

**ENVIRONMENTAL CODES OF
PRACTICE (ECOP) FOR
STORM WATER DRAINAGE
SYSTEMS**

National Environment Commission

Royal Government of Bhutan

August 2004



དཔལ་ལྷན་འབྲུག་གཞུང་།
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ROYAL GOVERNMENT OF BHUTAN
NATIONAL ENVIRONMENT COMMISSION SECRETARIAT

FOREWORD

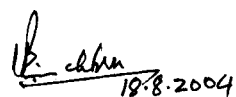
In 1999, the National Environment Commission with technical and financial assistance from the Asian Development Bank (ADB) published six sectoral environmental assessment guidelines for the mining, roads, industries, hydropower, transmission lines and forestry sectors. Several stakeholder consultation workshops and seminars were conducted before the guidelines were published. These guidelines were intended to guide different project proponents through the process of acquiring an environmental clearance for their projects. The Environmental Assessment 2000 (EA Act 2000) was passed by the National Assembly in 2000 and the Regulations under the Act were adopted two years later. Stakeholder feedback and our experiences in implementing the EA Act and the guidelines indicated that there was a need to revise the guidelines in order to make them more practical and relevant to the Bhutanese context and also to streamline them with the provisions of the EA Act 2000. It was also felt that there was a need for two more sectoral guidelines for urban development and tourism as rapid developments in these two sectors was becoming a concern for Bhutan. Therefore, in 2003 the NEC once again revisited these guidelines and revised and updated them to make them more practical and functional documents. Several Environmental Codes of Best Practices (ECOPs) have also been produced to support these environmental assessment guidelines.

The NEC is grateful to the ADB for being so forthcoming with technical and financial assistance to revise and update these guidelines. The revision and updating of these guidelines were accomplished through close consultation with all the various stakeholders. We would also like to express our gratitude and appreciation to all the line ministries and stakeholders for their active participation, support and inputs. We are confident that the revised guidelines will be more useful documents that facilitate and expedite the environmental clearance process as project proponents will now have a better understanding of what information must be provided in order to attain an environmental clearance.

In Bhutan, environmental conservation has been embraced as one of the four pillars of Gross National Happiness - the other three pillars being good governance, socio-economic development and cultural preservation. However, with the expansion of developmental activities in the country, it is becoming very difficult to strike a sustainable balance between environmental conservation and socio-economic development. The number of industries is on the rise every year

while the demand for rural access to market facilities in the form of farm roads and feeder roads is increasing with every Five Year Plan - in the 9th Five Year Plan alone there is a plan to develop 588kms of farm roads. Environmental issues such as waste disposal related to urbanization are also becoming serious concerns for Bhutan. Bhutan is lauded by the international community for its sound environmental policies and the political will to implement these policies. However, environmental problems are becoming more and more visible and instruments like the EA Act 2000 must be implemented effectively to support the government's sound environmental policies and to ensure that Bhutan remains clean and green.

The environmental assessment process endeavors to mitigate and prevent the undesirable impacts of developmental activities. It is in no way intended to hamper socio-economic development in Bhutan but to guide project proponents in making the right investments in land, manpower, technology and mitigation measures to ensure that their projects have the least possible impacts on the environment. With the revision and updating of the old guidelines and the publication of two new guidelines on Urban Development and Tourism and relevant ECOPs, the NEC is hopeful that the private sector, line ministries and competent authorities under the Regulations for Environmental Clearance of Projects find the guidelines more useful, practical, informative and easy to comply with. It is the sincere wish and hope of NEC that all the stakeholders, both public and private will make the best use of these guidelines, which in turn will help in protecting our fragile ecology. Sound implementation of these guidelines will go a long way in minimizing the negative impacts of developmental activities on Bhutan's environment.



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Abbreviations

CA	Competent Authority
EC	Environmental Clearance
ECOP	Environmental Codes of Practice
NEC	National Environment Commission

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1. Introduction

- 1.1.** This Environmental Code of Practice (ECOP) addresses basic storm water drainage requirements in urban areas. The major concern with existing storm water drainage systems is frequent overflows that occur during the monsoon season, where runoff spills out onto roads and public areas. This is unhygienic and could lead to health concerns. One of the main causes of blockages in the drainage systems is the accumulation of foreign materials especially sediments, solid waste and plastics as a result of the low gradient of the drains. This ECOP has been prepared through a series of consultations with the relevant agencies, particularly those who construct storm water drainage systems. The code is available in hardcopy and in compact disk (CDs) as well. A copy of this code is also posted on the NEC website: www.nec.gov.bt.

2. Purpose of the Code

- 2.1.** This code will assist the Competent Authority in planning, and regulating the construction of Storm Water Drainage systems in urban areas by incorporating environmental aspects into the survey, design, construction and post-construction stages, including compliance monitoring. This Code is to be attached to the Contract document as a part of the Contract clause and to be used in conjunction with other requirements of the Royal Government or Municipal Authority.

3. Legal Aspects

- 3.1.** The basis for this code is the EA Act 2000, and the Regulation for Environmental Clearance of Projects, 2002. While implementing this Code, the applicants, Competent Authorities or the NEC must refer to Annex 2 of the Regulation.
- 3.2.** This code will replace the Environmental Terms and conditions that would normally be attached to the Environmental Clearance.

4. Environmental Codes of Practice

In Bhutan storm water runoff is separated from sewer flows and is normally regulated via open channels. The channel is normally covered where it transects footpaths or pedestrian areas. Wherever the drain remains open, it is prone to foreign material falling into the system. Storm water drainage systems may be built to channel flows originating from: water courses; non-built up and non-paved areas; roads and other paved areas; runoff from roofs; and may also include domestic grey water

The code will guide the Competent Authority and the applicants in incorporating environmental concerns into three phases of Storm Water Drainage construction: (1) The Preparatory Phase (includes Survey, Design and Layout); (2) Construction and; (3) Operation. These are discussed separately in the following sections.

4.1 Code for Preparatory Phase

- 4.1.1. Survey:** The following parameters should be included in the survey:

Survey the topography of the drain route. Identify all existing utilities (roads, footpaths, cables etc.) that may be affected by the drain construction

Establish the longitudinal gradient of the drain from the contour survey

Determine the catchment area for the proposed drain and locate the inflow points

Identify other sources of inflows

Identify potential areas where rubbish is likely to enter the drain

Identify an outlet considering the possibility of erosion

Plot this information on the plan of the channel. The plan should show topographic contours

4.1.2. Design: Based on the information from the survey, consider the following environmental parameters into the design:

Mitigation measures where utilities cross the drain

Design confluence points for other inflows entering the drain so that the drain capacity is not reduced

The gradient of the channel should be maintained throughout its length so that water does not pond within it. Flows are to be maintained at velocities that will scour the channel of debris. For instance, runoff velocities should not be less than 1 m/s nor should they exceed 3 m/s

Based on the catchment area, potential inflows and rainfall intensity, determine the drain size so as to minimize damage resulting from high intensity storms

Energy dissipaters such as drop structures should be provided along the channel where runoff velocities may become excessive

In populated sections of the drain, provide gridiron, RCC covers or pipes to prevent foreign material from entering the drain

All the drain dimensions and areas where special attention to excavation is required e.g. location of utilities, other drain intersections, etc., should be marked on the topographic plan. The plan is to be provided to the contractor so that the contractor will have a clear understanding of the work to be carried out along the entire length of the drain

4.2 Code for Construction Phase

4.2.1. Layout: The following should be observed during field layout:

Mark the drain centre line with white paint and at every 50m use a strong marker peg to identify the longitudinal measurement

Where the proposed drain encounters other existing utilities, erect signboards to mark the utility

4.2.2. Construction and Management of Excavated Material: Excavated materials should be managed as follows:

Excavated material should only be retained at the work site if it does not cover or obstruct any other utility(ies) including drains, roads, footpaths, etc. Unwanted excavated material should be dumped at an approved site

Topsoil should be stored separately

The holder will plan and direct the contractor to execute the work progressively so that the length of the open excavated trench is minimised in order to reduce possible accidents

4.2.3. Warning and Safety Signs: In accident-prone areas, the following protective measures and safety signs should be erected:

Open trenches should be cordoned by a barrier that is visible at night

Reflective warning signs should be erected at adequate warning distances from the work site and should face on-coming traffic

The holder shall be liable for any claims arising from accidents that have occurred as a result of inadequate/improper attention to these safety measures

4.2.4. Management of Construction Materials: The following practices are to be applied while handling construction materials:

No construction materials should be stored on the road, on top of or beside drains and footpaths, or on any other public area as this may restrict public access to these utilities

Construction materials are to be stored at an approved storage site

Construction materials should only be transported to the worksite as and when required for construction

Construction materials should only be stored and prepared on the site if they do not obstruct the road or any surrounding public utility

4.2.5. Restoration of work site: Once construction has been completed, the site should be restored. The following practices are to be applied during site restoration:

All waste material including rocks which have been excavated are to be removed from the disturbed area so that the area is left clean

The topsoil should be replaced and the shaped and smoothed so that it is suitable for revegetation

Unless otherwise instructed, the disturbed areas should be revegetated with grass so as to provide an aesthetically pleasing finish and to reduce soil erosion

4.3 Code for Maintenance Phase

4.3.1. Maintenance: is required to ensure that drains are not clogged. The following practices should be adopted in maintaining storm water drains:

Drains should be regularly inspected and cleaned especially during the monsoons. Inspection and cleaning should be carried out as soon as possible after a major rainfall

All damaged or missing drain covers should be replaced immediately

Rubbish and silt that has been removed from the drainage system should not be left alongside the drain but taken to an approved disposal site

Areas where water ponds should be identified and measures carried out to rectify the problem

5. Roles and Responsibilities

5.1. The roles and responsibilities of the different agencies that will be involved in implementing this ECOP are as follows:

5.2. **Project Preparatory Phase:** In this phase, the Project Applicant (Proponent) will be responsible for and will monitor the following activities:

Ensure that surveys are carried out and that the design parameters, as required in the Code of Practice, are included in the design

Ensure that the ECOP is attached to the Contract Document as part of the Contract requirements

5.3. **Project Construction Phase:** In this phase, the following monitoring is required:

Regular Monitoring: The Applicant must ensure that the Contractor understands the relevant sections of the ECOP. During construction the Contractor will be responsible for regular monitoring to ensure that work is executed as per the terms and conditions of the Contract Document and the ECOP

Compliance Monitoring: Compliance Monitoring is the responsibility of the following three organisations: (1) The Project Proponent who has the overall responsibility for monitoring; (2) the Competent Authority; and (3) the NEC. The latter two organisations may conduct routine monitoring or may undertake spot checks at any time

5.4. Maintenance Phase: In this phase, the following monitoring is required:

Regular Monitoring: It is the Proponent's responsibility to ensure that drains are operating correctly and that faults are corrected on time

Compliance Monitoring: The CA or the NEC has the authority to conduct compliance monitoring to ensure that requirements that have been specified in the environmental terms are being met