA 1992).

allowed to discharge more wastewater than larger buildings. For example, a hotel which has less than 60 rooms is allowed to discharge wastewater with BOD 40 mg/l, while hotel which has 60-200 rooms is allowed to discharge BOD 30 mg/l.

Effluent standards from a factory under the FA 1992 are applied in conjunction with the permit system. As factories defined by the Factory Act are divided into three groups which differ in application for a permit, s.8 allows the Minister of Industry to issue ministerial rules specifying standards and methods of controlling discharge of waste into the environment for all business in a location or any group of businesses e.g. (s.8 FA 1992). For example, wastewater is not allowed to be discharged from a factory, unless the discharge is treated to have the characteristics as specified by the Ministerial rules but they are not allow to dilute the wastewater (the Ministerial rule 24 September 1992).

Zoning

Three kinds of zoning are applied in Thailand. They are zoning of use (e.g. industrial zone), protected area from pollution (e.g. pollution controlled area) and protected area for water resources (e.g. for water supply source). Zoning is provided for in the Seventh NESDP which aims to encourage development of both existing industrial zones - Eastern Sea Board industrial zone and newly developed industrial zones in different part of the country. Each zone has its own direction of development based on resource available and possibility of development in terms of infrastructure provided. These development area are Chiengmai, Pitsanulok and Nakonsawan for the north region; Nakon Ratchasima for the northeastern region, Saraburi and Ratchaburi for the central region, and Surattani and Songkla for the southern region.

The Minister of Industry, may specify the criteria governing to the location of factories (s.8(1) FA 1992). The Minister may also designate any area to be an industrial zone (s.30 FA 1992); and may limit a number and sizes or expansion of a particular type of factory in any areas (s.32(1) FA 1992). The industrial zones established under the jurisdiction of the MOI are managed by the Industrial Estate Authority of Thailand (IEAT). The IEAT has the duty to provide basic facilities e.g. road, electricity, drainage system, wastewater treatment facilities and services e.g. issuing all types of permits required for the operation of an industry (IEAT, 1991).

A pollution control area is notified by the NEB, as stated in s.59 (EQA 1992):

> *"In case it appears that any locality is affected by pollution problems and there is a tendency that such problems may be aggravated to cause health hazards to the public or adverse impact on the environmental quality, the National Environment Board shall have power to publish notification in the Government Gazette designating such locality as a pollution control area in order to control, reduce and eliminate pollution."* (s.59 EQA 1992)

Moreover, zoning for protection of the source of the Bangkok Metropolitan Region water supply is governed by the Cabinet Resolutions 1988 and 1992. These Cabinet Resolution are shown in Appendix M.

Zoning should have the following characteristics as shown in Figure 4.9.

Figure 4.9 Criteria for Zoning

Zoning should be combined with land use planning and regulatory approach such as

(a) to locate pollution source far from river and not allow to locate pollution upstream;

(b) To locate pollution source away from major urban areas;

(c) To establish industrial zone with provision of wastewater treatment facilities.

Zoning in Thailand is combined with other measures (e.g. land use planning, permit system). The Cabinet Resolutions of 1988 and 1992 provide for land use zoning in the protection of Bangkok Metropolitan water supply over a specific area as shown in Appendix M. The permit system for the operation of industrial business is controlled under the Factory Act 1992 same to business operated outside the zone. Moreover, in the restricted zone for protecting of Bangkok metropolitan water supply, factories which discharge wastewater containing toxic substances listed below or organic matter exceeding one kilogram of BOD per day, will not be permitted (Cabinet Resolution January 12, 1988). The toxic substances of concern to Cabinet include:

(a) Heavy metals: Zinc, Chromium, Copper, Mercury, Manganese, Cadmium, Lead, Selenium, Nickel, Barium, Iron, etc.

(b) Other toxic substances: PCB (Polychlorinated biphenyl, Cyanide, Arsenic, Phenol, etc.

Industrial activities containing high concentrations of toxic substances are not permitted to be established and/or expanded (Cabinet Resolution February 15, 1992).

Other regulatory approaches (e.g. effluent standards) are employed in conjunction with zoning, as stated in the Cabinet Resolution 1992. In the restricted zone for protection of Bangkok Metropolitan water supply, domestic wastewater and agricultural wastewater which includes highly polluted sources such as fish ponds and swine farms must be treated to meet the standards (Cabinet Resolution February, 1992).

4.4.2 Economic instruments

The National Plan specifies that during the Seventh National Economic and Social Development Plan (1992-1996), the Thai government will impose and enforce the Polluter-Pays Principle to ensure that polluters are responsible for polluting the environment. There are two main types of economic instruments (charges and financial assistance) provided for in the Thai framework.

Seven principle criteria which should be taken into account in setting the charges and subsidies are shown in Figure 4.10.

Figure 4.10 Criteria for Setting Charges and Subsidies

Charges should be:

(a) Based on quantity and quality of pollution generated;

(b) Reflecting both true cost of water consumption and other services;

(c) Providing incentives to change polluters' behaviours;

(d) Combined with regulatory approach e.g. effluent standards.

Subsidy should not be provided except:

(a) Selective and restricted to specific group otherwise severe difficulties may occur;

(b) Well-defined transitional period;

(c) Where market distortions may be created.

The Thai framework allows charges to be applied as administrative charges[20] or user charges[21]. While the NESDP provides guideline for the government to levy effluent charge on agricultural and industrial activities.

[20] Provided by FA 1992, PHA 1992 and NESDP 1992

[21] Provided by EQA 1992 and NESDP 1992

Administrative charges are set at both central and local levels of government. S.43 (FA 1992) provides that annual administrative charges are levied on factory businesses in group two and group three types of factories. Section 63 (PHA 1992) allows a local authority to determine administrative charges as appropriate but it may exceed the rates fixed in the Public Health Ministerial Rules for administrative charges. The revenues raising from charge can be used as an income for that authority (s.64 PHA 1992).

User charges are specified in s.88 (EQA 1992) that the National organisation -- the National Environmental Board may fix the rate of service fee for central wastewater treatment facilities by this Act. These user charges can be levied on polluters who send wastewater to the central wastewater treatment plant in the pollution control areas, or to that locality being served by the facilities (s.71 EQA 1992). The user charges can be varied as appropriate (s.89 EQA 1992). However, domestic household, in particular, can be classified as a small-scale user which is exempt from the payment of charges. At the local level, the National Plan provides that local authority can manage user charges for central wastewater treatment plant in an independent manner which means decentralization of the management system towards local government and also the Principle of Polluter-Pays can be imposed (NESDP 1992).

The National Plan provides for effluent charges to be levied on agricultural and industrial activities depending on types of activities and their residuals causing adverse effects on the environment (NESDP 1992).

In theory, charges should be based on quantity and quality of pollution generated, reflecting both true cost of water consumption and other services of water resources, providing incentive to change polluters' behaviours and combined with other types of policy instruments. So far, there is no evidence to show these criteria have been considered in relation to the Thai framework.

Financial assistance in Thailand is mainly provided for developing wastewater treatment facilities both in forms of grants for the public facility and loans for a local authority or state enterprise which can make its own profit by building a treatment facility and charging users.

The EQA provides that grants may be given to a government agency or local authority for investment in and operation of the central wastewater treatment plants (s.23(1) EQA 1992). This type of grant requested by the local authority should specified in the Changwat Action Plan. This is also supported by the National Plan which provides guidelines for providing partial or total public subsidies for construction of wastewater treatment facility to the local authorities (NESDP 1992). Moreover, grants may be provided for non-governmental organisations in order to support environmental management in an local area in which community has participated and there is an urgent to enhance and conserve environmental quality.

Loans may be provided to local authorities or state enterprise for making available of wastewater treatment facilities (s.23(2) EQA 1992) and private person to make available and install an on-site wastewater treatment plant (s.23(3) EQA 1992). Rules and conditions of the loans are determined by national organisation which are called "**the Environmental Fund Committee**" (s.25 EQA 1992).

Moreover, other kinds of financial assistance can be employed, as s.94(1),(2) (EQA 1992) provides that the owner or possessor of wastewater treatment facilities may request tax exemptions on the following matters:

(a) Import duties for imported necessary machinery, equipment and other material which are not available in Thailand;
(b) Income tax for foreign experts whose work concerning installation, monitoring, control, and operation of wastewater treatment facilities.

Moreover, the NESDP provides a framework for decentralize fiscal and monetary administration to local authorities by setting up local development fund and environmental development fund to provide credit for expansion and improvement of various local services which may include wastewater treatment facilities (NESDP 1992).

Aids or grants to support any activities concerning the promotion and conservation of environmental quality may be provided by the Environmental Fund e.g. to promote conservation of natural resources in local areas (s.23(4) EQA 1992).

It seems that financial assistance provided in the Thai water management framework is compatible with Polluter-Pays Principle, since the revenue raised from charges is used for environmental management e.g. for supporting activities concerning promotion and conservation of environmental quality. Financial assistance provided by the Thai Framework is clearly specified target for groups which are mainly dealing with wastewater treatment plant establishment and operation. However, there is no limiting time for providing financial assistance.

4.4.3 Other measures

The Thai framework provides mainly for public works dealing with wastewater treatment facilities. The national plan also provides the guideline for BMP in industrial activities and land management practices based on voluntary approach while advocacy is provided both statutory advocacy and the guideline of the provision of education. These are outlined below.

Public Works e.g One-site Treatment Plant

The government needs to take any action to deal with water pollution in Bangkok area, since Pescod (1993) reports that BOD levels are as high as 30 mg/l in most major canals in central Bangkok. Main source are from direct discharge of domestic waste into canals. Public works in Bangkok Metropolitan Area has been recognised as important over the last 30 years. Since 1968, many plans have been developed, and finally, wastewater treatment facilities serve various zones. A facility aims to focus on a specific zone which is divided into drainage zones rather than to deal with all sewage discharges from BMA. Wastewater facilities in each zone are designed based on land availability and cost, each zone will have a secondary treatment plants (Pescod, 1993). The first stage of the wastewater treatment facilities will serve two million people, while other areas are grouped based on priority criteria of zonal BOD loading, population density, impact on the Chao Phraya river and the extent of drainage in place (Pescod, 1993).

The National Plan aims to encourage investment in construction of wastewater treatment plant for communities and industrial plants in target areas e.g. Bangkok Metropolis, municipalities of vicinity towns, regional urban centres, as domestic wastewater from these areas drains to problem rivers, and to conduct feasibility studies

for the construction of comprehensive waste water treatment system for communities and industries in other areas in order of priority (NESDP, 1992). Public works for wastewater treatment in Bangkok will help reduction of wastewater discharge from domestic areas in Bangkok.

Wastewater treatment plants specifying as public works are responsible by government agencies or local authority, as s.77 (EQA 1992) specifies that:

> "*The government agency or the local authority which makes provision for the services of central wastewater treatment or central waste disposal facilities by using government budget, or revenues of the local authority, the Fund allocations under this Act shall be responsible for the management and control of such facilities ...*" (s.77 EQA 1992)

Moreover, other rules or conditions dealing with operation of the central wastewater treatment plants shall be specified by the ministerial regulations (s.77 EQA 1992). S.76 (EQA 1992) also provides that wastewater discharging from public works should meet the requirement of the effluent standards whether issued by s.55 or other law or set by the Governor of the provincial (s.76 EQA 1992). While industrial wastewater treatment are controlled under the FA 1992.

Best Management Practices

Two areas in which BMP is a relevant concept in Thailand is in the management of industry and rural land management practices. These are provided by the NESDP 1992. It is outlined based on selected criteria as shown in Figure 4.11.

Figure 4.11 Criteria for Best Management Practices

(a) To adopt BMPs to control pollution at sources;

(b) BMPs should combine with other measures e.g. financial incentive.

To control water pollution, the NESDP encourages the use of clean or pollution free technology in the production process or in business operations, and encourages waste recycling for production use and promote utilization of recycled water (NESDP, 1992). In the national plan a combination of BMPs and other measures are specified to prevent and resolve land deterioration problems by speeding up programs of soil and water conservation, emphasizing clear and low-cost methods which can be

implemented in practice with the government providing technical advise in areas facing severe problems (NESDP, 1992).

Advocacy and Provision of Information

Provision of advocacy is provided by the EQA 1992, NESDP 1992 and EQMP. It is specified by s. 6(1)(EQA 1992) that:

> *"For the purpose of public participation in the enhancement and conservation of national environmental quality, the following rights and duties may be according to individual person as provided by this Act or governing law related thereto:*
> *(1) To be informed and obtain information and data from the government service in matters concerning the enhancement and conservation of environmental quality, except the information or data that are officially classified as secret intelligence pertaining to national security, or secrets pertaining to the right to privacy, property rights, or the rights in trade or business of nay person which are duly protected by law."* (s.6(1) EQA 1992).

However, provision of information is not specifically provided for in the Thai framework. These will be outlined based on selected criteria are shown in Figure 4.12.

Figure 4.12 Criteria for Advocacy and Provision of Information

(a) Provision of advocacy

(i) Statutory advocacy through environmental education in school, university, training programm for officials;
(ii) Non-statutory advocacy through creation of leaflets, poster, media;

(b) Advocacy in combination with regulation and non-governmental organisation;

(c) Provision of availability of environmental information as a public asset.

The NESDP provides guidelines for statutory advocacy dealing with water pollution control to:

> *"Develop manpower and technology for the reduction and treatment of pollution by speeding up development of manpower at the university level in the fields of sanitary and environmental engineering, and environmental science, emphasizing studies of pollution, as well as development of technicians at the levels of lower and higher diplomas in the fields of pollution control to supervise activities at treatment plants. Furthermore, speed up research and transfer of pollution control and pollution reduction technology which allows for possible design and construction of the system and production of pollution control equipment."* (NESDP 1992, p.185)

Section 83(3) of the EQA provides that a pollution control official may give advice and suggestions to a local official or a relevant government agency concerned with the

operation and maintenance of the central wastewater treatment plant under the responsibility of that local official or government agency (s.83(3) EQA 1992).

The NESDP also provides guidelines for non-statutory advocacy by promoting public relations services to educate the public, and to disseminate information on various kinds of pollutants to the public at all levels as well as the preparation of campaigns to mobilize cooperation for the prevention and solution of environmental problems. (NESDP, 1992).

Section 8 of the EQA 1992 provides that non-governmental organisation registered according to s.7 of the Act may act as follows:

(a) To assist the performance of duty of government officials under this Act or other laws relating to the enhancement and conservation of environmental quality;

(b) To campaign and disseminate information or data to promote public awareness and proper understanding and knowledge about environmental protection and conservation of natural resources;

(c) To provide advocacy to initiate projects or activities for environmental protection and conservation of natural resources in a certain area;

(d) To conduct study and research in respect of environmental protection and conservation of natural resources;

(e) To provide legal aid to people who are in jeopardy of or afflicted by pollution damage caused by leakage of pollutants or contamination as well as acting as representative of such pollution victims to bring lawsuit and litigate claim in court for compensation or damage to which they are entitled as legal remedies.

Advocacy and education as provided by the EQMP are:

(a) To encourage national and local level of organisations, non-governmental organisation to get involved in providing environmental education for local people especially in an environmentally protected area and pollution control area;

(b) To establish environmental information centre in order to support continuous public relations by developing environmental education aid, providing public

education through television programme and academic institutions and other organisations;

(c) To establish environmental research and training centre;

(d) To develop information system dealing with national resources and the environment.

Availability of environmental information as a public asset is not provided for in the Thai framework.

Project Environmental Impact Assessment

An assessment of environmental impact from any project is provided by the Thai framework. It is evaluated based on selected criteria in Figure 4.13.

Figure 4.13 Criteria for an Environmental Impact Assessment

(a) To integrate an EIA in the planning process;

(b) The EIA should cover the impacts on the environment, social and economic and mitigatory measures of the impact of the project;

(c) The framework should provide for a statement indicating when an EIA is necessary and which project requires an EIA, an indication of what the EIA must contain, the section specifying mandates for organisation concerned, provision for full public participation, provision of a comprehensive monitoring programme, an indication of the legal and administrative sanctions.

The Thai framework does not provide for the integration of an EIA environmental planning processes, and full public participation.

It is specified in the Ministerial Notification (8 October 1992) that an Environmental Impact Statement should consider both direct and indirect impacts in terms of physical and biological resources, benefits for uses and their quality of life.

The EQA provides that the Minister of the Science, Technology and Environment shall notify what type of projects should require an EIA before being approved (s.46 EQA 1992). Even though some types of projects are required to obtain permission prior to construction or operation by other laws, the applicants are also required to prepare EIA if such project has the characteristics specified in s.46 of the EQA.

Moreover, s.44(3) (EQA 1992) states that the Minister of Science, Technology and Environment may issue ministerial rules to specify types and sizes of projects or activities undertaken by government agencies, state enterprises or private entities, to be constructed or operated in an environmentally protected areas, to submit reports of an EIA (s.44(3) EQA 1992).

The EQA 1992 empowers the NEB to require government agencies, state enterprise and other persons to deliver documents relating to the examination of impacts on the environmental quality and documents or data concerning the projects or workplans of government agencies, state enterprise and persons for its consideration. If the NEB is of opinion that any project or workplan may seriously affect environmental quality, it shall recommend remedial measures to the Cabinet (s.19 EQA 1992). Moreover, it is specified in s.47 that where a project or activity is the responsibility of a ministry, preparation of the EIA is the responsibility of that government ministry, state enterprise or joint venture with private sector. The EIA report should be submitted to the cabinet for consideration (s.47 EQA 1992).

The Ministerial Notification of 8 October 1992 specified type of project and stages of the project, where EIAs are required to be submitted. The content of the EIA, mandates for organisation concerned dealing with consideration of the project and monitoring provision should also be included in the EIS. There is no provision for full public participation.

4.5 Post-Implementation Stage

The Thai framework provides for monitoring and enforcement of plans and policies as outlined in the following subsections.

4.5.1 Monitoring system

The Thai framework provides some part of what is needed to develop a sound monitoring system as outlined below.

Selected criteria for monitoring system are shown in Figure 4.14.

Figure 4.14 Criteria for Monitoring System

(a) To monitor three types of matters - administrative and legislative measures, water and ecosystem, and social impacts;

(b) Provision of a systematic monitoring system with clear objective, sound system of data collection and analysis, regularly report to decision-makers and public, provide a training programme.

The Thai framework does not provide for monitoring administrative and legislative measures, water and ecosystem, and social impacts, and training programme for officials concerned.

The Thai framework provides a monitoring system with a system of data collection and analysis and regularly report to decision-makers and public. The NESDP (1992) provides guideline and measures for management of water resources by encouraging setting up water resource information system to support planning and policy formulation with respect to water allocation, as well as prevention and alleviation of flood problems (NESDP, 1992, p.192). The EQA states that one of the duty of the NEB is to submit reports on national environmental quality situation to the cabinet at least once a year (s.13(13) EQA 1992).

The owner or possessor or the Monitoring Control Operator or the Service Contractor of the point source of pollution require to collect statistics and data showing the daily function the wastewater treatment facilities and keep the records at the site and shall submit report summarizing the functions of the results of the facilities to the local official at least once a month (s.80 EQA 1992). Consequently, the local official shall gather the reports and send them to the pollution control official, who has the jurisdiction over that locality at least once a month. Moreover, the local official may make comments for consideration of the pollution control official (s.81 EQA 1992).

4.5.2 Enforcement system

The enforcement system in the Thai water quality management framework is tough with increasing penalties both in terms of fines and terms of imprisonment for polluters. Figure 4.15 shows the ideal criteria gainst which the Thai system may be evaluated.

Figure 4.15 Criteria for Enforcement System

A management framework should provide for:

(a) Methods of detecting violations e.g. consent conditions, water quality standards;

(b) Severe penalties including fine for violations, compensation for environmental damage, cancellation of consent, imprisonment;

(c) Provision of public participation;

(d) Provision of authorization e.g immediate assess and inspection when environmental pollution occurs.

The EQA 1992 provides for "strict liability" of offenses in s.96 in that:

> *"If leakage or contamination caused by or originated from any point source of pollution is the cause of death, bodily harm or health injury of any person or has caused damage in any manner to the property of any private person or of the State, the owner or possessor of such point source shall be liable to pay compensation or damage therefor, regardless of whether such leakage or contamination is the result of wilful or negligent act of the owner or possessor thereof, except in case it can be proved that such pollution leakage or contamination is the result of:*
>
> *(1) Force majeure or war*
> *(2) An act done in compliance with the order of the Government or State authorities.*
> *(3) An act or omission of the person who sustains injury or damage, or of any third party who is directly or indirectly responsible for the leakage or contamination.*
>
> *The compensation or damage to which the owner or possessor of the point source of pollution shall be liable according to the foregoing first paragraph shall mean to include all the expenses actually incurred by the government service for the lean-up of pollution arisen from such incident of leakage or contamination."* (s.96 EQA 1992)

Moreover, other methods of detecting violation are consent conditions and EIA, water quality standards and effluent standards also provided.

Fines for violations are provided by the EQA 1992 and the FA 1992. These are concluded in Figure 4.16.

Figure 4.16 Summary of Fine Penalties in the Thai Framework

Cause	Penalty	Source
Refraining from sending wastewater to central treatment plants; illegally discharge wastewater into central treatment plant; refuse to pay for service charges.	fine for 4 times of such service fee employed at the time of violation.	ss.90, 91, 92 EQA
Breaching the Ministerial rules or notification issued under s.8(1) (relating to area of factory and their environment), s.8(5) (relating to effluent standards and methods of control and pollutants from factory).	fine not exceeding 200,000 baht (app. NZ $ 12,500).	s.45 FA
Breaching the Ministerial issued under s.8(6) (relating to necessary document which should be kept at the factory), and s.8(7) (data which requires to report regularly.	fine not exceeding 20,000 baht (app. NZ $ 1,250).	s.46 FA
Any owner of point source of pollution who employs the revoked license Monitoring Control Operator.	fine not exceeding 50,000 baht (app. NZ $ 3,125).	s.110 EQA

The Thai framework provides for compensation not against the person committing pollution, but in addition, any person affected can be compensated if harm is caused by government agencies as stated in s.97 and s.6(2) as shown in Figure 4.17.

Figure 4.17 Compensation Provided in the Thai Framework

Section 97[1]

Any person who commits an unlawful act or omission by whatever means resulting in the destruction, loss or damage to natural resources owned by the State or belonging to the public domain shall be liable to make compensation to the State representing the total value of natural resources so destroyed, lost or damaged by such an unlawful act or omission.

Section 6(2)[2]

For the purpose of public participation in the enhancement and conservation of national environmental quality, the following rights and duties may be accorded to individual person as provided by this Act or governing law related thereto:

To be remedied or compensated by the State in case damage or injury is sustained as a consequence of dangers arisen from contamination by pollutants or spread of pollution, and such incident is caused by any activity or project initiated, supported or undertaken by government agency or state enterprise.

Source: 1 s.97 EQA 1992; 2 s.6(2) EQA 1992

Section 83(1) of the EQA empowers a pollution control official to:

> "*control the point source of pollution, to close down its operation, to suspend or revoke the license of its owner or operator, or to bar its use or utilization in any*

way, especially in connection with the point source of pollution under section 68, section 69 or section 74 which has no intention to treat the ... wastewaters ... and illegally discharges the untreated wastes into the environment outside the limits of its site and premise." (s.83(1) EQA 1992)

In cases where a factory in Group Three is closed down because of damages to any person and their property and its vicinity, it also means cancellation of their business license (s.39 Factory Act 1992). In cases where the group two and three factories do not pay annual charges for engaging in their businesses, an official can order them to cease the operation of their businesses until they pay all outstanding charges (s.43 Factory Act 1992).

The EQA provides for the penalty of imprisonment under the provision of various sections (e.g. ss. 98, 99, 100, 101, 104, 105, 106, 107, 109, 110, and 111) where pollution is severe. These are summed up in Figure 4.18.

Moreover, the EQA provides in s.111 in that in the case of an:

"offender who is liable to be punished according to this Acct is a juristic person, the directors or managers of such juristic person, or any person who has responsible for the business operation of such juristic person, shall also be punished by the same penalties prescribed by law for such offence, unless it can be proved that they have no part to play in the commission of such offence." (s.111 EQA 1992)

The Factory Act (1992) provides penalties not only to the owner but also other persons sharing responsibilities for the business (e.g. architecture or engineer) as specified in s.61 and s.62, shown in Figure 4.19.

Provisions for public participation are not provided for in the Thai framework. However the system provides for authorization of the pollution control official e.g immediate assess and inspection when environmental pollution occurs. Section 82 empowers a pollution control official as follows:

"To enter into the building, place and site of the factory or point source of pollution or the site of wastewater treatment ... which belongs to any person, between the sun rise and sun set or during the working hours, to inspect the functioning process of wastewater treatment ... as well as to examine the notes, statistics or data on the functioning of the said facility, equipment and instrument, or when there is a reasonable suspicion that there is non-compliance with this Act." (s.82(1) EQA 1992)

Figure 4.18 Summary of Penalties under the Thai Framework

Cause	Penalty	Source
Refuse to observe the order issued by s.9 (relating to pollution caused by pollution and may cause adverse effect on health and their property, or any act done in compliance with such order.	Imprisonment not exceeding 1 year, or fine not exceeding 100,000 Baht (NZ $ 6,250), or both. If the violator is the person who cause damage, imprisonment not exceeding 5 years or fine not exceeding 500,000 Baht (NZ $ 31,250) or both.	s.98 EQA
Illegally enter into public land and cause damage to natural resources or the environment in environmentally protected area.	Imprisonment not exceeding 5 years or fines not exceeding 500,000 Baht (NZ $ 31,250) or both.	s.99 EQA
Violators dealing with ministerial regulation according to s.44 and 45 (dealing with EIA).	Imprisonment not exceeding 1 year or fine not exceeding 100,000 Baht (NZ $ 6,250).	s.100 EQA
Spreading false information about the danger from any point source of pollution.	Imprisonment not exceeding 1 year or fine not exceeding 100,000 Baht (NZ $ 6,250) or both. If the dissemination of information are through mass media, the imprisonment will be not exceeding 5 years or fine not exceeding 500,000 Baht (NZ $ 31,250) or both.	s.101 EQA
Violators dealing with treating wastewater (s.71, 72, 74, 75), and gathering data dealing with wastewater treatment (s.80); any person who operates wastewater treatment without license according to s.73; Monitoring Control Operator who reports false information; any Service Contractor breaches the closing down order of wastewater treatment plant.	Imprisonment not exceeding 1 year or fine not exceeding 100,000 Baht (NZ $ 6,250) or both.	ss.104, 105, 107, 109 EQA
Failure to collect statistical data dealing with wastewater treatment.	Imprisonment not exceeding 1 month or fine not exceeding 10,000 Baht (NZ $ 625) or both.	s.106 EQA
Group 2 factory undertaking their business without informing authority concerned.	Imprisonment not exceeding 6 months, or fine not exceeding 50,000 Baht (NZ $ 3,125) or both	s.48 FA
Group 3 factory operating their business without consent	Imprisonment not exceeding 2 years or fine not exceeding 200,000 Baht (NZ $ 12,500) or both.	s.50 FA
Group 3 factory expand their factory without permission.	Imprisonment not exceeding 2 years or fine not exceeding 200,000 Baht (NZ $ 12,500) or both, if such factory is controlled under s.32 - imprisonment 4 years or fine not exceeding 400,000 Baht (NZ $ 25,000) or both.	s.52 FA
Breaching a closure order	Imprisonment 2 years or fine not exceeding 200,000 Baht (NZ $ 12,500) or both and 5,000 Baht (NZ $ 312) per day of continue breaching.	s.55 FA
A factory doe not comply with this Act and may cause adverse impact on the people and their property.	Imprisonment 1 year or fine 100,000 Baht (NZ $ 6,250) or both and 5,000 Baht (NZ $ 312) per day of breaching.	s.57 FA

Moreover, s.82(4) states that a pollution control official is empowered:

> "*To issue a written order directing the Service Contractor licensed to render the services of wastewater treatment ... to stop or shut down his services, or revoking his license in case such Service Contractor violates or does not comply with this Act, or any ministerial regulation, local ordinance, rules, notification or condition issued or stipulated by virtue of this Act, or does not comply with the order of the pollution control official issued by virtue of this Act.*" (s.82(5) EQA 1992)

Figure 4.19 Penalty for Related Person Engagement in Industrial Business

"In case where a person engaging in a factory business committing an offence under this Act, the architect or engineer working in the factory and responsible for the part of work in which such offence has been committed shall be deemed to take part in or know of the commission with the person engaging in the factory business and shall be subject to the same penalties as those for the person engaging in the factory business unless it is proved that such person does not know of or consent to the commission of such offence.
Apart from the penalties under paragraph one, the Permanent Secretary shall notify the Board on the Control of Architectural Profession or the Board on the Control of Engineering Profession of the name and commission of such person in order to proceed under the laws on architectural profession or on engineering profession accordingly."[1]

"Any person once punished for the commission of the offence under this Act, if again committed the same offence for which he/she has been punished, the court shall considered increasing the punishment for such persons at least one-third of the imprisonment penalty or increasing the punishment for another one-half of the fine penalty for such offence."[2]

Source: 1 s.61 Factory Act 1992; 2 s.62 Factory Act 1992

A pollution control official may recommend that the official who has the legal power to control the point source of pollution, may close down the operation, to suspend or revoke the license of its owner or operator, or to bar its use or utilization in any way, especially in connection with the point source of pollution under section 68, section 69 or section 74 where the polluter has no intention of treating the wastewaters and illegally discharges the untreated wastes into the environment outside the limits of the site and the premises (s.83(1) EQA 1992).

In addition, the Factory Act 1992 empowers officials, under approval of the Permanent Secretary or a person assigned by the Permanent Secretary of the MOI, to close down any machine which causes adverse effects to any person or their property or their vicinity (s.37 Factory Act 1992). If the owner of the factory which causes adverse effects does not comply with the official order mentioned above, the Permanent Secretary or a person assigned by him may close down the factory (s.39 Factory Act 1992).

4.6 Conclusion

Although, provisions are contained in a variety of Acts and Plans, the Thai framework of river water quality management provides for implicit consideration of sustainable development objectives in that it is provides a strategy to conserve and enhance natural resources by advocating that public and non-governmental organisation get involved. The system of management is slowly being upgraded taking into consideration the needs of present and future generation, and aims to improve quality of life of Thai people. However, integration of environmental and economic in decision-making process and to analyze the whole water cycle are not explicitly mentioned in the Thai framework. The strengths and weaknesses of the system of management are as followed and a summary is shown in Appendix O.

Two levels of administration are involved in the planning system - national and local levels. The five-year National Economic and Social Development Plan provides the framework of management with the mandate for all organisations through the EQA 1992. National plan is provided for development at catchment unit, national priorities of management and development, but it is not provided the public participation, a system of SEA, and consistency of the plan at different levels. A local plan is the responsibility of governors in each province especially in the areas which have environmentally protected areas and pollution control areas. The Changwat Action Plan is prepared within the national framework - the Environmental Quality Management Plan and the NESDP.

Some types of policy instruments provided for by the Thai system are well-developed. Regulatory approaches provided by the Thai framework are permit system, water quality standards, effluent standards, and zoning. Permit system in which a business under by the Factory Act 1992 is issued at the national level in some cases and at the provincial level while the permit under the Public Health Act 1992 are issued at local government - municipalities and sanitary district.

National water quality standards are in quantitative forms which are also classified based on different uses. Moreover, major rivers are classified with specific standards at different section of the rivers. So far, the Thai framework provides for two types of effluent standards - Building Effluent Standards and Factory Effluent Standards.

These two types of standards are direct effluent standards which control effluent at point source of pollution.

Industrial zones in Thailand is well-developed. They are controlled by the MOI through Industrial Estate Authority of Thailand. Moreover, some areas are specified as pollution control are under the EQA and restricted area for water supply for Bangkok Region. Each zone has their own condition and regulation.

Economic instrument are encouraged by the NESDP (1992-1996), some are mandated in the Acts e.g. administrative charge or a license under Factory Act 1992 and Public Health Act 1992, user charge for wastewater treatment facilities, loans, grants and tax exemption for making availability and operation of wastewater treatment facilities. Other measures include public works, advocacy, Best Management Practices and a project Environmental Impact Assessment. Public works are widely recognised by the NESDP and EQA. The NESDP encourage investment in wastewater treatment facilities. Advocacy and BMP are based on voluntary approach which leave for each organisation to provide them.

A sound system of EIA is provided by the Thai framework, but it is not clear how it is integrated into the planning process. Monitoring is not well-developed in the Thai system of management, but the system provides a report system to decision-makers both in forms of annual state of the environmental quality at the national level and month report from pollution sources.

The Thai framework provides good methods of detecting violation, severe penalties includes fines for violation and continue breaching the Acts or the related rules, compensation of environmental damage, cancellation of license and imprisonment as well as the concept of strict liability, authorize pollution control officials to enter, taking samples and to close down any pollution sources.

An integrated approach in environmental planning process is difficult to succeed, as an environmental planning boundary is based on provincial jurisdiction and the system of river water quality management is fragmented. there is an option for central government to establish an ad hoc committee for managing a river catchment

development or for solving water pollution as in the Chao Phraya River. The Thai framework also used to provide for a top-down type of planning, the bottom-up planning process has been developed,but in environmental planning process is not well-developed. Some of the obstacles are a difference in level of education of the thai people and the availability of the environmental information to the public.

The system of monitoring in river water quality management is not systematic, the result should be used to evaluate the previous and present government policies and provide for changing the national objective of development. An enforcement scheme should be imposed to cope with severe river water pollution problems, as the penalties provided for by the Acts are strong enough to halt environmental pollution. However, it is suggested that to impose all the measures provided for by the Acts require a strong organisation which is responsible for an environmental management without compromising with polluters. It is also contradicted with the national policies which aim to encourage economic development and provide jobs for the Thai people. Therefore, the time frame for imposing each policy instrument should be specified.

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CHAPTER FIVE

CHAPTER FIVE

COMPARISON OF THE NEW ZEALAND AND THE THAI RIVER WATER QUALITY MANAGEMENT SYSTEMS

5.0 Objectives of this chapter are to compare systems of river water quality management between Thailand and New Zealand and to give recommendations to the Thai framework based on theory and the strengths of the New Zealand framework.

5.1 Introduction

Selected criteria for sustainable development of water resources derived from Chapter Two, and the analysis of the New Zealand and the Thai frameworks in Chapters Three and Four as summarized in Figure 5.1 will be used for comparison of these two systems.

5.2 Sustainable Development for Water Resources

The New Zealand framework emphasises sustainable management of water and physical resources not sustainable development. Criteria for measuring achievement of sustainable management and the processes for achieving it, are specified in the Resource Management Act 1991. The Thai framework also refers to the concept of sustainability. However, most of the framework provides for encouraging economic development rather than an emphasis on environmental protection and conservation as shown in the first two principle development objectives of the NESDP. The first objective is to maintain economic growth rates at appropriate levels to ensure sustainability and stability. The second is concerned with the redistribution of income and development benefits to the regions and rural areas. While natural resource management is partially included in the third objective of the NESDP - the development of human resources, quality of life, environment and natural resources (NESDP, 1992).

The first principle of sustainable development - to conserve and enhance the resource base, is clearly stated in the meaning of sustainable management in New Zealand. This principle is partly recognised in the Thai framework, as shown in one of the purposes

Figure 5.1 Framework for Sustainable Development of Water Resources

Comparison of New Zealand and Thai systems	New Zealand			Thai		
Criteria	National	Regional	Local	National	Regional	Local
Sustainable development:						
(a) To conserve and enhance the resource base;	C	C	C	V	–	V
(b) To take into consideration the need of present and future generations;	C	C	C	V	–	V
(c) To integrate environmental and economics in decision-making process at all levels of administration;	V	V	V	–	–	–
(d) To analyse the whole cycle.	C	C	C	–	–	–
National Planning:						
(a) Long-term objectives for sustainable development and medium- and short-term for conservation and enhancement of resources;	V	–	–	V	–	–
(b) Provision of a framework for integrated development in river catchment;	–	–	–	C	–	–
(c) Indication of national priorities;	V	–	–	C	–	–
(d) Provision for public participation;	C	–	–	V	–	–
(e) Provision for Strategic Environmental Assessment for the policies and plans;	C	–	–	–	–	–
(f) To provide consistency of the plan at different levels of planning.	C	–	–	–	–	–
Regional Planning:	–	V	–	–	–	–
(a) Planning at river catchment plan within national framework;	–	C	–	–	–	–
(b) Establishment of priorities for local plans;	–	C	–	–	–	–
(c) Provision for public participation;	–	C	–	–	–	–
(d) Conduct Strategic Environmental Assessment t for plans and policies.	–	C	–	–	–	–
Local Planning:	–	–	C	–	–	–
(a) Plans for specific areas especially upstream river catchment;	–	–	V	–	–	V
(b) Plan within national framework as well as river catchment planing framework;	–	–	C	–	–	V
(c) Provision of public participation.	–	–	C	–	–	–
Permit system:						
(a) Decision should be made at lowest level of organisation;	–	C	C	C/–	–	C/V
(b) Consent process should be clear and streamlined including lifetime, process of renewing permits, provision for amendment of consent conditions;	–	C	C	V	–	V
(c) Permit system should take into consideration environmental factors and unavoidable malfunction and equipment failure including water quality standards, carrying capacity of receiving waters, total permission discharges, seasonal variations, assessment of environmental impacts.	–	C	C	V	–	V
Water quality standards:	V	V	–	C	–	–
(a) Different standards are established for various sections due to different uses, assimilative capacity, seasonal variation and/or flow rate;	–	V	–	C	–	–
(b) Standards may be changes or added more conditions;	–	V	–	C	–	–
(c) Specifying the result of statistical evaluation;	–	V	–	C	–	–
(d) Description of standards in precise, technical and quantitative terms;	–	V	–	C	–	–
(e) Application of minimum standards	–	C	–	C	–	–
Effluent standards:	–	V	–	C	–	–
(a) Direct effluent standards should be established;	–	V	–	C	–	V
(b) Effluent standards can be uniform or time or location variations by taking into consideration carrying capacity of receiving water and water quality standards;	–	V	–	V	–	V
(c) Effluent standards should be applied in conjunction with a permit system and be complement water quality standards.	–	V	–	V	–	V
Zoning should be combined with land use planning and regulatory approach such as:	–	V	–	C	–	–
(a) To locate pollution sources far from river and not allow to locate pollution upstream;	–	V	–	C	–	–
(b) To locate pollution source away from major urban areas;	–	V	–	V	–	–
(c) To establish industrial zone with provision of wastewater treatment facilities.	–	–	V	C	–	–

C = Compulsory (Specify in the Acts or plans and mandatory)
V = Voluntary (Specify in the Acts or plans but non-mandatory)
– = Not available (Not specify by the Acts or plans)

Figure 5.1 Framework for Sustainable Development of Water Resources (Continued)

Comparison of New Zealand and Thai Systems	New Zealand			Thai		
Criteria	National	Regional	Local	National	Regional	Local
Charges should be: (a) Based on quantity and quality of pollution generated; (b) Reflecting both true cost of water consumption and other services; (c) Providing incentives to change polluters' behaviours; (d) Combined with regulatory approach e.g. effluent standards.	V	V	V	V	–	V
Subsidies should not provide except: (a) Selective and restricted to specific groups otherwise severe difficulties may occur; (b) Well-defined transitional period; (c) Where market distortions may be created.	V	–	–	V	–	V
Public works e.g. wastewater treatment facilities:	–	–	–	C	–	C/V
(a) The facilities should provide for domestic and industrial waste treatment.	–	–	–	V	–	V
(b) Wastewater treatment facilities should be provided at least secondary treatment.	–	–	–	V	–	V
Best Management Practices:	–	–	–	–	–	V
(a) To adopt BMPs to control pollution at sources;	–	V	V	V	–	–
(b) BMPs should combine with other measures e.g. financial incentives.	–	V	V	V	–	–
Provision of Advocacy and information:						
(a) Provision of advocacy:	–	V	V	–	–	–
(i) Statutory advocacy through environmental education in school, university, training programme for officials;	–	–	–	C	–	–
(ii) Non-statutory advocacy through creation of leaflets, poster, media;	–	V	V	C	–	–
(b) Advocacy in combination with regulatory and non-governmental organisation;	–	V	V	C	–	–
(c) Provision of availability of environmental information as a public asset.	–	C	C	V	–	–
Environmental Impact Assessment:						
(a) To integrate an EIA in the planning process;	V	C	C	V	–	V
(b) The EIA should cover the impacts on the environment, social and economic and mitigatory measures of the impacts of the project;	V	C	C	C	–	V
(c) The framework should provide for a statement indicating when an EIA is necessary and which project requires an EIA, an indication of what the EIA must contain, the section specifying mandates for organisation concerned, provision for full public participation, provision of a comprehensive monitoring programme, an indication of the legal and administrative sanctions.	V	C	C	C	–	–
Monitoring system:						
(a) To monitor three types of matters - administrative and legislative measures, water and ecosystem and social impacts;	C	C	C	C/V	–	–
(b) Provision of a systematic monitoring system with clear objective, sound system of data collection and analysis, regularly report to decision-makers and public, provide a training programme.	V	V	V	C/V	–	–
Enforcement system:						
(a) Methods of detecting violations e.g. consent conditions, water quality standards;	–	C	C	C	–	C
(b) Severe penalties including fine for violations, compensation for environmental damage, cancellation of consent, imprisonment;	–	C	C	C	–	C
(c) Provision of public participation;	–	C	C	–	–	–
(d) Provision of authorisation e.g. immediate assess and inspection when environmental pollution occurs	–	C	C	C	–	C

C = Compulsory (Specify in the Acts or plans and mandatory)
V = Voluntary (Specify in the Acts or plans but non-mandatory)
-- = not available (Not specify by the Acts or plans)

of the EQA 1992 which encourages public and non-governmental organisations to get involved in enhancement and conservation of national environmental quality.

The second principle - to take into consideration the need of present and future generations - is mentioned in both systems. The New Zealand framework provides for the considerations of present and future generations as part of the purpose of the Resource Management Act 1991. Therefore, it is crucial for all organisations concerned, including individual developers managing resources, to achieve the purpose of the Act. However, as Thailand is a developing country, it mainly aims to serve the present generation by providing for its needs, instead of focusing on long-term objectives. As a result, the national plan seeks to improve the quality of life of Thai people by reducing negative impacts on the quality of life from environmental degradation, and by encouraging and supporting development of higher quality of life through an improved education system. Therefore, to consider the needs of future generations in the Thai framework may only be achieved if the country's aim for development is integrated with an environmental management.

The third principle - integration of environmental and economic into decision-making processes, is not explicitly provided for in either system. Unlike the New Zealand which has one principle Act governing resource management, the Thai system has three principle Acts - EQA 1992, Factory Act 1992, Public Health Act 1992, and the Seventh NESDP and EQMP plus some other 30 Acts dealing with water resource management in Thailand. This leads to fragmentation of resource management in Thailand, because integration economic development and environmental management in decision-making processes becomes difficult. Therefore, the Thai government should develop new management systems in order to achieve integration. The new national framework should require all government agencies and state enterprises to consider integration in all planning processes. Moreover, private sectors which contribute pollution in the environment, should recognise a purpose of an environmental management.

The fourth principle is to consider the whole water cycle. The New Zealand framework generally provides for consideration of the whole water cycle from upper streams catchments to coastal water because management systems are based on

catchments. The Thai framework does not mention the relationship of freshwater to coastal waters in the water cycle. The New Zealand framework provides for coastal management with compulsory policies and plans developed at different levels while freshwater management is based on a more voluntary approach. However, in Thailand where people's life depend on freshwater, the system of management emphasises freshwater management rather than coastal management. A new framework of the Thai system should also provide for the consideration of water as it drains from upstream catchments through the country, until it drains into coastal waters. Both quantity and quality of river water should be considered.

Therefore, the Thai framework can be improved by including the conservation and enhancement of the resource base, especially water resources, as objectives in national plans and acts. Integration of economic development and environmental management at the national level is a priority, as is improvement of the planing system by developing new legislation which takes into account the whole water cycle rather than sectoral development. However, consideration of the needs of future generation is difficult to achieve, because of limitations in the national budget especially for the environmental management which is less of a priority than economic development. Government policies usually prioritise provision of infrastructure (e.g roads, electricity) and provide basic needs (e.g. education, health services) for their people. Moreover, there is a need to improve integration of various Acts by providing an integration mechanism through a national department, and by limiting the mandate of each organisation in managing use of water resources.

5.3 Pre-Implementation Stage - Planning Process

The two systems also have different approaches to environmental planning. The New Zealand framework provides for planning at national, regional and local levels based on river catchments, and territorial areas. The Thai framework emphasises planning at national level and empowering local authorities to prepare the plan at provincial levels.

Planning at the national level of both systems is also different in that the New Zealand frameworks provides for the long-term objectives for sustainable management through the Act, but medium and short-term objectives for conservation and enhancement of

resources are provided for in plans and policies at regional and district levels. While the Thai framework provides for the medium and short-term objectives at national and local level, but does not provide for long-term objective for conservation and enhancement of resources.

The New Zealand framework provides for integrated development in river catchments, since the plans and other policies emphasises the need to complement the nature of river catchments. However, the Thai framework only provides guidelines in the national plan for development of water resources based on river catchments e.g. Chao Phraya, Ping, Wang, Yom, Nan river catchments, but the framework does not provide for the water quality management in all river catchments. Generally, a river catchment is considered the most appropriate area for river water quality planning (see Chapter Two).

The New Zealand planning system emphasises planning at regional and local levels. Therefore, the New Zealand framework allows local authorities to establish their own priorities in river management. However, the Thai planning system emphasises planning at the national level which provides guidelines for management at subsequent levels. The National Economic and Social Development Plan and the Environmental Quality Management Plan provide national priorities for development. The NESDP is the principle plan for economic development and environmental management and the EQMP guides environmental quality management. Consequently, all governmental agencies are required to prepare their working plans based on the provisions in the NESDP and EQMP within each area of responsibility. Moreover, each year, all authorities preparing annual budgets need to consider whether local plans or departmental plans achieve the objectives of NESDP or EQMP. Therefore, the national plans can act as an implicit guide for resource management. Although local authorities cannot set their own priorities of resource management as in New Zealand. A national plan of Thailand foresees the direction of development of the country, it can provide for more effective control over water resource from upstream catchment to coastal management. However, the Thai framework should provide for both water quantity and quality management especially in the rivers where severe water pollution problems occur, or where people demand better quality in water resources.

In the New Zealand system, the public may participate in the planning process in a number of ways. For example, opportunities are provided for participation by making submissions in relation to plans and policy statements and, in the case of individual resource consents. Individuals in the community may also approach the Planning Tribunal if they feel that plans or consents are not enforced. By contrast, the Thai framework does not explicitly provide for public participation except in small water resource development schemes. However, public should be allowed to become involved in the Thai planning process. This may be done at all stages of planning. For example, at the initial phase of planning people may express their opinions about problems, and methods for dealing with the issue of water resource management. At decision-making stage the public can also get involved in the selection of plans to ensure that all users of water resources are being served.

The New Zealand framework provides for a form of Strategic Environmental Assessment in Section 32 of the RMA 1991. Before preparing a policy, plan, or rule authority must be able to demonstrate that preparation of objectives, policies and rules is required. While the Thai system is based on ad hoc policy development, with little formal evaluation.

The New Zealand framework also provides for consistency between plans and policies over different levels. The system also provides for the Planning Tribunal to mediate in disputes about consistency. While the Thai framework does not explicitly provide for consistency between plans.

Therefore, at a national level, the Thai system of management should improve the development of long-term objectives for resource management. The system should aim at considering water resources in terms of both quantity and quality of water. It should provide for public participation in the planning process. The Thai framework provides the national priority of development in the national plan in which all organisation concerned should prepare the plan within this framework. Moreover, plans at different levels should be consistent with national objectives. A system of the SEA would be difficult to implement in Thailand, because plan preparation is complicated and dependent on variable budget allocations each year.

Planning at a regional level is included in the New Zealand framework, since planning for water resources is one of the functions of regional planning. The Thai framework is based on provincial jurisdictions (see Chapter Four). However, an ad hoc committee is responsible for catchment management of the Chao-Phraya river, because of the government's emphasis on solving pollution problems in the Chao Phraya river. Therefore, the Thai framework may be improved by establishing a more accountable planning process for water resource management by setting up a planing committee consisting of the governor of each provincial in the catchment and other organisations concerned. The system should provide for public participation by helping to reduce wastewater discharges and advocating the use of Best Management Practices where activities cause adverse effects along the river shorelines. Subsequently, an SEA may be applied following plan preparation to understand the effects of the plan on the river and people who depend on it. The planning process could be applied in individual catchments or over a set of river catchments.

Planning at local level is provided for in both the New Zealand and the Thai frameworks. These systems are similar in that planning at this level operates within national framework. They are different in that an upstream river catchment in the Thai framework would need to be specified as an environmentally protected area for which a province then prepares a plan to protect the catchment. District plans in New Zealand must provide for the effects of land use, and for public participation, within a context provided by a variety of plans and policy statements.

5.4 Implementation Stage

Various measures are employed at implementation stage of the two systems. These are regulatory approach (e.g. permit system, water quality standards and zoning); economic instruments (e.g. administrative charges, grants and loans); other measures (e.g. Best Management Practices, advocacy and provision of information). There are differences, for example in provision of effluent standards, public works (e.g.on-site treatment facilities).

5.4.1 Regulatory approach

Provision of a permit system, water quality standards, effluent standards and zoning in the New Zealand and the Thai system of water resource management are compared.

Permit systems

The permit systems for water resource management in New Zealand and Thailand differ in many ways. A permit system regulating to quantity and quality of water resources in New Zealand is generally controlled by regional councils which manage whole catchment areas. While in Thailand the central organisations still control the permit system. Central organisations specify the types of activities requiring a permit under both the Factory Act 1992 and the Public Health Act 1992. Moreover, central organisations also control the granting of a permit for engagement in factory businesses under the Factory Act. For example all types and size of factories including factory under s.32 of the FA 1992 need a permit. A Provincial Industrial Office is empowered to grant permits only for factories which use machinery between 5-200 horse power, or employ less than one hundred workers. In industrial zones, a permit may be granted by the Industrial Estate Authority of Thailand which is responsible for that area. Authority for granting a permit under the Public Health Act 1992 is more decentralised with permits required for any business which is, or is likely to be, harmful to community health. However, the Minister of Public Health is empowered to specify what types of activity requires a permit under the Public Health Act 1992.

Therefore, it is suggested that the Thai permit system under the FA 1992 should be managed at the lowest level of planning as possible. Permit system under both the FA 1992 and the PHA 1992 should be improved by providing a mechanism to combine granting a permit for a factory under the FA 1992 and a business under the PHA 1992.

The conditions for granting a permit under the PHA 1992 should also include consideration of environmental factors. The officials who grant permits should investigate before granting permit whether operation of the business causes unacceptable adverse effects to the public.

The permit system established by New Zealand's Resource Management Act 1991 is a considerable improvement on previous practices. A number of applications for resource consent may be managed using one permit. However, in Thailand one activity may require several permits from different organisations. For example, if an activity is defined as a factory under the Factory Act, and it is defined as an offensive

business under the Public Health Act, the activity is required to conduct an EIA under the Enhancement and Conservation of the National Environmental Quality Act 1992. The EIA is submitted for consideration by the National Environmental Board for approval. It also requires a permission to engage in business from the Minister of Industry, and a construction permit from local authority under the Building Act. A final permit is required from the local authority under the Public Health Act 1992 before commencing such activity. Where such an activity or business is established in an industrial zone, the Industrial Estate Authority of Thailand may grant the permits required under the Factory Act and Building Act. However, the permit is still required from a local authority dealing with an offensive business.

Both the New Zealand and Thai systems provide clear and streamlined process for issuing permits and renewing them. Both systems also explicitly provide for the relevant authority to amend consents or conditions. However, the New Zealand system would obviously reduce the time taken to obtain permits.

The New Zealand framework provides guidelines for the consideration of environmental factors when granting a permit. For example, the potential for equipment failure, carrying capacity of receiving waters and potential impacts of activities on the environment are all matters to be considered in the consent process. The Thai framework does not explicitly provide for these considerations in the consent frameworks. Any activity which causes or is likely to cause adverse effects on the environment, is controlled by the Minister of the Industry through notification specifying the activity to be an industry under s.32. Therefore, a permit can only be obtained from the central organisation - the Ministry of Industry. The authority is able to take into consideration of the impact of businesses on the environment before granting a permit. However, the system of consideration is not clearly defined how these impacts are taken into considerations.

Therefore, the Thai framework could be improved by combining the permit systems under the FA 1992 and the PHA 1992 together, with the permit being granted at the lowest level of organisation - municipality or province. For example, there could be a committee at provincial level comprising representatives from the Ministry of Industry, municipality or provincial office and other organisations concerned (e.g. any

adjacent province affected by the proposal) to consider applications for permits. Moreover, the system should enable local governments to specify their own conditions and the direction of economic development and environmental management in each jurisdiction. This is possible, if the decision-making committee is based on river catchment rather than provincial jurisdiction, since water pollution is likely to cause adverse effect not only where such an activity takes place, but also downstream.

Water Quality Standards

Water quality standards in New Zealand and Thailand are both similar and different. Both systems provides for minimum water quality standards, as both water quality standards specify maximum allowable limits of receiving water. Both systems also provide for changes to conditions related to the imposition of standards. New Zealand water quality standards are specified in the Third Schedule of the RMA 1991 (Appendix A) and the water quality standards in Thailand are classified, based on the purpose of water use (Appendix B). The New Zealand water quality standards are in narrative forms, with each regional council able to specify more stringent standards or specify quantitative standards for different sections of individual rivers. Conflicts about water quality standards is not really an issue at the regional level of planning in New Zealand, because regional council boundaries are based on catchments, with little or no overlap. Whereas in Thailand more than one authority may administer water resources within a catchment. The Thai freshwater quality standards are specified by the central organisation and provide for different standards in different sections of rivers.

The statutory minimum water quality standards, specified in sections 70 and 107 of the New Zealand's RMA 1991, relate to the effects of contaminants after reasonable mixing. These standards are applied throughout New Zealand until there are regional rules specifying water quality standards imposed by individual regional councils. Regional rules can be used to impose more stringent standards than the Third Schedule of the RMA 1991. Therefore, each regional council can set their own standards which may suit the carrying capacity of rivers in their area instead of complying with national standards which may be too stringent or too loosely formulated to guide water management.

Critics argue that imposition of water quality standards require an investigation and understanding of characteristics of pollutants and their impacts on receiving waters, along with water use. Therefore, in the Thai system where resources (in terms of expertise, equipment, and budget) are located mainly at the national level, it is more appropriate to use national standards.

Effluent Standards

Effluent standards in both countries are different in that New Zealand has not been developed explicit effluent standards. However, the RMA provides directly for development of both direct effluent standards in regional plans, and indirectly through use of s.108 (see Chapter Three). In Thailand, effluent standards are quite well-developed for controlling discharges from point sources of pollution - buildings and factories. These standards are direct effluent standards which specify quality of the discharge.

In some cases, indirect effluent standards in some cases are not effective enough to control water pollution because indirect effluent standards imply that a desired quality in receiving water will be achieved. In addition, Milne (1992) indicates that the best practical options being applied by New Zealand consent authorities may cause dischargers to adopt more expensive methods of wastewater treatment.

Effluent standards in both systems are applied in conjunction with the permit systems. The New Zealand effluent standards may be applied through a rule in a regional plan for any person applying for a resource consent which is defined as a "controlled activity" or "discretionary activity", or through a rule referring to the "Best Practical Option" condition. While in Thailand, factories specified under the Factory Act, and wastewater treatment plants operated by local authority and Industrial Estate Authority of Thailand should comply with factory effluent standards. Building effluent standards are developed, but guidelines for their implementation have not been provided for.

Zoning

New Zealand and Thailand have different approaches in using zoning as a tool in water resource management. Zoning in New Zealand is effects based and aims at

conservation and enhancement of water quality. Instead of prescribing activities which are or are not allowed to be conducted in a zone. Zoning in New Zealand sets limits on effects which are allowed to occur within a given area (Milne, 1992). In Thailand, toxic pollution resulting from discharges from industrial activities are implicitly encouraged by a government concerned with improving jobs and quality of life. Therefore, an industrial zone in Thailand may be developed in order to control industrial activities by concentrating pollution within specific areas. Moreover, it is under responsibility of the Industrial Estate Authority of Thailand to provide facilities for wastewater treatment in an industrial zone.

Sources of water supply should be zoned as protected areas, since almost all major cities in Thailand are situated on rivers, and their water supply depends on rivers which are polluted by activities upstream along river shores. Therefore, in some sensitive areas (e.g. an area enclosing water supply sources) zoning should be utilized to protect water supply from adverse effects. It is suggested that the same conditions used in controlling water supply source in the Chao Phraya river catchment (discussed in Chapter Four) should be applied throughout the country. These conditions should include prohibition of adverse effects on water supply sources. Industrial activities discharging high concentrations of toxic substances should not be permitted to become established or be expanded within such areas. Conditions should also include controls on all discharges which cause accumulative impacts on water sources and water users (e.g. toxic substances). Measures such as BMPs for agricultural and forested areas, and construction sites and urban storm runoff control non-point of pollution from upstream should also be used . While waste from farms may be controlled by treating before discharging to receiving waters.

5.4.2 Economic instruments

The two systems both use economic instruments in the form of charges and subsidies. The New Zealand and the Thai frameworks are quite similar in that both of them provide for administrative charges which are generally inefficient in economic terms, because there is less incentive for polluters to change inappropriate behaviour, and charges are generally not based on quantity and quality of pollution generated. Administrative charges in New Zealand framework are incurred when an application is made for resource consent and changes of plan or policy statement. While

administrative charges in the Thai system are incurred by any applicants engaging in a factory business, under the Factory Act, and for controlled activity under the Public Health Act when permits are applied for.

Administrative charges in Thailand are effective in practice because they are applied in conjunction with an existing permit system. However, the New Zealand system provides for a more wider scope of administrative charges (as discussed in Chapter Three), than the Thai framework. Milne (1992) indicates that the New Zealand charging system may include an administrative charge on a person who requests the information and document. This may become an obstacle to effective public participation in resource management issues.

In addition, the Thai framework provides for national plans to use economic instruments within the Seventh National Economic and Social Development Plan. It is also possible to impose the other type of charges (e.g. user charges of central wastewater treatment facilities when they are completely constructed and operated). This type of charge is incurred by any person who discharges wastewater into central wastewater treatment plants provided by local authorities or the private sector which serve as public facilities.

In theory, a user charge is more compatible with the Polluter-Pays Principle, since all polluters serviced by the facility would be charged. If the charge is based on quantity and quality of pollution generated, it would be efficient in economic terms. However, in Thailand these criteria may not be achieved, because domestic wastewater is classified as a "small-scale user" of the rives capacity. Therefore, households are exempt from paying of the charge. User charges should be high enough in order to change polluters' behaviours. Charges may vary depending on the carrying capacity of receiving environment and the effects of pollutants on water quality and other users. User charges can be applied in conjunction with effluent standards (e.g. factory or domestic effluent standards).

In theory, subsidies should not be granted if they are incompatible with the Polluter-Pays Principle. Both Thailand and New Zealand provide guidelines for subsidies to be granted. However, the New Zealand framework does not clearly specify how

subsidies would be paid. The Thai framework provides for varieties of subsidies in terms of loans, grants, tax exemptions by national government to business.

Thai subsidies, seem to be compatible with Polluter-Pays Principle in that subsidies support the development and maintenance of wastewater facilities. The aim of the Thai subsidies is to prevent pollution and to remedy pollution problems in Thailand. Some other countries also provide subsidies for the same purpose as Thailand (e.g. France and Italy as discussed in Chapter Two). In order to achieve the Polluter-Pays Principle, the Thai government must specify the period over which the subsidies will be provided. Therefore, provision of loans, grants, tax exemptions in Thailand should clearly specify the time frame for subsidy. Moreover, grants should be provided for encouraging any activity dealing with reduction of water pollution and water resource protection.

5.4.3 Other measures

Provision of other measures (e.g. public works, BMPs, advocacy and provision of information, and project EIA) in the New Zealand and the Thai system of water resource management are compared.

Public Works e.g. On-site Treatment Plant

Water pollution problems in Thailand are generally far more serious than New Zealand (e.g. dissolved oxygen in the river in Thailand has been reported as nil in some areas especially in the lower part of the Chao Phraya River). On-site wastewater treatment facilities, especially domestic wastewater treatment, are necessary to avoid a dangerous situation. In addition, budgetary constraints in Thailand, and the needs of other priority areas such as education, road and electricity, mean that public works associated with water pollution are often delayed. The EQA 1992 and the NESDP have the same objective for wastewater management which is to bring about the construction, operation and maintenance of wastewater treatment facilities. Completion of projects requires a guarantee of budget allocation for each year of construction, operation and maintenance. Therefore, the Thai framework provides for public works (wastewater treatment facilities) as one of the national measures to deal with water pollution. While the New Zealand framework deals with public works as part of a range of local authorities responsibilities under the Local Government Act 1974.

Public works should be combined with other measures e.g. user charges, provision of education, and application of Best Management Practices for urban stormwater runoff in order to reduce waste loads flowing into the treatment plants. Moreover, any monitoring and enforcement scheme should be strengthened to deal with violations.

Best Management Practices

Best Management Practices are generally based on a voluntary approach in both New Zealand and Thailand. For example, to impose Best Practical Options, a local authority concerned has to take into consideration many factors involving in water management such as the nature of the discharge and the sensitivity of receiving environment, financial implications, and adverse effects on the environment. This helps individual dischargers avoid installation of unnecessarily expensive measures dealing with a water pollution problem. Both systems allow organisations concerned to impose BMPs in conjunction with other measures e.g. advocacy, education in order to achieve reduction of pollution at sources through BMPs.

Non-point sources of pollution (e.g. agriculture, forestry, urban stormwater, construction sites) contribute significantly to water pollution in Thailand. Therefore, each organisation responsible should adopt BMPs where possible. For example, municipalities may be responsible for reducing wastewater from urban stormwater runoff in terms of structural and non-structural management practices. Construction sites can be controlled by local authorities (e.g. urban areas which are the responsibility municipalities and sanitary districts). While agricultural and forestry management practices could be imposed through the Ministry of Agriculture and Co-operative, based on a voluntary approach. However, Best Management Practices should be supported by other measures (e.g. provision of technical assistance, education programme) where possible. Moreover, financial incentives may be used where severe water pollution problems occur.

Incentives and BMPs may be applied through funding from the Thai Environmental Fund which specifies that grant can be provided for any project which aims to encourage environmental at local level in order to solve environmental problem for specific area. To implement BMPs especially in agricultural and forestry areas may

solve less serious soil erosion problems in local areas and also contribute to alleviation of water pollution problems downstream.

Advocacy and Provision of Information

Provisions for advocacy and education are used differently in the two systems. The New Zealand framework aims to provide for non-statutory education programmes by making available environmental information, while the Thai framework provides for both statutory and non-statutory education programmes and technical assistance transfers from national to the local authority as well as to non-governmental organisations. But the Thai framework does not provide for environmental information to be available to the public, which is due partly to the nature of the traditional, bureaucratic Thai administrative system.

Environmental information (e.g. cause and effect of environmental pollution) can help in understanding, solving and even preventing environmental problems. Therefore, the Thai system could help future generations by providing more environmental information to schools, public and interest groups and businesses, especially where pollution is widespread, and affects the public. For example, information from monitoring systems, information from discussion documents and State of the Environment reports could all be made available to the public in various forms (e.g. reports, posters, signs, etc.). However, the information to be disseminated should be easily understood by people in general. Since, each area may differ in characteristics of problems and the methods to solve such problem. Local language may also vary, so non-governmental organisations could be encouraged to become involved in developing education programmes. Financial support can be requested from the Environmental Fund.

Project Environmental Impact Assessment

The New Zealand framework applies a term "*Assessment of Environmental Effect* (AEE)" instead of the well-known term "*Environmental Impact Assessment* (EIA). AEE is broadly defined to cover effect both positive or adverse effect, past, present and future effects, temporary or permanent or cumulative.

An AEE under the New Zealand system is integrated into the plan preparation process. A regional council may state a rule, specifying types of activities allowed or not allowed in a region. It is clearly defined when controlled, discretionary and non-complying types of activities require a consent in which an AEE should be submitted with the application for resource consent. However, under the Thai framework, it is not clear how an EIA is involved in planning process to develop plans for managing major rivers.

It is suggested that the Thai framework should clearly define how an EIA relates to planning process. EIA preparation should also include the public (including those who have gained benefits as well as those who are adversely affected), enabling people participate at the very early stages of its preparation, and evaluation of impacts.
Both systems are quite similar in terms of specifying that the EIA report should cover all impacts on the environment (ecosystem, cultural and socio-economic). The Thai system should provide guidance indicating when an EIA is necessary, what an EIA must contain, mandates for organisations concerned, and the potential monitoring programmes. However, both systems do not explicitly provide for public participation in the EIA process. The New Zealand framework does not provide for legal sanction towards the offenders dealing with conducting the EIA, while the Thai framework does.

The EIA system in Thailand can be improved by providing for enforcement if an activity required to prepare an EIA fails to do so. The authority concerned should be empowered to close down the project or prepare an EIA at the developer's cost.

5.5 Post-Implementation Stage

At post-implementation stage, two types of policy instruments are employed in both New Zealand and Thailand. Detail of each measure will be compared.

5.5.1 Monitoring system

The New Zealand and the Thai frameworks are different, in that the New Zealand RMA framework provides for monitoring of administrative and legislative measures. The system of data collection and reporting are not clearly defined within the framework and are able to be developed individually by regional councils and

territorial authorities. The Thai framework does not provide for monitoring of administrative and legislative measures, the state of water resources, ecosystem quality, or socio-economic impacts. But in general, organisations concerned (e.g. the Ministry of Public Health and the Ministry of Science, Technology and Environment) conduct monitoring programmes for environmental quality (e.g air quality, river water quality and coastal water quality) in order to assess existing environmental conditions. Moreover, the Ministry of Science, Technology and Environment has to report the state of the environmental quality to the cabinet at least once a year.

The Thai framework, has developed data collection and reporting systems for point sources of pollution where polluters or dischargers are responsible for collecting and reporting data dealing with wastewater treatment operation to the authorities concerned (municipalities, sanitary districts, Provincial Organisation Administrations, Bangkok Metropolitan Administration and the City of Pattaya). A local official gathers the reports and sends them to the pollution control official who are responsible for such area at least once a month. Therefore, the Thai framework could provide for effective administrative and legislative monitoring. For example, compliance with permit conditions could be monitored including permits granted under the Factory Act and the Public Health Act, which would improve integration of monitoring. Moreover, other administrative and legislative measures could also be monitored to ensure policies or mandates of organisation are implemented.

The reporting system could be improved especially at a local level, or on a catchment basis, to support decisions about water quality and use, and to assist in evaluating local environmental conditions. This decentralization of decision-making is an important aim for environmental management in Thailand, because it is recognised that economic expansion in the past causes severe impacts on people's living conditions especially local people (NESDP, 1992). In addition, reports from point source of pollution which are gathered by local authorities should be utilised in order to consider broader issues when granting a permit, especially if pollution sources are defined as offensive business under the PHA 1992.

The Thai monitoring system would also be improved by establishing clear objectives for monitoring. This can improve evaluation of previous and present government

policies on the environment, and to be used to improve subsequent decisions. Data collection and system of report should be systematic, continuous, long-term and consistent. It should also provide for data or reports able to be used at all levels of administration.

5.5.2 Enforcement system

Enforcement systems in the New Zealand and Thailand are similar in that both frameworks provide for "strict liability" of polluters. Liability in the Thai framework aims to cover the adverse effects of leakage or contamination on human health, while strict liability in the New Zealand framework widely covers any violator who contravenes the Act and rules in plans.

Both systems are different in that the New Zealand framework provides for lesser penalties when compared with the Thai framework. An offender under the New Zealand system would be punished using jail term *or* fines, while under the Thai framework, an offender may be punished using jail terms *and* fines. Thai offenders who repeat an offence are punished by a maximum of double fines and jail terms.

The New Zealand framework specifies that compensation may be needed if emergency works are required to undertaken by a local authority to prevent or remedy an urgent environmental problem. Moreover, any person may be ordered to completely restore natural or physical resources to its natural state before the adverse effects occurred. The Thai framework provides for compensation for third parties affected by the government or state enterprise projects. Any individual who commits an unlawful act, which pollutes a river or stream has to make compensation representing the total value of the destroyed natural resources. Under the New Zealand framework restoration does not only mean monetary value but also some efforts needs to be undertaken to repair damage, while the Thai system implies that only compensation in monetary terms needs to be paid.

The New Zealand framework allows the consent authority to establish conditions dealing with cancellation of consent, while the Thai framework provides for cancellation of factory license, wastewater treatment operator license in many cases.

The New Zealand framework allows a third person to apply to the Planning Tribunal for an enforcement order. If pollution is occurring or has already occurred, the third person must apply to the relevant consent authority for an abatement order to be obtained from the Planning Tribunal. The Thai system does not provide for this form of participation.

The New Zealand framework authorizes official entry to a site by officials at any time without prior notice to investigate and deal with pollution, while the Thai framework empowers a pollution control official to enter the site of pollution sources only during day time. Both systems provide for the consent authority to take samples from what is suspected to be polluted waters, or of the pollutants themselves. Moreover, the Thai framework empowers the Permanent Secretary of the Minister of Industry or an assigned person to close down factories which cause adverse effects on water in rivers and streams.

It is suggested that people respond better to positive incentives rather than severe penalties. However, because river water in Thailand is more polluted, severe penalties should be provided for and strong enforcement mechanism are needed. Due to limitations of budget and human resources, the public should be encouraged to support and participate in enforcement systems.

5.6 Conclusion

It is found that the New Zealand and Thailand provide some similarities and differences in the river water quality management systems in the following issues. These similarities are:

(1) Water quality standards in both countries are classified using different uses of water;

(2) Both systems provide for administrative charges and subsidies, but the Thai framework also provides for user charges;

(3) Best Management Practices in these two countries are based on voluntary approach;

(4) Enforcement schemes in both systems are quite similar, but the thai framework provides more severe penalty;

(5) Both systems provide for an Environmental Impact Assessment, but some difference in details.

These differences are:

(1) There are differences in providing for achievement of sustainable development for water resources. As the New Zealand system provides for sustainable management at all levels of planning and explicitly specifies in the purpose of the RMA 1991. Whereas the Thai system implicitly provides for sustainable development;

(2) Planning system in New Zealand emphasises planing at regional and local levels, while the Thai framework aims at planning at national and provincial levels;

(3) The permit system in New Zealand is generally controlled at regional council level, while in Thailand, permits are obtained from central organisations or are under the control of central organisations;

(4) Water quality standards in New Zealand are in narrative forms while those in Thailand are quantitative;

(5) There is no effluent standards in the New Zealand framework, while the Thai system provides effluent standards for controlling pollution from point sources of pollution - factory and domestic;

(6) Zoning in New Zealand may be used to both the regional and local levels of plan to conserve and enhance water quality. Zoning at a regional level may be used to delineate water body areas which should reach specified standards of quality. Local district plans may zone areas of surrounding catchment to preclude adverse effect of land uses which could potentially affect water quality. Whereas in Thailand zoning are established for industrial areas as well as specified for protection of water supply sources;

(7) Public works - wastewater treatment facilities are clearly mentioned in the Thai system, while New Zealand does not;

(8) Provision of advocacy and information in New Zealand aims to provide information to the public, while the Thai framework provides for education programmes and technical assistance;

(9) Monitoring programmes in New Zealand aim at monitoring administrative and legislative measures, while, in practice, the Thai government conduct more general environmental quality monitoring programme.

Although the Thai government aims to encourage sustainable development of the country by providing various policy instruments to cope with environmental pollution resulting from economic development. There are gaps which may be only dealt with by future research.

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CHAPTER SIX

CHAPTER SIX

CONCLUSION, DISCUSSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

6.0 Objective: This chapter presents the conclusion of the study and some recommendations for further research. A summary of the problem and objectives of the study is included along with the results of the comparative study.

6.1 Introduction

Development policy in Thailand is aimed at encouraging economic growth to serve the needs of the people. Therefore, deterioration of the environment and over exploitation of natural resources, particularly relating to forestry and water resource management cannot be avoided without using sophisticated planning tools. Water pollution is one of the most severe environmental problems in Thailand, because freshwater is crucial for use as an economic resource (e.g. water supply for industrial uses, fishery, agriculture, and electric generation). Rivers are also used as the receiving water for both domestic and industrial wastewater. Major rivers in Thailand such as the Chao Phraya, Thachin, Maklong rivers are already polluted.

Thai development schemes in the past have been largely concerned with economic issues with less priority being given to natural resource management at a national level of planning. Therefore, environmental planning in Thailand faces major constraints such as low budgets, lack of equipment and trained personnel, and few coordinating mechanisms across levels of planning. Water pollution has now accumulated to serious levels, threatening health of people living in major catchments. However, the Thai planning system has been improved through the preparation of the First to the Third of the National Economic and Social Development Plans which traditionally had not included integration of environmental considerations. The environment is now recognised as a major component of national plan (Prasith-rathsint, 1987).

The aim of this study has been to develop further means of improving the system of water resource management in Thailand by using theory and recommendations of the IUCN/UNEP/WWF (1991) "Caring for the Earth Strategy", World Commission for

Environment and Development, Agenda 21 and International Conference of Water and Environment. Examples from the New Zealand Resource Management Framework are also used in analysing the Thai framework. Finally, in Chapter Five, proposals are presented for changing the Thai framework.

6.2 Limitations of the Research

The principle contribution of this study are the recommendations for improving the framework for resource management in Thailand. Improvement of the Thai system should enable the country to achieve new targets towards sustainable development. Constraints facing this study have not diminished this contribution. Some of documents used are in the Thai language and required translation. Some documents have not been available because of difficulties associated with distances from New Zealand. As it mentioned in Chapter Four, there are more than 20 Acts and 30 departments dealing with water resource management in Thailand. This study limits investigation into three principle Acts - the Enhancement and Conservation of National Environmental Quality Act 1992, the Factory Act 1992 and the Public Health Act 1992 and two nationals plans - the Seventh National Economic and Social Development Plan (1992-1996), and the Environmental Quality Management Plan.

Moreover, other notifications and ordinances associated with these principle Acts and plans are still not well-developed because most relevant legislation was enacted in 1992. For example, ministerial rules dealing in detail with requirements for businesses carrying out offensive activities under the Public Health Act 1992 and ministerial rules specifying which activities require an Environmental Impact Assessment when renewing the permits under s.49 of the EQA, have not yet been announced.

Research into the effectiveness of the New Zealand framework is also limited because the Resource Management Act 1991 only became effective in 1991 (amended in 1993). Plans at the regional and district levels dealing with sources of pollution have not been completed and there is still a heavy reliance on transitional plans. To date, there are no national policy statements or national environmental standards for water quality. Moreover, river water quality management is not a crucial issue to most regions of New Zealand as it is in Thailand. Only a few regional councils intend to produce regional plans to deal with river water quality management. These include

Manawatu-Wanganui Regional Council (1994) and the Wellington Regional Council (1994).

6.3 Conclusion

Criteria used to evaluate the New Zealand and Thai systems of water resource management are derived from the literature review in Chapter Two. Those criteria are also used as a framework in the subsequent chapters (Chapter Three, Four and Five) in reviewing of systems and to propose changes to Thai system. The review and analysis are divided into the three principle stages of planning - Pre-Implementation, Implementation, and Post-Implementation stages. To achieve sustainable development, it is important that any evaluation framework should provide for economic development to be treated in a positive way in conjunction with natural resources and environmental management. An ideal system of resource management should not be fragmented. One of the measures to support achievement of this goal at pre-implementation stage is that system should provide for a sound environmental planning process and Strategic Environmental Assessment of policies, plans and programmes.

It was suggested that three types of approaches should be integrated in planning. The rational comprehensive approach can be used in determining the ideal plan for natural and physical resources. The strategic approach aims to overcome the institutional constraints (e.g. objectives of the organisation, changes in priorities and limitation of decision-making environment). While the interactive approach aims to define the values and roles of individuals and organisations in the environmental planning process. Before the policies or plans are integrated and implemented, the impact of these policies or plans should be assessed by using Strategic Environmental Assessment. Ideally, policies and plans should be developed at a regional level on river catchment basis. However, planning at the national and local levels are also important, as the national plan may be used as a framework for addressing nationally significant matters, and as a guide for the preparation of regional and local plans. While planning at the local level also serves to achieve the purpose of the river catchment planning, as it is the level of planning which deals with specific areas and is closest to the people affected by plans.

A variety of implementation methods may be used to increase the effectiveness of water use, and to prevent, mitigate and remedy the negative effects of human activities on river water quality. These include regulatory approaches (e.g. permit system, water quality standards, effluent standards), economic instruments (e.g. charges, subsidies), and other supportive measures (e.g. public works, advocacy and education, Best Management Practices and EIA). Moreover, monitoring and enforcement systems are also important to evaluate whether implemented policies and plans have changed people's behaviour, and to identify which groups in the community have experienced costs and benefits.

The regulatory approach is important in halting existing practices and preventing future environmental problems, because it determines quantity and nature of pollution able to discharged into the environment without incurring a penalty. Typical tools in this approach include the permit system, water quality standards, effluent standards and zoning. This type of approach allows an authority to immediately control the amount of permitted pollutants, while meeting desired water quality standards. However, it is argued that the regulatory approach provides no choice for polluters to adopt the most suitable measure for achieving the reduction of water pollution. Hence, economic instruments become useful if applied as a market mechanism such as charges, subsidies and marketable permit. Charges and subsidies are common in Thai water pollution management.

Other supportive measures which are suggested for future prevention and protection of water values are provision of public works (e.g. wastewater treatment facilities), advocacy and education, Best Management Practices and an Environmental Impact Assessment. Wastewater treatment plant is effective in controlling pollution from point sources. While other types of measures are based on voluntary approach except the EIA system can be specified in the statute and is useful in the permit system.

When the plans are implemented, they require monitoring and enforcement mechanisms to ensure that organisations concerned undertake appropriate actions referred to under each policy and plan. Moreover, it ensures that all statutory requirements are complied with. The result will be fed back into the planning system

where it is useful for decision-makers, when reviewing plans, objectives or other measures dealing with the water pollution problem.

The analysis of Thai framework for water resource management is presented in Chapter Four. Currently, the Thai framework provides for the sustainable development concept in a general context. However, the planning system has not systematically provided for integrated water resource management at national and provincial levels of planning. The system does provide for the use of various types of instruments to deal with water pollution. Therefore, sustainable utilization of water resources would be difficult to achieve in the current planning regime.

6.4 Discussion

The New Zealand system is one of the most advanced pieces of environmental legislation. It provides an integrated planning framework for consideration the needs of present and future generations. It also measures up well to WCED (1987), IUCN/UNEP/WWF (1991) and Agenda 21 recommendations. The Resource Management Act would be difficult to implement in countries with little planning and scientific expertise at all levels of planning, because it is assumed that every organisation concerned is able to conduct their activities towards same direction in achieving sustainable management of natural and physical resources.

The Thai framework aims to serve the need for present generation and encourage economic development, while environmental concerns are lesser in priority. The Planning system is also vague, partly because of assumptions about the use of National Plans in that:

(a) Ministries, departments and state enterprises are assumed to have common understanding and interpretation of their roles and responsibilities under the national plan;

(b) It is assumed that the ability of people and availability of resources are similar in all ministries, and that state enterprises can develop their plans and projects to fit the overall objectives of the national plans;

(c) It takes for granted that coordinating mechanisms among ministries, state enterprise, developers, and the public are effective, and fit the overall objectives of national plans;

(d) It assumes an effective coordinating function of the National Economic and Social Development Board and the national Environmental Board in supporting ministries and departments to develop annual plans that are in line with the objective of the national plan;

(e) It accepts the notion that the private sector has a common understanding of its role in achieving the purpose of the National Economic and Social Development Plan;

(f) It assumes the objectives of a 5-year national plan would not be distorted when implemented by the Thai bureaucracy, or by budgetary limits.

6.5 Further Research

There is a need for further research about limitations, strength and weakness of each instrument employed in water pollution control area. A summary of further research is shown in Figure 6.1.

The fragmentation of the Thai framework legislation and plans is a serious constraint. Research about deciding appropriate functions for each level of planning in thailand would be useful. Reducing the complexity of the local government structure is a further priority for research. Various organisations at all levels are responsible for water resources with different points of view about management. Further research should also deal with how to reorganise responsible environmental organisations to cooperate or to coordinate various sectors to manage the same resource.

Figure 6.1 Summary for Further Research in Thailand

Criteria	Improvement
Planning process	- National plan should aim for long-term objective of sustainable development; - Provision of integrated approaches at a regional level based on river catchment; - Regional plan and local plan should be developed with medium- and short-term objective of sustainable development; - Provision of public participation in the planning process; - Establishment of SEA for policies and plans at all levels of planning.
Permit system	- Decision should be made on river catchment basis; - Environmental factors and other measures e.g. water quality standards and carrying capacity of receiving waters should be taken into consideration.
Water quality standards	- Establishment of water quality standards at regional level for each or a set of catchments.
Effluent standards	- Establishment of effluent standards for each local areas based on carrying capacity of receiving waters; - Consideration of implementation of effluent standards in conjunction with permit system, water quality standards and other economic instruments (e.g. effluent charges, subsidies).
Zoning	- Imposition zoning policies on relocating of industrial activities away from water sources, especially water supply sources and upstream river catchments.
Economic instruments	- Establishment of effluent charges based on pollution generated and potentially adverse effects on the environment; - Imposition of economic instruments in conjunction with regulatory approaches.
Other measures	- Imposition of supportive measures (e.g. wastewater treatment facilities, Best Management Practices, provision of advocacy and information, EIA process in conjunction with regulatory and economic approaches.
Monitoring system	- Preparation of a national monitoring system including administrative and legislative measures, water and ecosystem and social impacts; - Establishment of the State of the Environment report for decision-making, and regularly provide environmental information to the public.
Enforcement system	- Establishment of an effective enforcement system for environmental control.

The consequences of imposing environmental policy from a national level should also be of interest to researchers, since each policy instrument or the combination of the imposed policies may cause both beneficial and adverse effects on the environment. Therefore, environmental quality and ecosystem, social impacts and institutional structures should be re-evaluated.

Economic development in Thailand is the first priority of the country's development. However, the measures to prevent or remedy or mitigate the adverse effects on the environment resulting from the economic development should also be considered. The

result will be the further economic growth is possible, along with improvements in people's quality of life while preserving options for future generations of Thailand.

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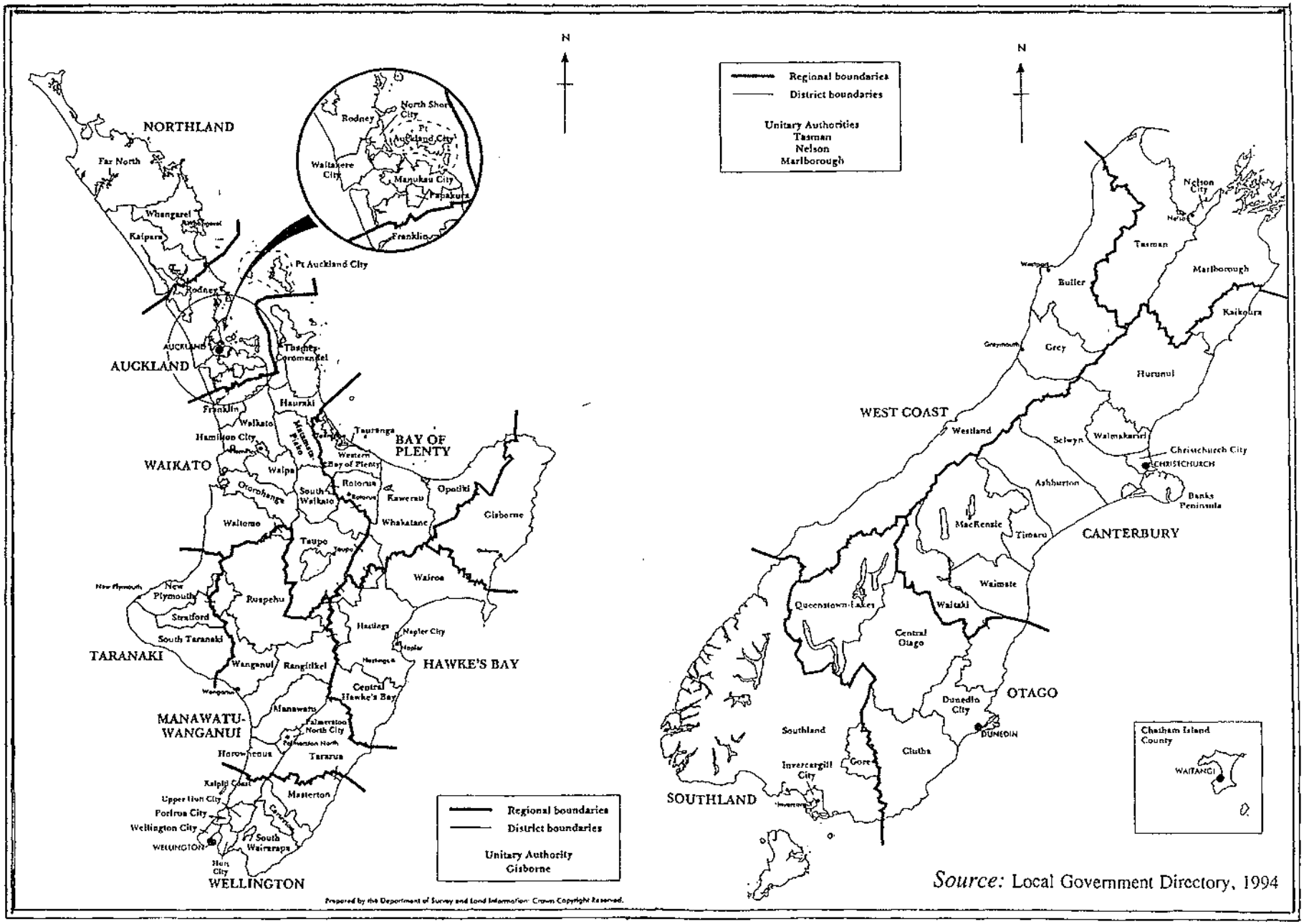
APPENDICES

APPENDIX A

THE MAP OF NEW ZEALAND



Source: Local Government Directory, 1994

APPENDIX B

SCHEDULES

Sections 60, 64, 65, and 73

FIRST SCHEDULE

Preparation, Change, and Review of Policy Statements and Plans

Analysis

PART I

Preparation and Change of Policy Statements and Plans by Local Authorities

PART II

Requests for Changes to Policy Statements and Plans of Local Authorities and Requests to Prepare a Regional Plan

FIRST SCHEDULE - PART I
Preparation and Change of Policy Statements and Plans by Local Authorities

1. Interpretation and time limits -

(1) In this Schedule, a reference to a policy statement or plan includes a reference to a change to a policy statement or plan.

(2) Where any time limit is set in this Schedule, a local authority may extend it under section 37.

(3) Where no time limit is set, section 21 (obligation to avoid unreasonable delay) applies.

(4) Where, under this Schedule, a request for a plan change is to be heard and an application for a resource consent or a requirement for a designation or heritage order has been made in relation to the same proposal, section 102 (joint hearings) and section 103 (combined hearings) may apply.

Amendment:
Clause 1(4) added by s209 RMAA 1993

2. Preparation of proposed policy statement or plan, -

(1) The preparation of a policy statement or plan shall be commenced by the preparation by the local authority concerned, of a proposed policy statement or plan.

(2) A proposed regional coastal plan shall be prepared by the regional council concerned in consultation with the Minister of Conservation and iwi authorities of the region.

3. Consultation

(1) During the preparation of a proposed policy statement or plan, the local authority concerned shall consult

(a) The Minister for the Environment; and

(b) Those other Ministers of the Crown who may be affected by the policy statement or plan; and

(c) Local authorities who may be so affected; and

(d) The tangata whenua of the area who may be so affected, through iwi authorities and tribal runanga.

(2) A local authority may consult anyone else during the preparation of a proposed policy statement or plan.

(3) Without limiting subclauses (1) and (2), a regional council which is preparing a regional coastal plan shall consult -

(a) The Minister of Conservation generally as to the content of the plan, and with particular respect to those activities to be described as restricted coastal activities in the proposed plan: and

(b) The Minister of Transport in relation to matters to do with navigation and the Minister's functions under the Marine Pollution Act 1974: and

(c) The Minister of Fisheries in relation to fisheries management, and the management of aquaculture activities.

4. Requirements to be inserted prior to notification of proposed district plans -

(1) Before a territorial authority publicly notifies a district plan under clause 5, it shall, by written request, invite requiring authorities which have a designation in the district that has not lapsed, to give written notice to the territorial authority stating whether the requiring authority requires the designation to be included in the proposed plan, with or without modification.

(2) The written request shall give the requiring authority at least 30 working days to respond, and shall specify the final date for the requiring authority to provide its written notice.

(3) Where the requiring authority states that a designation is to be included in the proposed plan, with modifications, the requiring authority shall include in its written notice the nature of the modifications, and the reasons for the modifications, in accordance with section 168(3).

(4) If the requiring authority fails to notify the local authority in accordance with subclause (1), no provision for the designation shall be included in the proposed plan.

(5) A territorial authority shall include in its proposed plan provision for any designation it receives notice of under this clause, any existing heritage orders, and any requirements for designations and heritage orders to which sections 170 and 192 apply.

(6) A territorial authority may include in its proposed district plan -

(a) Any requirement for a designation or heritage order which the territorial authority has responsibility for within its district; and

(b) Any existing designations or heritage orders, with or without modifications, which the territorial authority has responsibility for within its own district.

(7) The provisions of section 168(3) shall apply to any requirement or modification under subsection (6).

(8) Nothing in this clause applies where a territorial authority publicly notifies a change or variation to a district plan under clause 5.

Amendment:
Clause 4 repealed and substituted by s210 RMAA 1993

5. Public notice and provision of document to public bodies -

(1) A local authority that has prepared a proposed policy statement or plan shall publicly notify it.

(1A) A territorial authority shall, not earlier than 60 working days before public notification or later than 10 working days after public notification of its plan, either -

(a) Send a copy of the public notice, and such further information as the territorial authority thinks fit relating to the proposed plan, to every person whose name for the time being appears in the occupier's column of the valuation roll for the area of the territorial authority where that person, in the local authority's opinion, is likely to be directly affected by the proposed plan; or

(b) Include the public notice, and such further information as the territorial authority thinks fit relating to the proposed plan, in any publication or circular which is issued or sent to all residential properties and Post Office box addresses located in the affected area -

and shall send a copy of the public notice to any other person who, in the territorial authority's opinion, is directly affected by the plan.

(1B) Notwithstanding subclause (1A), a territorial authority shall ensure that notice is given of any requirement or modification of a designation or heritage order under clause 4 to land owners and occupiers who, in the territorial authority's opinion, are likely to be directly affected.

(1C) A regional council shall, not earlier than 60 working days before public notification or later than 10 working days after public notification, send a copy of the public notice and such further information as the regional council thinks fit relating to the proposed policy statement or plan to any person who, in the regional council's opinion, is likely to be directly affected by the proposed policy statement or plan.

(2) Public notice under subclause (1) shall state -

(a) Where the proposed policy statement or plan may be inspected; and

(b) That any person may make a submission on the proposed policy statement or plan; and

(c) The process for public participation in the consideration of the proposed policy statement or plan; and

(d) The closing date for submissions; and

(e) The address for service of the local authority.

(3) The closing date for submissions -

(a) Shall, in the case of a proposed policy statement or plan, be at least 40 working days after public notification; and

(b) Shall, in the case of a proposed change or variation to a policy statement or plan, be at least 20 working days after public notification.

(4) A local authority shall provide one copy of its proposed policy statement or plan without charge to

(a) The Minister for the Environment; and

(b) The appropriate regional manager for the Ministry for the Environment; and

(c) In the case of a regional coastal plan, the Minister of Conservation and the appropriate regional conservator for the Department of Conservation; and

(d) In the case of a district plan, the regional council and adjacent local authorities; and

(e) In the case of a policy statement or regional plan, constituent territorial authorities, and adjacent regional councils; and

(f) The tangata whenua of the area, through iwi authorities and tribal runanga.

(5) A local authority shall make any proposed policy statement or plan prepared by it available in every public library in its area and in every other place in its area that it considers appropriate.

(6) The obligation imposed by subclause (5) is in addition to the local authority's obligations under section 35 (records).

Amendment

Clause 5(1) repealed and substituted by s211(1) RMAA 1993

Clause 5(1A) (1B) & (1C) added by s189(1) RMAA 1993

Clause 5(3)(b) amended by s189(2) RMAA 1993

6. Making submissions -

Any person, including the local authority in its own area, may, in the prescribed form, make a submission to the relevant local authority on a proposed policy statement or plan that is publicly notified under clause 5.

Amendment:

Clause 6 repealed and substituted by s212 RMAA 1993

7. Public notification of submissions -

(1) A local authority shall publicly notify, through a prominent advertisement, -

(a) The availability of a summary of all decisions requested by persons making submissions on a proposed policy statement or plan; and

(b) Where the summary of decisions and the submissions can be inspected; and

(c) The date on which further submissions close, which date shall not be less than 20 working days after the date of notification; and

(d) The address for service of the local authority.

(2) A local authority shall send a copy of the public notice advising of the summary of all decisions requested by persons making submissions to all persons who made submissions.

Amendment:

Clause 7 repealed and substituted by s212 RMAA 1993

8. Further submissions -

Any person, including the local authority in its own area, may, in the prescribed form, make a further submission to the relevant local authority, but only in support of or in opposition to those submissions made under clause 6 on a proposed policy statement or plan.

Amendment:

Clause 8 repealed and substituted by s212 RMAA 1993

8A Service of further submissions -

Where a person makes a further submission under clause 8, that person shall, within 5 working days after making the submission to the local authority, serve a copy of the further submission on the person who made a submission under clause 6 to which the further submission relates.

Amendment:

Clause 8A added by s212 RMAA 1993

8B Hearing by local authority

A local authority shall hold a hearing into submissions on its proposed policy statement or plan, and any requirements notified under clause 4, and give at least 10 working days notice of the dates, times, and place of the hearings to -

(a) Every person who made a submission or further submission, and who requested to be heard (and has not since withdrawn that request); and

(b) In the case of a district plan, every authority which made a requirement under clause 4.

Amendment:

Clause 8B added by s212 RMAA 1993

8C Hearing not needed -

Where submissions are made but no person indicates they wish to be heard, or the request to be heard is withdrawn, the local authority shall consider the submissions along with the other relevant matters, but shall not be required to hold a hearing.

Amendment:

Clause 8C added by s212 RMAA 1993

8D Withdrawal of proposed policy statements and plans -

(1) Where a local authority has initiated the preparation of a policy statement or plan, the local authority may withdraw its proposal to prepare, change, or vary the policy statement or plan at any time -

(a) Where no reference has been made to the Planning Tribunal under clause 14, or every such reference has been withdrawn, before the policy statement or plan has been approved by the local authority; or

(b) Where any reference has been made to the Planning Tribunal, before any Planning Tribunal hearing commences

(2) The local authority shall give public notice of any withdrawal under subclause (1), including the reasons for the withdrawal.

Amendment: Clause 8D added by s212 RMAA 1993

Annotation:

Cl 8D - Councils should promptly process and come to a decision on changes and variations to their district plan. Where objections and cross objections had been called but no action had been taken between August 1991 and June 1993 the Tribunal commented this was poor practice see - Te Aroha Air Quality Protection Appeal Group v Waikato R.C. & Others, A070/93 NZPTD Vol 2

9. Recommendations and decisions on requirements -

(1) The territorial authority shall make and notify its recommendation in respect of any provision included in the proposed district plan under clause 4(5) to the appropriate authority in accordance with section 171 or section 191.

(2) The territorial authority shall make its decision on provisions included in the proposed district plan under clause 4(6) in accordance with section 168A(3) or section 189A(3), as the case may be.

(3) Nothing in this clause shall require the territorial authority to make a recommendation or decision in respect of any existing designations or heritage orders that are included without modification and on which no submissions are received.

Amendment: Clause 9 repealed and substituted by s213 RMAA 1993

10. Decision of local authority -

Subject to clause 9, whether or not a hearing is held on a proposed policy statement or plan, the local authority shall give its decisions, which shall include the reasons for accepting or rejecting any submissions (grouped by subject-matter or individually).

Amendment: Clause 10 repealed and substituted by s214 RMAA 1993

11. Notification of decision -

(1) A local authority shall serve, on every person who made a submission on a provision, a copy of its decision on that provision.

(2) Where a decision has been made under clause 9(2), the territorial authority shall also notify land owners and occupiers who, in the territorial authority's opinion, are directly affected by the decision.

Amendment: Clause 11 repealed and substituted by s214 RMAA 1993

12. Record of effect of decisions on provisions other than requirements

Amendment: Clause 12 repealed by s214 RMAA 1993

13. Decision of requiring authority or heritage protection authority

(1) A requiring authority or heritage protection authority shall notify the territorial authority whether it accepts or rejects its recommendation in whole or in part

within 30 working days after the day on which the territorial authority notifies its recommendation under clause 9.

(2) A requiring authority and a heritage protection authority may modify a requirement if, and only if, that modification is recommended by the territorial authority, or it is not inconsistent with the requirement as notified.

(3) The territorial authority shall alter the proposed district plan to show the modification or delete the requirement in accordance with the requiring authority's or heritage protection authority's notice.

(4) The territorial authority shall ensure a copy of the decision by the requiring authority or heritage protection authority is served on every person who made a submission on the requirement, and on the land owners and occupiers who are directly affected by the decision, within 15 working days of the territorial authority receiving the decision.

Amendments:
Clause 13(1) amended by s214(2) RMAA 1993
Clause 13(4) repealed and substituted by s214(3) RMAA 1993
Clause 13(5) repealed by s214(3) RMAA 1993

14. Reference of decision on submissions and requirements to the Planning Tribunal

(1) Any person who made a submission on a proposed policy statement or plan may refer to the Planning Tribunal

(a) Any provision included in the proposed policy statement or plan, or a provision which the decision on submissions proposes to include in the policy statement or plan; or

(b) Any matter excluded from the proposed policy statement or plan, or a provision which the decision on submissions proposes to exclude from the policy statement or plan,

if that person referred to that provision or matter in that person's submission on the proposed policy statement or plan.

(2) Subclause (1) does not apply to any provision that is included under clause 4.

(3) The following persons may refer any aspect of a requiring authority's or heritage protection authority's decision to the Planning Tribunal:

(a) Any person who made a submission on the requirement which referred to that matter; or

(b) The territorial authority.

(4) Any reference to the Planning Tribunal under this clause shall be lodged with the Planning Tribunal within 15 working days of service of the decision of the local authority under clause 11 or the service of the decision of a requiring authority or heritage protection authority under clause 13. and shall state -

(a) The reasons for the reference and relief sought; and

(b) The address for service of the person who made the reference; and

(c) Any other matters required by regulations.

(5) A person who makes a reference to the Planning Tribunal under this clause shall serve a copy of the notice
   (a) Within the time specified in subclause (4), on -
      (i) The local authority; and
      (ii) The requiring authority or heritage protection authority, as the case may be, in the case of a requirement; and
   (b) Where the reference is made in respect of a submission on a provision, other than a requirement, within 5 working days of making the reference, on
      (i) Every person who made a submission on that provision; and
      (ii) The Minister of Conservation. in the case of a regional coastal plan; and
   (c) Where the reference is made in respect of a requirement in a district plan, on every person who made a submission on that requirement within 5 working days of making the reference.

Amendments:
Clause 14(2) amended by s214(4)RMAA 1993
Clause 14(4) repealed and substituted by s214(5) RMAA 1993

15. Hearing by the Planning Tribunal

(1) The Planning Tribunal shall hold a public hearing into any provision or matter referred to it.

(2) Where the Tribunal holds a hearing into any provision of aproposed policy statement or plan (other than a regional coastal plan) that reference is an appeal, and the Tribunal may confirm, or direct the local authority to modify, delete, or insert, any provision which is referred to it.

(3) Where the Tribunal hears a reference into a regional coastal plan. that reference is an inquiry and the Tribunal

(a) Shall report its findings to the applicant. the local authority concerned, and the Minister of Conservation; and

(b) May include a direction to the regional council to make modifications to, deletions from, or additions to, the regional coastal plan.

16. Amendment of proposed policy statement or plan -

(1) A local authority shall make an amendment to its proposed policy statement or plan to give effect to any directions of the Planning Tribunal.

(2) A local authority may make an amendment, without further formality, to its proposed policy statement or plan to alter any information, where such an alteration if of minor effect, or may correct any minor errors.

Amendment:
Clause 16 repealed and substituted by s215 RMAA 1993

16A. Variation of proposed policy statement or plan -

(1) A local authority may initiate variations (being alterations other than those under clause 16) to a proposed policy statement or plan, or to a change, at any time before

the approval of the policy statement or plan.

(2) The provisions of this Schedule, with all necessary modifications, shall apply to every variation as it if were a change.

Amendment:
Clause 16A added by s215 RMAA 1993

16B. Merger with proposed policy statement or plan -

Every variation initiated under clause 16a shall be merged in and become part of the proposed policy statement or plan as soon as the variation and the proposed policy statement or plan are both at the same procedural stage; but where the variation includes a provisions to be substituted for a provision in the proposed policy statement or plan against which a submission or an appeal has been lodged, that submission or appeal shall be deemed to be a submission or appeal against the variation.

Amendment:
Clause 16B added by s215 RMAA 1993

17. Final consideration of policy statements and plans other than regional coastal plans

(1) A local authority shall approve a proposed policy statement or plan (other than a regional coastal plan) once it has made amendments under clause 16, or variations under clause 16A (if any).

(2) A local authority may, with the consent of the Planning Tribunal, approve part of a policy statement or plan, if all submissions or appeals relating to that part have been disposed of.

(3) Every approval under this clause shall be effected by affixing the seal of the local authority to the proposed policy statement or plan.

Amendment:
Clause 17(1) amended by s216(1) RMAA 1993
Clause 17(3) repealed and substituted by s216(2) RMAA 1993

18. Consideration of a regional coastal plan by regional council

(1) A regional council shall adopt a proposed regional coastal plan for reference to the Minister of Conservation once it has made amendments under clause 16 or variations under clause 16A (if any).

(2) Every adoption of a proposed regional coastal plan under this clause shall be effected by affixing the seal of the regional council to the proposed regional coastal plan.

(3) As soon as practicable after a regional council adopts a proposed regional coastal plan it shall send the plan to the Minister of Conservation for his or her approval.

(4) A regional council may adopt part of a proposed regional coastal plan if all submissions or inquiries relating to that part have been disposed of.

Amendments:
Clause 18(1) amended by s217(1) RMAA 1993
Clause 18(2) repealed and substituted by s217(2) RMAA 1993
Clause 18(3) amended by s217(3) RMAA 1993
Clause 18(4) added by s217(4) RMAA 1993

19. Ministerial approval of regional coastal plan -

(1) Prior to his or her approval of a regional coastal plan, the Minister of Conservation may require the regional council to make any amendments to the plan specified by that Minister.

(2) The Minister of Conservation may not require a regional council to make an amendment to a regional coastal plan that is in conflict or inconsistent with any direction of the Planning Tribunal, unless the Minister made a submission on the provision concerned when the provision was referred to the Tribunal.

(3) When the Minister of Conservation requires a regional council to make changes under subclause (1), the Minister shall give reasons.

(3A) If all submissions or inquiries relating to part of a regional coastal plan have been disposed of, the Minister of Conservation may approve that part.

(4) Every approval of a regional coastal plan under this clause shall be effected by the Minister of Conservation signing the regional coastal plan.

Amendment:
Clause 19(3A) inserted by s218 RMAA 1993

20. Operative date -

(1) Subject to subclause (2), an approved policy statement or plan shall become an operative policy statement or plan on a date which is to be publicly notified.

(2) The local authority shall publicly notify the date on which the policy statement or plan becomes operative at least 5 working days before the date on which it becomes operative.

(3) Repealed by s219 RMAA 1993

(4) The local authority shall provide one copy of its operative policy statement or plan without charge to

(a) The Minister for the Environment: and

(b) The appropriate regional manager for the Ministry for the Environment; and

(c) In the case of a regional coastal plan, the Minister of Conservation and the appropriate regional conservator for the Department of Conservation: and

(d) In the case of a district plan, the regional council and adjacent territorial authorities: and

(e) In the case of a policy statement or regional plan, constituent territorial authorities and adjacent regional councils: and

(f) The tangata whenua of the area, through iwi authorities and tribal runanga.

(5) The local authority shall provide one copy of its operative policy statement or plan to every public library in its area.

(6) The obligation imposed by subclause (5) is in addition to the local authority's obligations under section 35 (records).

Amendments:
Clause 20(1) & (2) repealed and substituted by s219 RMAA 1993
Clause 20(3) repealed by s219 RMAA 1993

FIRST SCHEDULE - PART II

Requests for Changes to Policy Statements and Plans of Local Authorities and Requests to Prepare Regional Plans

21. Requests -

(1) Any person may request a change to a district plan or a regional plan (including a regional coastal plan).

(2) Any person may request the preparation of a regional plan, other than a regional coastal plan.

(3) Any Minister of the Crown or any territorial authority in the region may request a change to a regional policy statement.

22. Form of request -

(1) A request made under clause 21 shall be made to the appropriate local authority in writing and shall explain the purpose of, and reasons for, the proposed plan or change to a policy statement or plan.

(2) Where environmental effects are anticipated, the request shall describe those effects, taking into account the provisions of the Fourth Schedule, in such detail as corresponds with the scale and significance of the actual or potential environmental effects anticipated from the implementation of the change, policy statement, or plan.

23. Further information may be required -

(1) Where a local authority receives a request from any person under clause 21, it may within 20 working days, by written notice, require that person to provide further information necessary to enable the local authority to better understand -

(a) The nature of the request in respect of the effect it will have on the environment, including taking into account the provisions of the Fourth Schedule; or

(b) The ways in which any adverse effects may be mitigated; or

(c) The benefits and costs, the efficiency and effectiveness, and any possible alternatives to the request; or

(d) The nature of any consultation undertaken or required to be undertaken -

if such information is appropriate to the scale and significance of the actual or potential environmental effects anticipated from the implementation of the change or plan.

(2) A local authority, within 15 working days of receiving any information under this clause, may require additional information relating to the request.

(3) A local authority may, within 20 working days of receiving a request under clause 21, or, if further or additional information is sought under subclause (1) or subclause (2), within 15 working days of receiving that information, commission a report in relation to the request and shall notify the person who made the request that such a report has been commissioned.

24. Modification of request -

As a result of further or additional information, commissioned reports, or other relevant matters the local authority may, with the agreement of the person who made the request, modify the request.

25. Local authority to consider request -

(1) A local authority shall, within 30 working days of-

(a) Receiving a request under clause 21; or

(b) Receiving all required information or any report which was commissioned under clause 23; or

(c) Modifying the request under clause 24 -

whichever is the latest, decide under which of subclauses (2),(3), and (4), or a combination of subclauses (2) and (4), the request shall be dealt with.

(2) The local authority may accept the request in whole or in part and either -

(a) Adopt the request or part of the request as if it was a proposed policy statement or plan made by the local authority itself and -

(i) It shall thereupon be notified in accordance with clause 5 within 4 months of the local authority adopting the request; and

(ii) The provisions of Part I of this Schedule shall apply; and

(iii) The proposed plan shall have effect once publicly notified; or

(b) Proceed to notify the request or part of the request under clause 26.

(3) The local authority may decide to deal with the request as if it were an application for a resource consent and the provisions of Part VI shall apply accordingly.

(4) The local authority may reject the request in whole or in part, but only on the grounds that -

(a) The request or part of the request is frivolous of vexatious; or

(b) The substance of the request or part of the request has been considered and given effect to or rejected by the local authority or Planning Tribunal within the last 2 years; or

(c) The request or part of the request is not in accordance with sound resource management practice; or

(d) The request or part of the request would make the policy statement or plan

inconsistent with Part V: or

(e) In the case of a proposed change to a policy statement or plan, the policy statement or plan has been operative for less than 2 years.

(5) The local authority shall notify the person who made the request, within 10 working days, of its decision under this clause, and the reasons for that decision.

26. Notification timeframes -

Where a local authority accepts the request or part of the request under clause 25(2)(b) -

(a) The local authority shall prepare the change to the policy statement or plan in consultation with the person who made the request under clause 21: and

(b) The local authority shall publicly notify the change or the proposed policy statement or plan -

(i) Within 4 months of agreeing to adopt the request; or

(ii) Within the period that the Planning Tribunal directs under clause 27.

27. Appeals

(1) Where a local authority agrees to the request only in part, or refuses the request, or decides to treat the request as an application for a resource consent under clause 25, the person who made the request may, within 15 working days of receipt of the decision, appeal to the Planning Tribunal against the local authority's decision.

(2) The Planning Tribunal may make such decision on any such appeal as it thinks fit.

28. Withdrawal of requests -

(1) Where any person has made a request under clause 21 that person may withdraw the request at any time before the decision by the local authority under clause 29 is notified.

(2) Where any local authority has reasonable grounds to consider that a person who made a request under clause 21 no longer wishes to continue with the request, the local authority may send a notice to that person at their last known address.

(3) A notice sent under subclause (2) shall state that if the person who made the request does not advise the local authority within 30 working days of their wish to continue with the request, the local authority shall deem the request to have been withdrawn.

(4) If the local authority receives no response to its notice sent under subclause (2), it shall deem the request to have been withdrawn under subclause (1).

(5) Where notice of withdrawal if given under subclause (1) or is deemed to be given under subclause (4), preparation of the policy statement or plan or change shall cease, unless the local authority determines to proceed with the request itself under this Part.

(6) The local authority shall ensure that, within 15 working days of receiving a notice

of withdrawal under subclause (1) or deeming it to be withdrawn under subclause (4), public notice of the withdrawal, including the reason for the withdrawal, is given, unless the local authority determines to proceed with the request itself.

29. Procedure under this Part -

(1) Except as provided in subclauses (2) to (9), Part I of this Schedule, with all necessary modifications, shall apply to any plan or change requested under this Part and accepted under clause 25(2)(b).

(2) The local authority shall send copies of all submissions on the plan or change to the person who made the request.

(3) The person who made the request has the right to appear before the local authority under clause 8B.

(4) After considering a plan or change, the local authority may decline, approve, or approve with modifications, the plan or change, and shall give reasons for its decision.

(5) In addition the those persons covered by clause 11, the local authority shall serve a copy of its decision on the person who made the request under clause 21.

(6) The person who made the request, and any person who made submissions on the plan or change, may refer the decision of the local authority to the Planning Tribunal.

(7) Where a plan or change has been referred to the Planning Tribunal, clauses 14 and 15 shall apply, with all necessary modifications.

(8) Where a plan or change has been referred to the Planning Tribunal, the person who made the request under clause 21 has the right to appear before the Planning Tribunal.

(9) With the agreement of the person who made the request, the local authority may, at any time before its decision on the plan or change, initiate a variation under clause 16A.

Amendment:
Part II of First Schedule repealed and substituted by s220 RMAA 1993

Source: Resource Management Act 1991 (1993 Amendment)

APPENDIX C

SECOND SCHEDULE

Sections 62, 67, and 75

Matters That May Be Provided For In Policy Statements And Plans

SECOND SCHEDULE - PART I
Matters Related to Regions

1. Any matter relating to the use, development, or protection of any natural and physical resources for which the regional council has responsibility under this Act, including the control of

(a) Taking, using, damming, or diverting of any water in the region:

(b) The quantity, level, and flow of water in any water body, including

(i) The setting of any maximum or minimum levels or flows of water:

(ii) The control of the range, or rate of change, of levels or flows of water:

(c) Discharges of contaminants into or onto land, air, or water, and discharges of water into water:

(d) Setting objectives and policies for any actual or potential effects of any use, development, or protection of land described in section 9 which are of regional significance:

(e) Use of land for the purpose of -

(i) Soil conservation:

(ii) The maintenance and enhancement of the quality of water in water bodies and coastal water:

(iii) The maintenance of the quantity of water in water bodies and coastal water:

(iv) The avoidance or mitigation of natural hazards:

(v) The prevention or mitigation of any adverse effects of the storage, use, disposal, and transportation of hazardous substances:

(f) The introduction or planting of any plant in, on, or under any bed of a river or lake for any purpose described in paragraph (e):

(g) Any emission of noise arising from any activity referred to in paragraphs (a) to (f), and the mitigation of the effects of noise.

(2) In the case of a regional coastal plan, any matter relating to the use, development, or protection of the coastal marine area covering the area which a regional council has responsibility for under this Act, in conjunction with the Minister of Conservation, including the control of

(a) Use of the coastal marine area described in section 12 including, where appropriate, the protection of conservation values, the recognition of opportunities for recreation, aquaculture, and other forms of development:

(b) Actual or potential effects of the use, development, or protection of the land, including the avoidance or mitigation of natural hazards and the prevention or mitigation of any adverse effects of the storage, use, disposal, or

transportation of hazardous substances:

(c) Occupation of space on lands of the Crown or lands vested in the regional council and the extraction of sand, shingle, and other natural material from those lands:

(d) Activities in relation to the surface of the water :

(e) Discharges of contaminants into or onto land, air, or water, and discharges of water into water:

(f) Taking, using, damming, or diverting of the water:

(g) Any emission of noise arising from any activity referred to in paragraphs (a) to (f), and the mitigation of the effects of noise.

(3) In the case of a regional coastal plan, any matters necessary for the implementation of any policy stated in a New Zealand coastal policy statement in respect of the Crown's interests in land of the Crown in the coastal marine area.

(4) Any matter relating to the management of any actual or potential effects of any use, development, or protection described in clauses 1 or 2 on

(a) The community or any group within the community (including minorities, children, and disabled people):

(b) Other natural and physical resources:

(c) Natural, physical, or cultural heritage sites and values, including landscape, land forms, historic places, and waahi tapu:

(d) The creation, minimisation, recycling, treatment, disposal, and containment of all forms of contaminants.

(5) The circumstances when a financial contribution (within the meaning of section 108 (9)), whether in cash, land, works, or services, may be imposed, the maximum amount of the levy that may be imposed or the formula by which such amount may be calculated, and the general purposes for which the levy may be used.

(6) The scale, sequence, timing, and relative priority of regional public works, goods, and services, including public utility networks which cross district boundaries.

Amendments:

Clause (1)(d) amended by s221(1) RMAA 1993

Clause (2) amended by s221(2) RMAA 1993

Clause (2)(d) amended by s221(2) RMAA 1993

Clause (2)(f) amended by s221(2) RMAA 1993

Esplanade Reserves and Strips on Reclamations

(7) Having regard to section 229, those locations or circumstances where an esplanade reserve or esplanade strip is required to be set aside or created on a reclamation and the width of such a reserve or strip.

Amendments:

Clause (7) added by s222 RMAA 1993

SECOND SCHEDULE - PART II

Matters Related to Districts

(1)Any matter relating to the management of the use, development, or protection of land and any associated natural and physical resources for which the territorial authority has responsibility under this Act, including the control of

(a) Any actual or potential effects of any use of land described in section 9(4) (a) to (e), including -

(i) For the purpose of the avoidance or mitigation of natural hazards; and

(ii) For the purpose of the prevention or mitigation of any adverse effects of the storage, use, disposal, or transportation of hazardous substances:

(b) Any subdivision of land described in section 11 and Part X of this Act:

(c) Any emission of noise from land and structures in the district, and the mitigation of the effects of noise:

(d) Any actual or potential effects of activities in relation to the surface of water in rivers and lakes.

(2) Any matter relating to the management of any actual or potential effects of any use, development, or protection described in clause 1 of this Part, including on

(a) The community or any group within the community (including minorities, children, and disabled people):

(b) Other natural and physical resources:

(c) Natural, physical, or cultural heritage sites and values, including landscape, land forms, historic places, and waahi tapu.

(3) The circumstances when a financial contribution (within the meaning of section 108 (9)), whether in cash, land, works, or services, may be imposed, the maximum amount of the levy that may be imposed or the formula by which such amount may be calculated, and the general purposes for which the levy may be used.

(4) repealed by s224 RMAA 1993

(5) Having regard to s229 -

(a) Where any allotment of less than 4 hectares is created when land is subdivided, the locations or circumstances in which the requirement under section 230 to set aside a 20 metre reserve should -

(i) Apply; or

(ii) Be waived; or

(iii) Be varied by increasing or reducing the width of the reserve; or

(iv) Be replaced by a requirement to create, under section 232, an esplanade strip of a specified width:

(b) Where any allotment of 4 hectares or more is created when land is subdivided, the locations or circumstances in which an esplanade reserve or esplanade strip is required to be set aside or created and the width of the reserve or strip:

(c) The locations or circumstances where an access strip would be appropriate:

(d) The locations or circumstances in which an esplanade reserve required under section 345 of the Local Government Act 1974 when a road is stopped should -
(i) Be waived: or
(ii) Be varied by increasing or reducing the width of the reserve: or
(iii) Be replaced by a requirement to create, under section 232, an esplanade strip of a specified width:

(e) The locations where, or the circumstances in which, the vesting of ownership of land in the coastal marine area or the bed of a lake or river under section 237A would be appropriate.

(6) The scale, sequence, timing, and relative priority of public works, goods, and services, including public utility networks and any provision for land used or to be used for a public work for which the territorial authority has financial responsibility.

Amendments:
Clause 1(a)(i) & (ii) repealed and substituted by s223 RMAA 1993
Clause (4) repealed by s224 RMAA 1993
Clause (5) repealed and substituted by s224 RMAA 1993

Source: Resource Management Act 1991 (1993 Amendment)

APPENDIX D

THIRD SCHEDULE

Section 69

Water Quality Classes

Note: The standards listed for each class apply after reasonable mixing of any contaminant or water with the receiving water and disregard the effect of any natural perturbations that may affect the water body.

2. Class AE Water (being water managed for aquatic ecosystem purposes)

(1) The natural temperature of the water shall not be changed by more than 3° Celsius.

(2) The following shall not be allowed if they have an adverse effect on aquatic life:

(a) Any pH change:

(b) Any increase in the deposition of matter on the bed of the water body or coastal water:

(c) Any discharge of a contaminant into the water.

(3) The concentration of dissolved oxygen shall exceed 80% of saturation concentration.

(4) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

2. Class F Water (being water managed for fishery purposes)

(1) The natural temperature of the water -

(a) Shall not be changed by more than 3° Celsius, and

(b) Shall not exceed 25° Celsius.

(2) The concentration of dissolved oxygen shall exceed 80% of saturation concentration.

(3) Fish shall not be rendered unsuitable for human consumption by the presence of contaminants.

3. Class FS Water (being water managed for fish spawning purposes)

(1) The natural temperature of the water shall not be changed by more than 3° Celsius. The temperature of the water shall not adversely affect the spawning of the specified fish species during the spawning season.

(2) The concentration of dissolved oxygen shall exceed 80% of saturation concentration.

(3) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

4. Class SG Water (being water managed for the gathering or cultivating of shellfish for human consumption)

(1) The natural temperature of the water shall not be changed by more than 3° Celsius.

(2) The concentration of dissolved oxygen shall exceed 80% of saturation concentration.

(3) Aquatic organisms shall not be rendered unsuitable for human consumption by the presence of contaminants.

5. Class CR Water (being water managed for contact recreation purposes)

(1) The visual clarity of the water shall not be so low as to be unsuitable for bathing.

(2) The water shall not be rendered unsuitable for bathing by the presence of contaminants.

(3) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

6. Class WS Water (being water managed for water supply purposes)

(1) The pH of surface waters shall be within the range 6.0-9.0 units.

(2) The concentration of dissolved oxygen in surface waters shall exceed 5 grams per cubic metre.

(3) The water shall not be rendered unsuitable for treatment (equivalent to coagulation, filtration, and disinfection) for human consumption by the presence of contaminants.

(4) The water shall not be tainted or contaminated so as to make it unpalatable or unsuitable for consumption by humans after treatment (equivalent to coagulation, filtration, and disinfection), or unsuitable for irrigation.

(5) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

7. Class I Water (being water managed for irrigation purposes)

(1) The water shall not be tainted or contaminated so as to make it unsuitable for the irrigation of crops growing or likely to be grown in the area to be irrigated.

(2) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.

8. Class IA Water (being water managed for industrial abstraction)

(1) The quality of the water shall not be altered in those characteristics which have a direct bearing upon its suitability for the specified industrial abstraction.

(2) There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water

9. Class NS Water (being water managed in its natural state)

The natural quality of the water shall not be altered.

10. Class A Water (being water managed for aesthetic purposes)

The quality of the water shall not be altered in those characteristics which have a direct bearing upon the specified aesthetic values.

11. Class C Water (being water managed for cultural purposes)

The quality of the water shall not be altered in those characteristics which have a direct bearing upon the specified cultural or spiritual values.

Source: Resource Management Act 1991 (1993 Amendment)

APPENDIX E

Manawatu Water Quality Standards

for Contact Recreation Purposes

(a) The change in horizontal visibility over reaches of rivers shall not be greater than 30 %. (Horizontal visibility is defined as the horizontal sighting range of a 200 mm black disc).

(b) The change in hue over reaches of rivers shall not be greater than 10 points on the Munsell scale.

(c) In the defined reaches of rivers the euphotic depth (the depth at which photosynthetically active radiation (PAR) is reduced to 1 % of its value immediately below the water surface, as measured by a standards PAR meter) shall not be changed by more than 10 %. In shallow waters the reduction in light at the sediment bed shall not exceed 20 % of its undisturbed value.

(d) The daily average concentration of ammonia in water:
(reduction) shall not exceed 1.1 g/m at water temperature of 15 C; or
(ii) shall not exceed 0.8 g/m at water temperature of 20 C.

(e) The daily average carbonaceous BOD concentration due to dissolved organic compounds (that is, material passing through a GF/C filter), shall not exceed 2 g/m.

(f) The water shall not be rendered unsuitable for bathing by the presence of contaminants. With the exception of entercocci bacteria, all discharges shall comply with this standards as soon as this Plan becomes operative.

(g) The horizontal visibility in lakes and rivers shall be greater than 1.6 metres. horizontal visibility is defined as the horizontal sighting range of a 200 mm. black disc. Existing discharges shall comply with this Standard by 1 June 1999.

(h) bacterial and/or fungal slime growths shall not be visible to the naked eye as plumose growths or mats. Existing discharges shall comply with this Standard by 1 June 1999.

(i) The daily average concentration of particulate organic matter shall not exceed 5 g/m. Existing discharges shall comply with this Standard by 1 June 2004.

(j) The median concentration of entercocci of at least 20 samples taken throughout the bathing season shall not exceed 33 per 100 ml. nor shall any sample exceed 107 enterococci per 100 ml. The bathing season is defined as the period of November to Easter inclusive. Existing discharges shall comply with this Standard by 1 June 2004.

(k) The seasonal maximum cover of stream or river beds by periphyton as filamentous growths or mats (more than 3 mm. thick) shall not exceed 40% and the biomass on the bed hall not exceed 100 mg. chlorophyll /m over a representative reach. Existing discharges shall comply with this Standard by 1 June 2009.

(l) The daily average concentration of dissolved reactive phosphorus (DRP) shall be less than 15 mg/m unless other physical and/or biological factors prevent undesirable biological growths developing at higher DRP concentrations. Existing discharges shall comply with this Standard by 1 June 2009.

Source: Rule 1 and Rule 2 of the Proposed Manawatu Catchment Water Quality Regional Plan, 1994

APPENDIX F

FOURTH SCHEDULE

Section 88(6)(b)

Assessment of Effects on the Environment

1. Matters that should be included in an assessment of effects on the environment -

Subject to the provisions of any policy statement or plan, an assessment of effects on the environment for the purposes of section 88(6)(b) should include

(a) A description of the proposal:

(b) Where it is likely that an activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity:

(c) Repealed by s225 RMAA 1993

(d) An assessment of the actual or potential effect on the environment of the proposed activity:

(e) Where the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment which are likely to arise from such use:

(f) Where the activity includes the discharge of any contaminant, a description of

(i) The nature of the discharge and the sensitivity of the proposed receiving environment to adverse effects; and

(ii) Any possible alternative methods of discharge, including discharge into any other receiving environment:

(g) A description of the mitigation measures (safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect:

(h) An identification of those persons interested in or affected by the proposal, the consultation undertaken, and any response to the views of those consulted.

(i) Where the scale or significance of the activity's effect are such that monitoring is required, a description of how, once the proposal is approved, effects will be monitored and by whom.

Amendment:

Clause 1(c) repealed by s225 RMAA 1993

2. **Matters that should be considered when preparing an assessment of effects on the environment -**

Subject to the provisions of any policy statement or plan, any person preparing an assessment of the effects on the environment should consider the following matters:

(a) Any effect on those in the neighbourhood and, where relevant, the wider community including any socio-economic and cultural effects:

(b) Any physical effect on the locality, including any landscape and visual effects:

(c) Any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity:

(d) Any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural, or other special value for present or future generations:

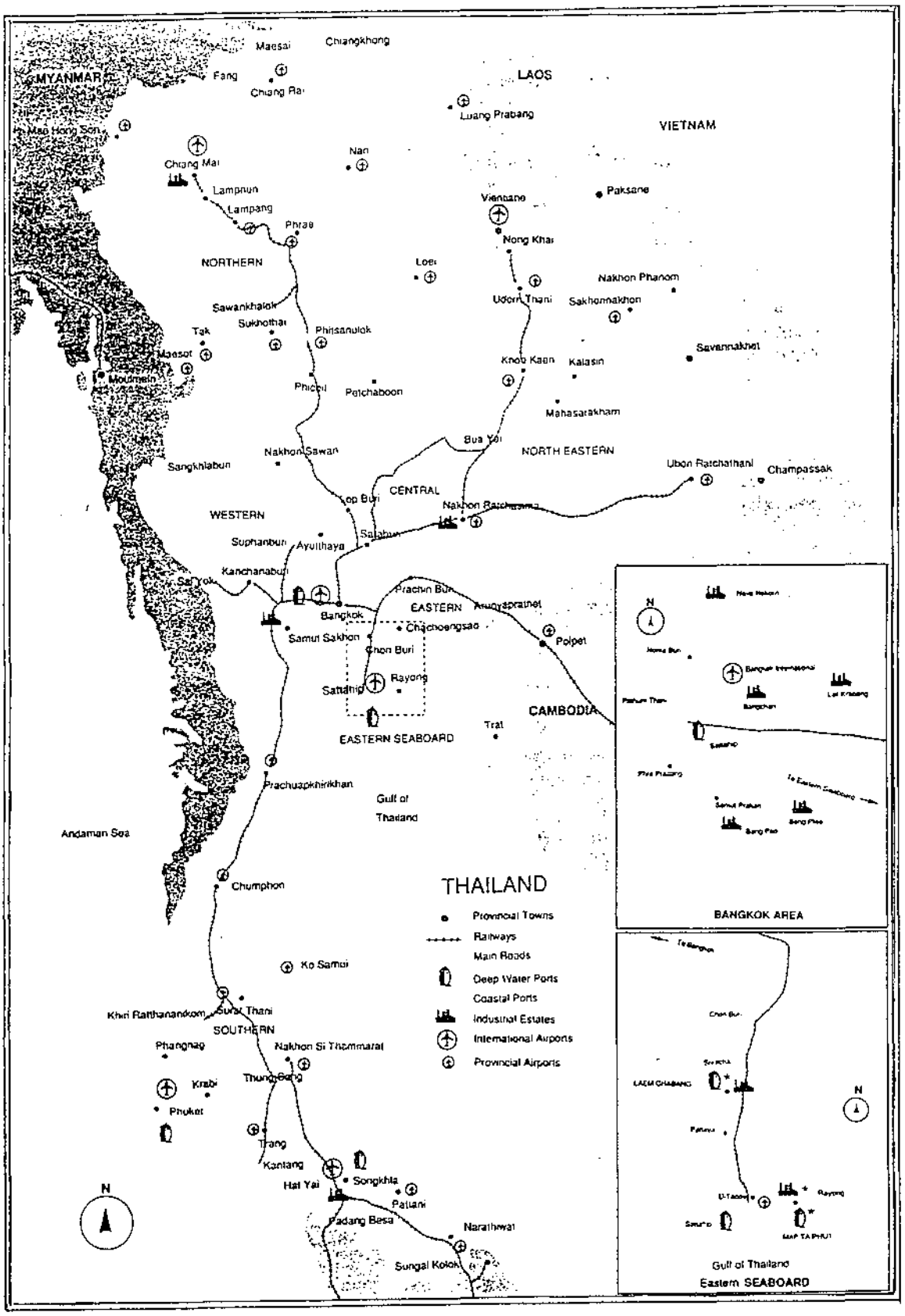
(e) Any discharge of contaminants into the environment, including any unreasonable emission of noise and options for the treatment and disposal of contaminants:

(f) Any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.

Source: Resource Management Act 1991 (1993 Amendment)

APPENDIX G

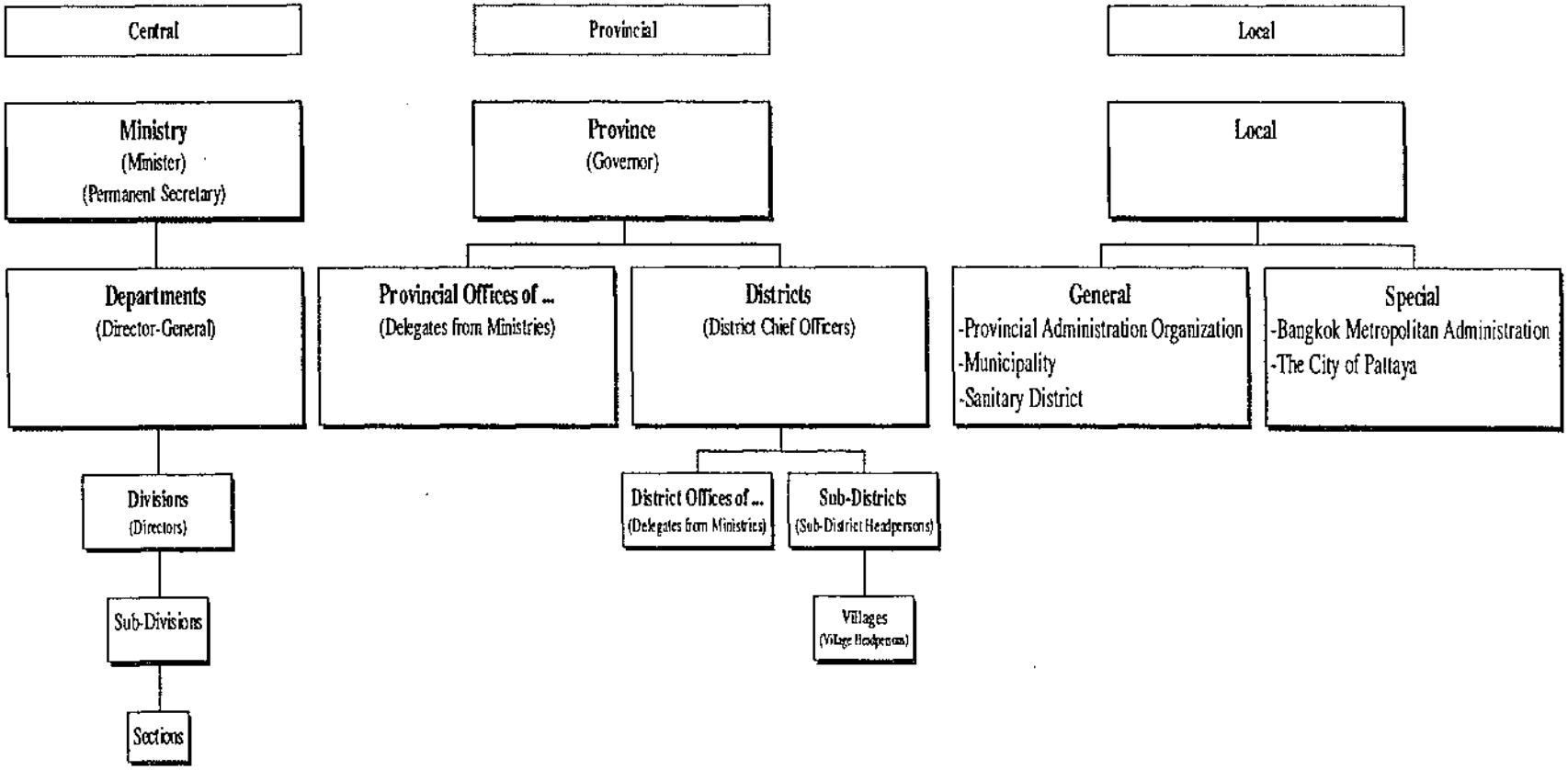
The Map of Thailand



Source: Office of the Prime Minister and Ministry of Foreign Affairs, 1994

APPENDIX H

THAI PUBLIC ADMINISTRATION



Source: Department of Local Administration, 1994

APPENDIX I

SURFACE WATER QUALITY STANDARDS IN THAILAND

Parameter	Units	Statistic	Standard value for class*** 1	2	3	4	5
1.Colour, Odour and Taste	-	-	n	n	n	n	-
2.Temperature	^{o}C	-	n	n'	n'	n'	-
3.pH value	-	-	n	5-9	5-9	5-9	-
4.Dissolved oxygen	mg/l	P20	n	6	4	2	-
5.BOD(5 days, 20^{o}C)	mg/l	P80	n	1.5	2.0	4.0	-
6.Coliform bacteria							
-Total coliform	MPN/100 ml	P80	n	5000	20000	-	-
-Faecal coliform	"	P80	n	1000	4000	-	-
7.NO_3-N	mg/l	Max.allo-	n	←	5.0	→	-
8.NH_3-N	"	wance	n	←	0.5	→	-
9.Phenols	"	"	n	←	0.005	→	-
10.Cu	"	"	n	←	0.1	→	-
11.Ni	"	"	n	←	0.1	→	-
12.Mn	"	"	n	←	1.0	→	-
13.Zn	"	"	n	←	1.0	→	-
14.Cd	"	"	n	←	.005*,.05**	→	-
15.Cr (hexavalent)	"	"	n	←	0.05	→	-
16.Pb	"	"	n	←	0.05	→	-
17.Hg(total)	"	"	n	←	0.002	→	-
18.As	"	"	n	←	0.01	→	-
19.CN	"	"			0.005		
20.Radio-activity	Bec-		n	←	0.1	→	-
-Gross α	qurel/l	"	n	←	1.0	→	-
	"	"					
-Gross β	mg/l	"	n	←	0.05	→	-
21.Pesticides (total)							
-DDT	µg/l	"	n	←	1.0	→	-
-α BHC	"	"	n	←	0.02	→	-
-Dieldrin	"	"	n	←	0.1	→	-
-Aldrin	"	"	n	←	0.1	→	-
-Hepta-chlor & Heptachlor epoxide	"	"	n	←	0.2	→	-
-Endrin	"	"	n	←	none	→	-

Note : P = Percentile value
n = naturally
n′= naturally but changing not more than 3 ^{o}C
* = when water hardness not more than 100 mg/l as $CaCO_3$
** = when water hardness more than 100 mg/l as $CaCO_3$
*** = Water Classification

Classifications	Objectives/Condition & Beneficial Usages
Class 1	Extra clean fresh surface water resources used for: (1) conservation, not necessary pass though water treatment processes require only ordinary process for pathogenic destruction (2) ecosystem conservation where basic organisms can breed naturally
Class 2	Very clean fresh surface water resources used for: (1) consumption which requires ordinary water treatment processes before use (2) aquatic organism of conservation (3) fisheries (4) recreation
Class 3	Medium clean fresh surface water resources used for: (1) consumption, but passing through an ordinary treatment process before using (2) agriculture
Class 4	Fairly clean fresh surface water resources used for: (1) consumption, but requires special water treatment process before use (2) industry
Class 5	The resources which are not classified in class 1-4 and used for navigation

Source: Notification of the Minister of Science, Technology and Environment, B.E. 2537 (1994)

APPENDIX J

Major Rivers Water Quality Standards in Thailand

River	Control Areas (Km. from river mouth)	Water quality standard (same as standards of water classification)	Remarks
Chao Phraya River	7 - 62 62 - 142 142 - 379	Class 4 Class 3 Class 2	
Thachin River	0 - 82 82 - 202 202 - 325	Class 4 Class 3 Class 2	
Maklong River	0 - 140	Class 3	
Bangpakong River	0 - 122	Class 3	From River mouth to Ban Sang, Prachinburi Province.
Nakornnayok River	0 - 77	Class 3	From Ban Sang, Prachinburi to Muang Nakornnayok.
Prachinburi River	0 - 62	Class 2	From Ban Sang, Prachinburi Province to Muang Prachinburi.

Source: Notification of the Minister of Science, Technology and Environment, published in the Royal Thai Government Gazette Vol. 110, dated 4 August B.E. 2537 (1994).

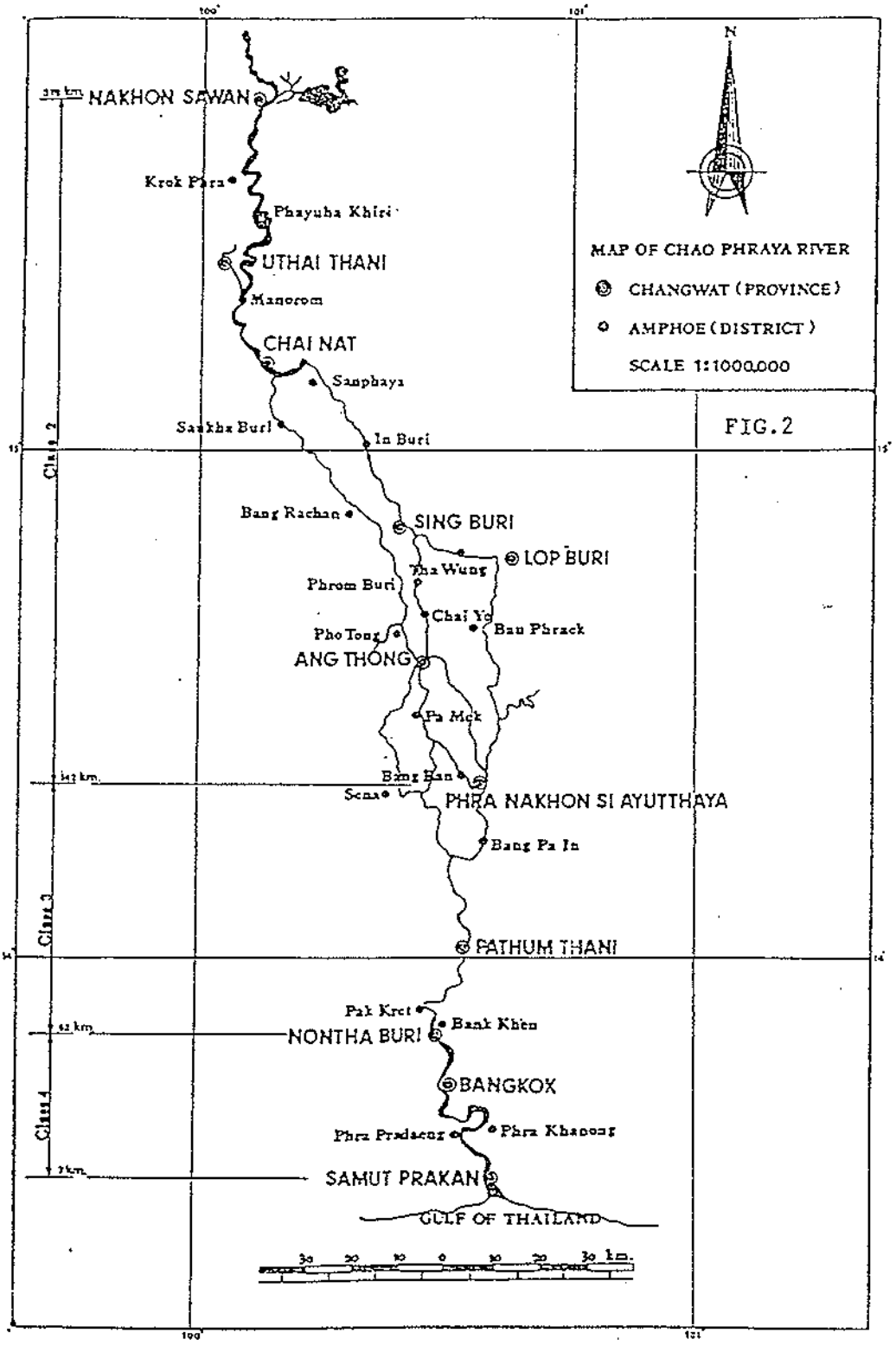

N
MAP OF CHAO PHRAYA RIVER
CHANGWAT (PROVINCE)
AMPHOE (DISTRICT)
SCALE 1:1000,000
NAKHON SAWAN
Krok Phra
Phayuha Khiri
UTHAI THANI
Manorom
CHAI NAT
Sanphaya
Sankha Buri
In Buri
Bang Rachan
SING BURI
LOP BURI
Tha Wung
Phrom Buri
Chai Yo
Pho Tong
Ban Phrack
ANG THONG
Pa Mok
Bang Ban
Sena
PHRA NAKHON SI AYUTTHAYA
Bang Pa In
PATHUM THANI
Pak Kret
Bank Khen
NONTHA BURI
BANGKOK
Phra Pradaeng
Phra Khanong
SAMUT PRAKAN
GULF OF THAILAND
Class 2
Class 3
Class 4
30 20 10 0 10 20 30 km.

FIG.2

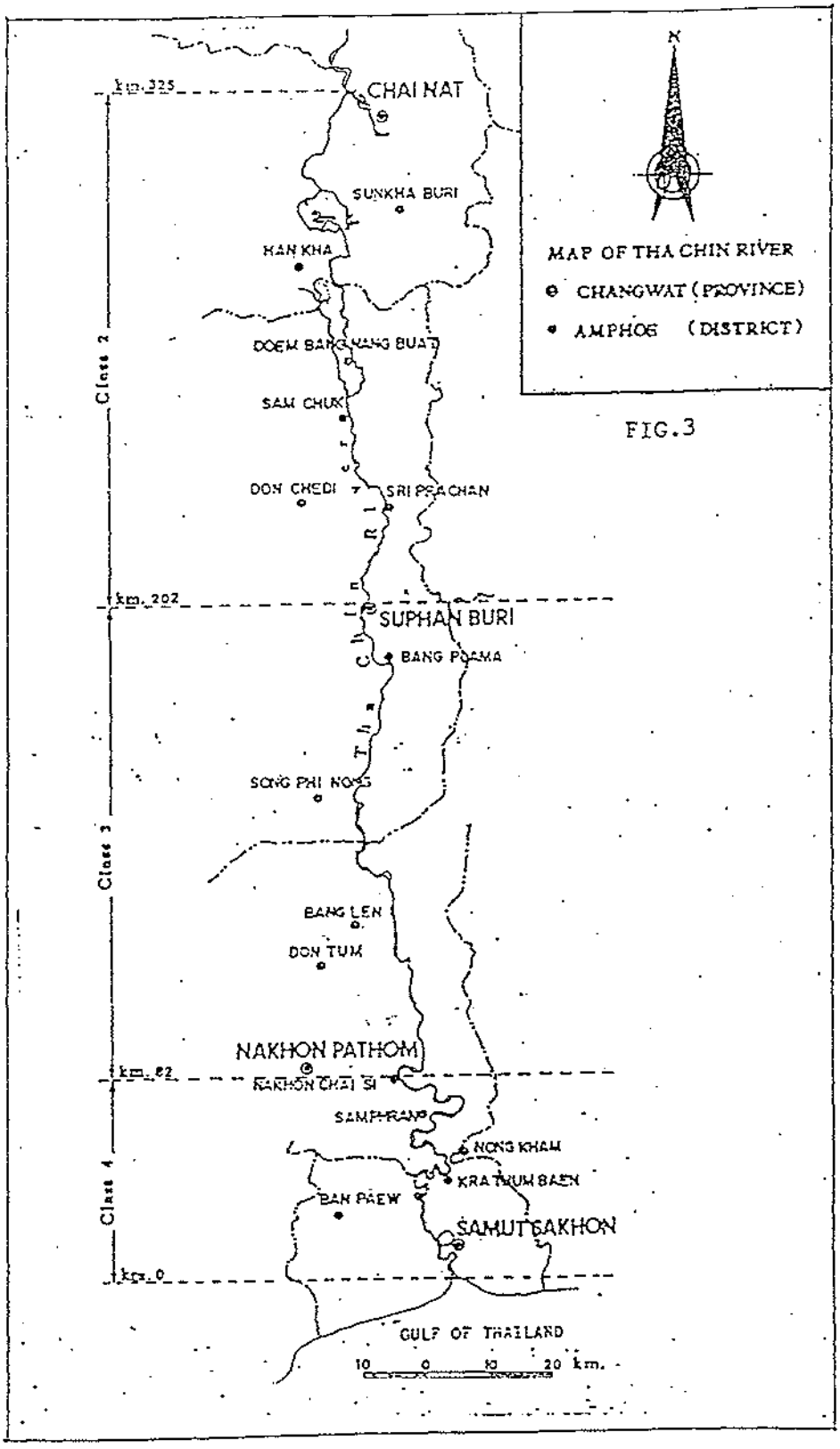
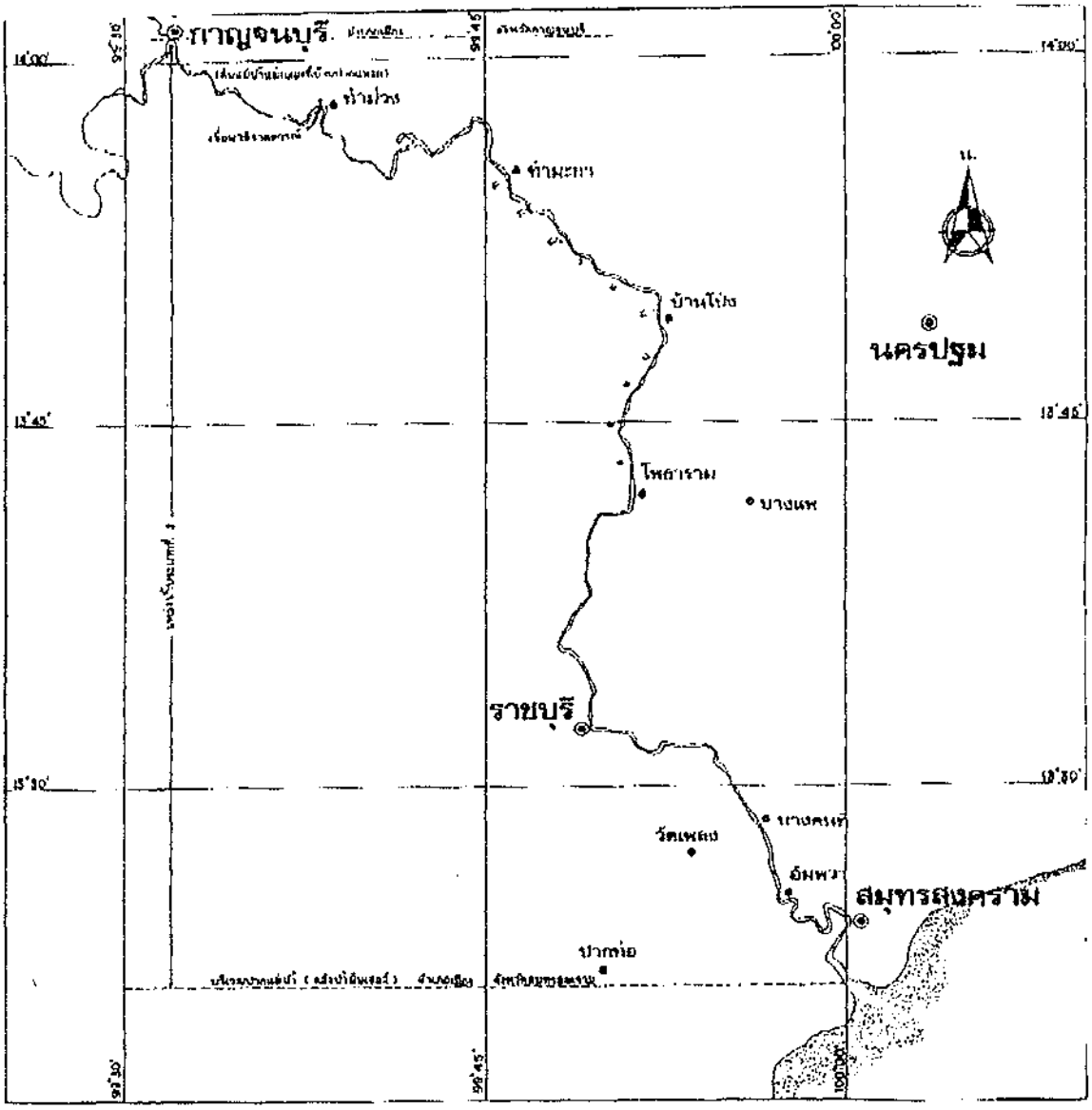

CHAI NAT
SUNKHA BURI
KAN KHA
DOEM BANG NANG BUAT
SAM CHUK
DON CHEDI
SRI PRACHAN
SUPHAN BURI
BANG PLAMA
SONG PHI NONG
BANG LEN
DON TUM
NAKHON PATHOM
NAKHON CHAI SI
SAMPHRAN
NONG KHAM
KRATHUM BAEN
BAN PAEW
SAMUT SAKHON
GULF OF THAILAND
km. 325
km. 202
km. 82
km. 0
Class 2
Class 3
Class 4
10 0 10 20 km.
N
MAP OF THA CHIN RIVER
CHANGWAT (PROVINCE)
AMPHOE (DISTRICT)

FIG.3


กาญจนบุรี
ท่าม่วง
ท่ามะกา
บ้านโป่ง
นครปฐม
โพธาราม
บางแพ
ราชบุรี
วัดเพลง
อัมพวา
สมุทรสงคราม
ปากท่อ

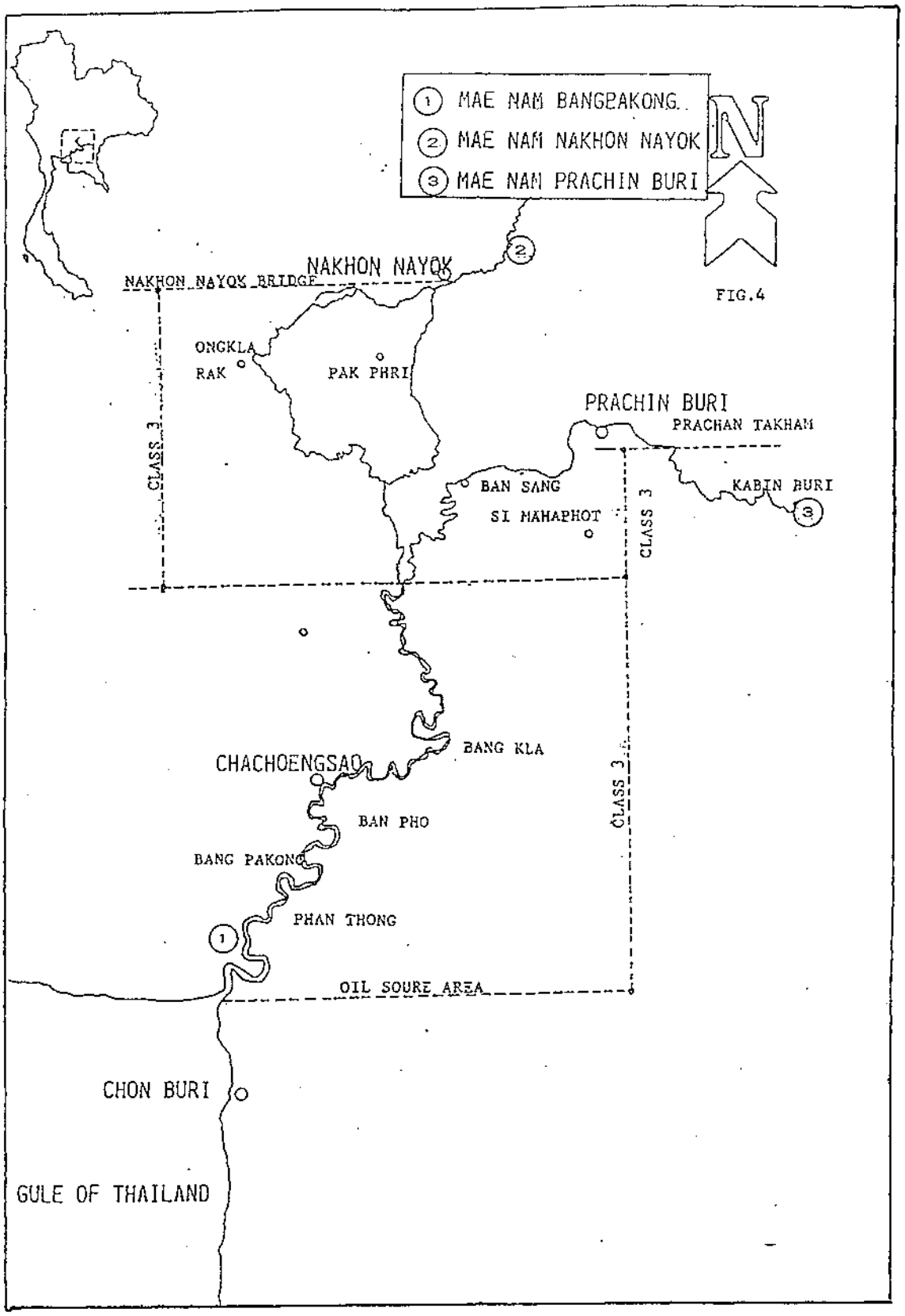

1 MAE NAM BANGPAKONG
2 MAE NAM NAKHON NAYOK
3 MAE NAM PRACHIN BURI
N
NAKHON NAYOK
NAKHON NAYOK BRIDGE
ONGKLA
RAK
PAK PHRI
PRACHIN BURI
PRACHAN TAKHAM
KABIN BURI
BAN SANG
SI MAHAPHOT
CLASS 3
CLASS 3
CLASS 3
CHACHOENGSAO
BANG KLA
BAN PHO
BANG PAKONG
PHAN THONG
OIL SOURE AREA
CHON BURI
GULE OF THAILAND

FIG.4

APPENDIX K

Building Effluent Standards*
1) Standard Values

PARAMETER	UNIT	RANGE OR MAXIMUM PERMITTED VALUE FOR THESE CATEGORIES				
		A	B	C	D	E
1. pH	-	5-9	5-9	5-9	5-9	5-9
2. BOD	mg/l	20	30	40	50	200
3. Solids						
3.1 SS	mg/l	30	40	50	50	60
3.2 Settleable S.	mg/l	0.5	0.5	0.5	0.5	-
3.3 TDS**	mg/l	500	500	500	500	-
4. Sulfide	mg/l	1.0	1.0	3.0	4.0	-
5. Nitrogen as TKN	mg/l	35	35	40	40	-
6. Fat, oil and grease	mg/l	20	20	20	20	100

*To be issued by notification by MOSTE as prescribed in Section 55 of the ACT.

**These values are in addition to the TDS of the water used.

2) Type and Sizes of Buildings Subject to Effluent Control

BUILDING TYPE	SIZE	LEVEL OF STANDARD[1]	REMARKS
1. Condominium	Less than 100 units 100 but not more than 500 500 units or more	C B A"	
2. Hotels	Less than 60 rooms 60 but not more than 200 200 rooms or more	C B A"	
3. Dormitories	From 10 to not greater than 50 rooms From 50 to 250 rooms 250 rooms or more	D C B	
4. Massage parlors (or equivalent)	From 1,000 m^2 to not greater than 5,000 m^2 5,000 m^2 or more	C B	
5. Hospitals	From 10 to not greater than 30 beds 30 beds or more	B A"	
6. Schools, colleges, universities or institutes	From 5,000 m^2 to not greater than 25,000 m^2 25,000 m^2 or more	B A"	

BUILDING TYPE	SIZE	LEVEL OF STANDARD*	REMARKS
7. Government offices, state enterprises, international agencies, banks, and office buildings	From 5,000 m^2 to not greater than 10,000 m^2 10,000 m^2 to not greater than 55,000 m^2 55,000 m or more	C B A**	Working area only (excluding central service area)
8. Department stores	From 5,000 m^2 to not greater than 25,000 m^2 25,000 m^2 or more	B A**	
9. Fresh food markets	From 500 m^2 to not greater than 1,000 m^2 From 1,000 m^2 to not greater than 1,500 m^2 From 1,500 m^2 to not greater than 2,500 m^2 2,500 m^2 or more	D C B A**	
10. Restaurants and food shops or food centers	Less than 100 m^2 From 100 m^2 to not greater than 250 m^2 From 250 m^2 to not greater than 500 m^2 From 500 m^2 to not greater than 2,500 m^2 2,500 m^2 or more	E D C B A**	Dining area

* Level of Standard refers to the 6 parameters listed in Standard Value-Building Effluent Standrads.

** This type and size of building will be controlled by the Pollution Control Officer, as specified in Section 69 of the ACT.

Source: Ministry of Science, Technology and Environment.

APPENDIX L

Industrial Effluent Standards

Items	Units	Standard values	Remarks
1)BOD(5 day, at 20^0C)	mg/l	20	Depends on physical geography or under office 's consideration but not more than 60 mg/l except. 1) Fishery canning Max. 100 2) Starch industry -Centrifugal Max. 60 -Sedimentation Max. 100 3) Noodle industry Max. 100 4) Tanning industry Max. 100 5) Pulp industry Max. 100 6) Frozen Food industry Max. 100
2)Suspended solids (SS)	mg/l	Depends on dilution ratios of waste-water and receiving water	Ratio 1) 1/8 to 1/150 Max. 30 2) 1/151 to 1/300 Max. 60 3) 1/301 to 1/500 Max. 150
3)Dissolved solids (DS)	mg/l	Max. 2,000 or under office's consider-ation but not more than 5,000	If salinity of receiving water is higher than 2,000 mg/l,DS in the effluent should not be higher than 5,000 mg/l of the DS in the receiving water
4)pH	-	5-9	
5)Permanga-nate Value		Max. 60	
6)Sulphide as H_2S		Max 1.0	

Items	Units	Standard values	Remarks
7)Cyanide as HCN	"	Max. 0.2	
8)Tar	"	none	
9)Oil & Grease	"	Max. 5.0	Refinery & Lubricant oil industry Max 15.0
10)Formalde-hyde	"	Max. 1.0	
11)Phenol & Cresols	"	Max. 1.0	
12)Free Chlorine	"	Max. 1.0	
13)Insecti-cides	"	none	
14)Radioac-tivity	Becqurel /l	none	
15)Heavy metals			
-Zinc (Zn)	mg/l	Max. 5.0	Zinc industry Max. 3.0
-Chromium(Cr)	"	Max. 0.5	Zinc industry Max. 0.2
-Arsenic (As)	"	Max. 0.25	
-Copper (Cu)	"	Max. 1.0	
-Mercury (Hg)	"	Max. 0.005	Zinc industry Max. 0.002
-Cadmium (Cd)	"	Max. 0.03	Zinc industry Max. 0.1
-Barium (Ba)	"	Max. 1.0	
-Selenium(Se)	"	Max. 0.02	
-Lead(Pb)	"	Max. 0.2	
-Nickel(Ni)	"	Max. 0.2	Zinc industry
-Manganese (Mn)	"	Max. 5.0	Max. 0.2
-Silver(Ag)		-	Zinc industry Max. 0.02
16)Tempera ture	°C	Max. 40	
17)Colour and odour	-	not objection-able	

Source : (1) Notification of the Ministry of Industry No.12, B.E. 2525 (1982) issued under the Factory Act B.E. 2521 (1978), published in the Royal Government Gazette, Vol. 99, Part 33, dated March 5, B.E. 2525 (1982).
(2) Notification of the Ministry of Industry No. 10, B.E. 2521 (1978) issued under the factory Act B.E. 2521, (1978). published in the Royal government Gazette, vol. 95, Part 132, dated November 28, B.E. 2521 (1978).

APPENDIX M

Restricted Zone for Protecting of the Bangkok Metropolitan Region water supply

(1) Restricted zone for protecting of the Bangkok Metropolitan Region water supply B.E. 2531.

The Cabinet decided to protect the source of the Bangkok Metropolitan Region (BMR) water supply by expanding the restricted zone of Samlae Catchment area from 200 square kilometres to 350 square kilometres in accordance with the recommendations of the NEB. This regulation requires that in the restricted zone, the building and expansion of factories which discharge wastewaters containing toxic substances listed below or organic matter exceeding one kilogram of BOD per day, will not be permitted. The mentioned toxic substances include:

(a) Heavy metals: Zinc, Chromium, Copper, Mercury, Manganese, Cadmium, Lead, Selenium, Nickel, Barium, Iron, etc.

(b) Other toxic substances: PCB (Polychlorinated biphenyl, Cyanide, Arsenic, Phenol, etc.

Source: National Environmental Board (Cabinet Resolution, January 12, B.E. 2531 (1988).

(2) Restricted zone for protecting of Bangkok Metropolitan water supply at the Western part of the Chao Phraya River B.E. 2534.

The Cabinet decided to protect the sources of the Bangkok Metropolitan Region water supply by expanding the restricted zone of the Western part of the Chao Phraya River which effects water quality at Klong Mahasawas and the Thachin River which have as area of 458 square kilometres, on the recommendation of NEB. The areas covered Bangkok Metropolitan, Nontaburi Province and Nakornpatom Province. The pollution sources control are as follow:

(a) Industrial activities containing high concentrations of toxic substances are not permitted to be established and/or expanded.

(b) Domestic wastewater must be treated to meet the standards.

(c) Agricultural wastes must be treated, which include highly polluted sources, such as fish ponds and swine farms.

Source: National Environmental Board (Cabinet Resolution, February 15, B.E. 2535 (1992).

APPENDIX N

New Zealand Framework for Sustainable Development of Water Resources			
Criteria	National	Regional	Local
Sustainable development:			
(a) To conserve and enhance the resource base;	C	C	C
(b) To take into consideration the need of present and future generations;	C	C	C
(c) To integrate environmental and economics in decision-making process at al levels of administration;	V	V	V
(d) To analyse the whole cycle.	C	C	C
National Planning:			
(a) Long-term objectives for sustainable development and medium- and short-term for conservation and enhancement of resources;	V	–	–
(b) Provision of a framework for integrated development in river catchment;	-	–	–
(c) Indication of national priorities;	V	–	–
(d) Provision for public participation;	C	–	–
(e) Provision for Strategic Environmental Assessment for the policies and plans;	C	–	–
(f) To provide consistency of the plan at different levels of planning.	C	–	–
Regional Planning:		V	–
(a) Planning at river catchment plan within national framework;	–	C	–
(b) Establishment of priorities for local plans;	–	C	–
(c) Provision for public participation;	–	C	–
(d) Conduct Strategic Environmental Assessment t for plans and policies.	–	–	–
Local Planning:		–	C
(a) Plans for specific areas especially upstream river catchment;	–	–	V
(b) Plan within national framework as well as river catchment planing framework;	–	–	C
(c) Provision of public participation.	–	–	C
Permit system:	–	C	
(a) Decision should be made at lowest level of organisation;	–	C	C
(b) Consent process should be clear and streamlined including lifetime, process of renewing permits, provision for amendment of consent conditions;	–	C	C
(c) Permit system should take into consideration environmental factors and unavoidable malfunction and equipment failure including water quality standards, carrying capacity of receiving weathers, total permission discharges, seasonal variations, assessment of environmental impacts.	–	C	C
Water quality standards:	V	V	–
(a) Different standards are established for various sections due to different uses, assimilative capacity, seasonal variation and/or flow rate;	–	V	–
(b) Standards may be changes or added more conditions;	–	V	–
(c) Specifying the result of statistical evaluation;	–	V	–
(d) Description of standards in precise, technical and quantitative terms;	–	V	–
(e) Application of minimum standards	–	C	–
Effluent standards:	–	V	–
(a) Direct effluent standards should be established;	–	V	–
(b) Effluent standards can be uniform or time or location variations by taking into consideration carrying capacity of receiving water and water quality standards;	–	V	–
(c) Effluent standards should be applied in conjunction with a permit system and be complement water quality standards.	–	V	–
Zoning should be combined with land use planning and regulatory approach such as:	–	V	V
(a) To locate pollution sources far from river and not allow to locate pollution upstream;	–	V	V
(b) To locate pollution source away from major urban areas;	–	V	V
(c) To establish industrial zone with provision of wastewater treatment facilities.	–	–	–

C= Compulsory (Specify in the Acts or plans and mandatory)
V = Voluntary (Specify in the Acts or plans but non-mandaroty)
– = Not available (Not pecify by the Acts or plans)

New Zealand Framework for Sustainable Development of Water Resources (Continued)			
Criteria	National	Regional	Local
Charges should be: (a) Based on quantity and quality of pollution generated; (b) Reflecting both true cost of water consumption and other services; (c) Providing incentives to change polluters' behaviours; (d) Combined with regulatory approach e.g. effluent standards.	V	V	V
Subsidies should not provide except: (a) Selective and restricted to specific groups otherwise severe difficulties may occur; (b) Well-defined transitional period; (c) Where market distortions may be created.	V	--	--
Public works e.g. wastewater treatment facilities: (a) The facilities should provide for domestic and industrial waste treatment. (b) Wastewater treatment facilities should be provided at least secondary treatment.	--	--	--
Best Management Practices: (a) To adopt BMPs to control pollution at sources; (b) BMPs should combine with other measures e.g. financial incentives.	-- --	V V	V V
Provision of Advocacy and information: (a) Provision of advocacy: (i) Statutory advocacy through environmental education in school, university, training programme for officials; (ii) Non-statutory advocacy through creation of leaflets, poster, media; (b) Advocacy in combination with regulatory and non-governmental organisation; (c) Provision of availability of environmental information as a public asset.	-- --	 V V C	 V V C
Environmental Impact Assessment: (a) To integrate an EIA in the planning process; (b) The EIA should cover the impacts on the environment, social and economic and mitigatory measures of the impacts of the project; (c) The framework should provide for a statement indicating when an EIA is necessary and which project requires an EIA, an indication of what the EIA must contain, the section specifying mandates for organisation concerned, provision for full public participation, provision of a comprehensive monitoring programme, an indication of the legal and administrative sanctions.	V V V	C C C	C C C
Monitoring system: (a) To monitor three types of matters - administrative and legislative measures, water and ecosystem and social impacts; (b) Provision of a systematic monitoring system with clear objective, sound system of data collection and analysis, regularly report to decision-makers and public, provide a training programme.	C V	C V	C V
Enforcement system: (a) Methods of detecting violations e.g. consent conditions, water quality standards; (b) Severe penalties including fine for violations, compensation for environmental damage, cancellation of consent, imprisonment; (c) Provision of public participation; (d) Provision of authorisation e.g. immediate assess and inspection when environmental pollution occurs	-- -- -- --	C C C C	C C C C

C = Compulsory (Specify in the Acts or plans and mandatory)
V = Voluntary (Specify in the Acts or plans but non-mandatory)
-- = Not available (Not specify by the Acts or plans)

APPENDIX O

Thai Framework for Sustainable Development of Water Resources			
Criteria	National	Regional	Local
Sustainable development:			
(a) To conserve and enhance the resource base;	V	–	V
(b) To take into consideration the need of present and future generations;	V	–	V
(c) To integrate environmental and economics in decision-making process at al levels of administration;	–	–	–
(d) To analyse the whole cycle.	–	–	–
National Planning:			
(a) Long-term objectives for sustainable development and medium- and short-term for conservation and enhancement of resources;	V	–	–
(b) Provision of a framework for integrated development in river catchment;	C	–	–
(c) Indication of national priorities;	C	–	–
(d) Provision for public participation;	V	–	–
(e) Provision for Strategic Environmental Assessment for the policies and plans;	–	–	–
(f) To provide consistency of the plan at different levels of planning.	–	–	–
Regional Planning:			
(a) Planning at river catchment plan within national framework;	–	–	–
(b) Establishment of priorities for local plans;	–	–	–
(c) Provision for public participation;	–	–	–
(d) Conduct Strategic Environmental Assessment t for plans and policies.	–	–	–
Local Planning:			
(a) Plans for specific areas especially upstream river catchment;	–	–	V
(b) Plan within national framework as well as river catchment planing framework;	–	–	V
(c) Provision of public participation.	–	–	–
Permit system:			
(a) Decision should be made at lowest level of organisation;	C/–	–	C/V
(b) Consent process should be clear and streamlined including lifetime, process of renewing permits, provision for amendment of consent conditions;	V	–	V
(c) Permit system should take into consideration environmental factors and unavoidable malfunction and equipment failure including water quality standards, carrying capacity of receiving weathers, total permission discharges, seasonal variations, assessment of environmental impacts.	V	–	V
Water quality standards:			–
(a) Different standards are established for various sections due to different uses, assimilative capacity, seasonal variation and/or flow rate;	C	–	–
(b) Standards may be changes or added more conditions;	C	–	–
(c) Specifying the result of statistical evaluation;	C	–	–
(d) Description of standards in precise, technical and quantitative terms;	C	–	–
(e) Application of minimum standards	C	–	–
Effluent standards:			
(a) Direct effluent standards should be established;	C	–	V
(b) Effluent standards can be uniform or time or location variations by taking into consideration carrying capacity of receiving water and water quality standards;	V	–	V
(c) Effluent standards should be applied in conjunction with a permit system and be complement water quality standards.	V	–	V
Zoning should be combined with land use planning and regulatory approach such as:	C	–	–
(a) To locate pollution sources far from river and not allow to locate pollution upstream;	C	–	–
(b) To locate pollution source away from major urban areas;	V	–	–
(c) To establish industrial zone with provision of wastewater treatment facilities.	C	–	–

C = Compulsory (Specify in the Acts or plans and mandatory)
V = Voluntary (Specify in the Acts or plans but non-mandatory)
– = Not available (Not specify by the Acts or plans)

Thai Framework for Sustainable Development of Water Resources (Continued)			
Criteria	National	Regional	Local
Charges should be:	V	–	V
(a) Based on quantity and quality of pollution generated; (b) Reflecting both true cost of water consumption and other services; (c) Providing incentives to change polluters' behaviours; (d) Combined with regulatory approach e.g. effluent standards.		–	
Subsidies should not provide except:	V	–	V
(a) Selective and restricted to specific groups otherwise severe difficulties may occur; (b) Well-defined transitional period; (c) Where market distortions may be created.			
Public works e.g. wastewater treatment facilities:	C	–	C/V
(a) The facilities should provide for domestic and industrial waste treatment.	V	–	V
(b) Wastewater treatment facilities should be provided at least secondary treatment.	V	–	V
Best Management Practices:			V
(a) To adopt BMPs to control pollution at sources;	V	–	–
(b) BMPs should combine with other measures e.g. financial incentives.	V	–	–
Provision of Advocacy and information:			
(a) Provision of advocacy:			
(i) Statutory advocacy through environmental education in school, university, training programme for officials;	C	–	–
(ii) Non-statutory advocacy through creation of leaflets, poster, media;	C	–	–
(b) Advocacy in combination with regulatory and non-governmental organisation;	C	–	–
(c) Provision of availability of environmental information as a public asset.	V	–	
Environmental Impact Assessment:			
(a) To integrate an EIA in the planning process;	V	–	V
(b) The EIA should cover the impacts on the environment, social and economic and mitigatory measures of the impacts of the project;	C	–	V
(c) The framework should provide for a statement indicating when an EIA is necessary and which project requires an EIA, an indication of what the EIA must contain, the section specifying mandates for organisation concerned, provision for full public participation, provision of a comprehensive monitoring programme, an indication of the legal and administrative sanctions.	C	–	–
Monitoring system:			
(a) To monitor three types of matters - administrative and legislative measures, water and ecosystem and social impacts;	C/V	–	–
(b) Provision of a systematic monitoring system with clear objective, sound system of data collection and analysis, regularly report to decision-makers and public, provide a training programme.	C/V	–	–
Enforcement system:			
(a) Methods of detecting violations e.g. consent conditions, water quality standards;	C	–	C
(b) Severe penalties including fine for violations, compensation for environmental damage, cancellation of consent, imprisonment;	C	–	C
(c) Provision of public participation;	–	–	–
(d) Provision of authorisation e.g. immediate assess and inspection when environmental pollution occurs	C	–	C

C = Compulsory (Specify in the Acts or plans and mandatory)
V = Voluntary (Specify in the Acts or plans but non-mandatory)
– = Not available (Not specify by the Acts or plans)