Sector Guidelines

for Pre-Feasibility Studies on

FLOOD AND DRAINAGE MANAGEMENT

A. Introduction

1. Context

Cities Development Initiative of Asia (CDIA) Sector Guidelines describes the approach to pre-feasibility studies in the sectors most commonly encountered in CDIA support to cities. These guidelines are a sector-specific appendix to the overarching *CDIA Pre-Feasibility Study Guidelines* (CDIA 2011) that sets out the format, process, and output requirements in general.

The Sector Guidelines are not meant to replace terms of reference or to provide detailed technical input for consultants, who are assumed to be qualified and experienced professionals in their field and thus technically capable. These apply to the conduct of a pre-feasibility study (PFS) for a project or group of projects (hereinafter referred to as "the project") identified and prioritized in the plan and by the relevant authority for implementation.

These guidelines apply in the context of existing policies, visions, plans, and studies pertaining to flood and drainage management and other related issues. These address the approach expected of consultants engaged at the PFS stage as regards flood and drainage management.

2. Objective

CDIA support to the formulation of any flood and drainage management project aims to enhance the impact, sustainability, and inclusiveness of the project. This means that the project should

1. Comprise a viable component of *integrated flood and drainage management* that includes a holistic approach to provision of services and infrastructure, institutional capacity, environmental and social concerns, economic and financial systems (see section B);
2. Be *inclusive* in the sense that stakeholders should be involved (i) to ensure a tailor-made and sustainable system for drainage and preparedness for flooding mitigation that is accessible and affordable to all regardless of income level, education, gender, etc. in the targeted areas, and (ii) to minimize the risk of unfounded (investment) decisions and adverse impacts.

Any risk of negative impact should be clearly communicated and measures taken to adequately compensate stakeholders. (see section C);

3. Be *economically viable* and *financially sustainable* in that the economic rate of return on a project must be acceptable *and* that capital costs can be met out of resources likely to be available and that operational costs including long-term maintenance and capacity building in the various components of the project can be met out of the recurrent revenues (see section D);
4. Be *environmentally sustainable* in that the proposed flood and drainage management system must aim at improving the existing environmental and health conditions *and* that adequate measures will be taken to mitigate any potential adverse environmental impacts of the project (see section E); and
5. Have *sound, transparent governance* arrangements enabling efficient planning, financing, design and construction, commissioning, and operation of the project (see section F).

B. Developing an Integrated Flood and Drainage Management System

The vision for any city (in Asia) must include an environment-friendly, low-carbon, integrated and inclusive development. Rapid urbanization in combination with climate change and extreme weather conditions lead to challenges in handling surface water and drainage. Failure may lead to impacts on fresh water resources, loss of property and livelihood and in its extreme conditions, and death due to flooding. Stagnant water leads to mosquitoes breeding and spreading of diseases. In cases of combined network for sewage and surface water drainage, the risks of environmental and health impacts are increased.

The surface water/storm water management system should make use of existing infrastructure (if any) and build on sound visions, policies, strategies and plans, not limited to drainage management but all sectors that influence the performance of such a system. The proposed investment project must also be based on a sound policy and planning framework and be within the relevant regulatory framework. In case the framework is not adequate or threatens the successful implementation of the project, the PFS should at an early stage identify the key issues and determine how they can be solved. Based on baseline data and professional judgment where data are not available, an overall assessment of the current flood and drainage management, strengths, weaknesses and areas for intervention, should be made

The PFS should address the following key considerations in an integrated system:

- **Service provision to all**

The provision of flood protection and storm water drainage network can generally not be provided on an exclusionary basis to individual households, thus the service provision is considered to be an area-based public good. This includes the practice of using the public drainage network to remove any liquid (and solid) waste, for a wide range of domestic and industrial activities. However, the lack of such a system, especially during extreme loads, may have serious and direct impacts on people's property, livelihood, and health. It is vital that water from rainfall (precipitation), referred to as surface water or storm water is handled properly in an urban area in a way that it does not interfere with the functions of the city and provision of other services. It is equally important that sewerage and wastewater are handled and treated according to its properties, and in a manner that does not interfere with the storm water system.

The PFS should carefully investigate, as far as possible depending on availability of data or other input, the current drainage system and its functionality. If flooding may occur, the PFS should examine the frequency and the magnitude, and distinguish between marginal and fundamental impacts. Special attention should be paid to the possible combined storm water/drainage and sewerage piping network, and the challenges to the system in case of heavy rainfall. The reasons for non-service must be examined and solutions recommended, bearing in mind disaster management and flooding issues.

- **Integrated water management and coordination with other development**

The PFS should focus on urban water and how drainage should be handled in an urban setting. However, water management is often a regional or even transnational issue that cannot be handled in isolation by a local government unit. The behavior of the water will depend on the water catchment area and its geophysical conditions, a river basin, proximity to mountains or coastal plains, built or rural environment, soil conditions, erosion, and climate, among others. Flood mitigation in one area may also lead to flooding in another. Thus, the PFS must be based on Integrated Water Resources Management (IWRM) or Integrated River Basin Management (IRBM) and make use of existing studies, to the extent that it is reasonable and applicable to the studied urban area. This includes the need for close coordination with other local, regional, or national government stakeholders. The PFS may suggest projects that will require involvement by external stakeholders, e.g. riverbank rehabilitation or storage dams. Temporary storage or leveling of water in upland of catchment area involves a larger jurisdiction. Uneven distribution downstream may also cause conflicts between stakeholders in the same river basin or water catchment area.

Water management is also a highly cross-sectoral issue in terms of local government offices, since it may combine issues on drinking water, sewerage, and drainage and has impacts on the whole society. The functionality of a drainage system is also closely linked to solid waste management since lack of collection services and other waste related issues causes blockage in the drainage canals. As this is all related to climate change, projections on changed precipitation must also be taken into account. Thus, the proposed projects in the PFS should be an integrated part of the whole system in harmony with other infrastructure development. The PFS must examine planned development, land use, urbanization, and urban growth pattern to design for future capacity needs and to conduct risk analysis/disaster management studies.

Traditionally, flood management projects have often been based on the assumption that any water flow can be controlled and that flooding must be a very rare event. For a storage dam, for instance, the investments are usually very high in terms of costs for material and construction works, and the investment and land use is locked. There is a great risk of negative environmental and social impacts in the dam area and other areas affected by the project. The flood return periods should determine the design, but the PFS should, where applicable, open up for a different approach where improved natural infiltration in green urban spaces or flood-resistant housing or roads would allow people to stay in a wetland area where the rise of the river has always been a natural part of that habitat.

- **Land use**

The proposed flood and drainage management project must be consistent with land use plans. Special attention should be given to disaster management plans and risk assessments, other systems in place to accommodate large water flows within the city, and the types of land use affected by flooding. Future land use and the potential risk of locating a storage dam in an area that is vital to agriculture must, in the future, be considered. Any conflict in land use as well as reduced value of land should be addressed.

Summary

- Review planning and regulatory framework to identify terms or gaps that may hamper the project and recommend approaches for policy to bridge these gaps.
- Identify the necessary building blocks in an integrated system—people's needs, appropriate technology, land use, human resources, urban road network, other infrastructure, and housing.
- Identify prioritized projects and necessary investments.
- Demonstrate, and quantify where possible, how the proposed project improves the living conditions for people, especially the poor and the women, and the environment.

C. Developing an Inclusive Flood and Drainage Management Project

The basis for an inclusive project would be to identify and invite all stakeholders to actively participate already during the planning process and to make them, particularly the poor, benefit from the project components. Gender aspects are crucial—women and children are more vulnerable to the adverse impacts of pollution, such as the contamination of a water source due to flooding or the fact that they may have to walk far to find uncontaminated water supply.

The PFS should analyze how lack of drainage or the occurrence of floods affect people, their health, livelihood, limitations in land use and urban growth, and how the proposed project can contribute to an inclusive, safe development. Employment opportunities tied to project components should be examined. If relocation is considered, disruption in basic services to the affected population must be examined and measured to minimize such disruption.

The overall aim is to develop a sustainable flood and drainage management system that is accessible in all areas by stakeholders, regardless of income level, gender, etc. However, it may not be possible or financially viable to design a system that could accommodate and eliminate all possible water flows in extreme weather conditions or to assume that people are willing to be relocated from flood prone areas. The PFS should discuss alternative solutions and take into account the possibilities to readjust the developed areas including formal and informal settlement to accommodate flooding.

Costs associated with the social impact mitigation measures should be included in the financial assessment (section D) and the associated management systems should be incorporated into governance arrangements (section F).

Summary

- Identify stakeholders for consultation at an early stage.
- Identify livelihood issues and design a project that will benefit as many as possible, especially the poor, directly or indirectly.
- Propose a project that will minimize disruption to the community.

D. Ensuring Financial and Economic Viability

1. Financial Assessment

The primary aim of the financial assessment is to make a realistic assessment, as far as possible, of the project costs in investment and operation and maintenance (O/M), project revenues and possible financing schemes, either from own sources or external funds. Given the early stage in project design, it may be difficult to estimate these. For instance, site selection and land acquisition may not be finalized or the final choice of technology must be further elaborated in a feasibility study or detailed engineering design study. However, the PFS should include this primary, early assessment to indicate to both the local government and potential investors whether the project is worth pursuing.

It is vital for the financial viability of the project to investigate revenue streams for each investment with a direct cost recovery component. For flood and drainage management, though, the benefits of service are not directly extended to individual users and cannot be charged through fees in the same way as for water supply or solid waste collection. However, in many cities, the surface water drainage is still combined with sewerage and the city may require households or other users to pay for connection to the public network. In that case, it would be easier to justify a drainage/sewerage fee and the revenues can cross-subsidize any improvements in flood control, among others. The risk of noncompliance in paying user fees (if any) and possible measures should also be discussed. Other funding sources for the construction, operation, and maintenance of drainage and flood control infrastructure should be investigated.

Existing project cost estimates must be investigated so that new solutions, at reduced costs or better performance can be suggested. Costs should be benchmarked against average construction costs in country (preferably), or in a similar country. Costs should explicitly include social (e.g. relocation) and environmental mitigation measures.

Subsidies, cross-subsidies from leasing of property, community service obligation payments, and others should be assessed for their sustainability and legal enforceability. Clean Development Mechanism for energy efficiency investments, and other credit/subsidies from international agencies should be assessed based on prior experience with similar projects and, if necessary, on engagement of specialist expertise[1] to provide advice where such funding is crucial to the viability of the project.

The financial assessment should include cash flow, income statement, and balance sheet projections of any corporate or special purpose vehicle (SPV) entities involved in the financing and a standard financial cost benefit analysis (CBA). The hurdle rate adopted for this latter should be the relevant weighted average cost of capital (WACC) for the sector and country, but where private investors are involved, market rates for return in equity and debt should be the benchmark for viability. However, because of the difficulty in getting direct revenues, flood and drainage control will not likely involve the private sector.

In particular, the assessment must include an analysis of the cash flow of participating (mostly local) government with project capital expenses and subsidies included to determine the sustainability of the project in relation tohe likely revenue streams, if any. Such an analysis should be the basis for discussions about alternate organizational structures for implementation (see section F).

[1] ADB Clean Energy Facility can provide resources for assessments of Clean Development Mechanism.

Summary

- Assess project investment and O/M costs, as far and realistically as possible
- Assess revenue generation, both direct and indirect revenue base, and willingness to pay (if it can be combined with sewerage).
- Adopt realistic return hurdle rates.
- Assess impact of project on (local governments) budget and use as basis for developing implementation options.
- Provide financial analysis for all relevant organization participants and adopt realistic return hurdle rates.

2. Economic Assessment

The economic assessment in a flood and drainage management project should involve estimates of cost savings resulting primarily from avoided damage to land and property, public health improvement accessibility on roads and its effect on gross domestic product, employment (income increase or decrease) and investment opportunities due to more efficient land use. Benefits from reduced carbon emissions should also be explained in the PFS, adopting proxy values where necessary as set out in ADB's Guidelines for the Economic Analysis of Projects.[2] Increased costs should also be taken into account, e.g. relocation of people in wetlands, provision of infrastructure in the new site, increased commuting transport costs, among others. If a storage dam for leveling of water is considered, the alternative land use must be discussed and included in the economic analysis.

Care should be taken to avoid double counting, such as health and employment productivity increases. Shadow pricing of costs is standard and follows an established process in each country. Hurdle rates for economic assessment are routinely set by ADB and other agencies in each country. ADB standards should be adopted in the PFS where available.

Summary

- Estimate all benefits of the proposed project.
- Undertake economic assessment using established processes and hurdle rates in the country concerned using ADB standards where possible.

E. Ensuring Environmental Sustainability

Flood and drainage management projects would typically aim at improving the environmental and health conditions, including reducing the risk of human casualty. Such projects are often labeled as adaptation measures for extreme weather conditions due to climate change. However, there are many other factors and every day scenarios that also affect the urban area's capability to cope with precipitation and surface water. The PFS should make an assessment of the impacts or risks associated with the present situation and how this will change after proposed project implementation. The objective of the proposed PFS interventions is to maximize the positive impacts and minimize the negative ones, if any.

[2] ADB. 1997. *Guidelines for the Economic Analysis of Projects.*

Most infrastructure projects would eventually require the preparation of an environmental impact assessment (EIA) as a basis for an environmental or similar permit. At the PFS stage, a rapid environmental assessment (REA) or a rapid environmental impact assessment (REIA) may be required.[3] It is also vital that the requirements and the time frame for a full-blown EIA are identified already during the PFS stage to avoid delays in downstream work and unexpected investments costs for environmental protection measures. For flood management, the risk analysis is crucial and available plans or regulatory framework on disaster management and preparedness must be carefully studied.

In terms of reducing possible adverse environmental impacts, the process is similar to that adopted for social assessment. The proposed investments and facilities should be screened to determine (i) potential environmental impacts in terms of noise and pollution to communities, and (ii) potential impacts on water resources, forest resources, biodiversity, etc. as set out in ADB's environmental checklist.[4] Mitigation measures should be formulated and costed. The implications of these measures should be included in the financial assessment (see section D) and governance arrangements (section F) of the project. This includes the assessment of any positive or negative impacts related to climate change.

Summary

- Identify the relevant regulatory framework for environmental issues as well as disaster preparedness and its implications on project implementation.
- Estimate the environmental and health improvement expected from the proposed project.
- Estimate the possible environmental and health-related risks and impacts connected to the proposed project and costs for mitigation of these risks.
- Investigate possibilities to reduce greenhouse gas emissions (mitigation) and adaptation measures in flood management.

F. Ensuring Good Governance

The institutional arrangements for implementing the project must be clearly described and agreed with the client government. [5]The ability to successfully implement almost any infrastructure project, including achieving social and environmental benefits, avoiding and mitigating adverse impacts, and achieving financial sustainability, depends on a sound governance structure.

The PFS must include the following:

(a) Discussion of organizational options for design, construction/ commissioning, and operation, including the possibility of PPP options. Where such options are pursued, the organization structure for transparent oversight, monitoring, and regulation of private operations needs to be considered. A monitoring system with clear and measurable key performance indicators must be discussed. In terms of services integration, the arrangements for coordination across sectors and facility providers need to be described. Stakeholders must be involved at an early stage, and their continued influence and input should be secured and institutionalized for the whole project period.

[3] ADB *Rapid Environmental Assessment checklists for categorization of projects.*
[4] ADB. 2003. *ADB Environmental Assessment Guidelines.*
[5] CDIA 2011 *Guidelines for Urban Governance and Institutional Development*

(b) Consideration of how, and with what incentives, will the existing institutions and stakeholders change to the proposed arrangements.

(c) Consideration of the legal basis of each involved organization, its sources of revenue and responsibilities for expenditures (the two must match), and the hierarchy of authority across organizations (the legal basis of coordination).

For flood and drainage management projects, good governance would include securing system performance and O/M budget, particularly considering the lack of user fees or other direct revenues, and public (and all other water users') awareness and collaboration, particularly in a crisis situation and its aftermath.

Summary

- Design of institutional arrangements must be thoroughly documented, encompassing the legal and financial bases of sustainable operation.
- A clear description of how we get from where we are now to the proposed arrangements is required.

G. Institutional Strengthening

The PFS team must at an early stage in the project (i) identify water rights and water governance boundaries, (ii) identify and assess the valid regulatory framework for flood and drainage management (possibly including wastewater management) and other aspects relevant to the terms of reference, and (iii) identify the legally appointed actors in the area as well as the actual operators and stakeholders, which may be in a relatively large geographical area depending on the water catchment area. Institutional strengthening as well as the overall sustainability of the project will benefit from a closer interdepartmental interaction.

The client, supported by the PFS team, shall then design a reference group or other structure and a communication strategy to ensure participation by the key stakeholders throughout the whole project period. Such a process will improve institutional capacity by fostering dialogue, setting joint priorities, and coordinating approaches to investment. Closer dialogue will enable faster and more accurate fact-finding and a possibility (for the local government) to elaborate on a better internal structure including the extended life of the reference group after the finalization of the project.

H. Capacity Development

The PFS must identify all stakeholders and their respective responsibilities and suggest a capacity development program that will match proposed projects and measures. The overarching goal is to create a safe and sustainable system and ensure that investments in the sector are properly handled. This includes technical and environmental expertise with operational staff, including how to handle warning systems, but also the ability to maintain the system.

Another crucial part in flood management is public awareness about the risks in flood prone areas and disaster preparedness as well as the roles of various stakeholders and function of levees and storage dams. Dumping of waste may adversely affect the functionality of the drainage system and ultimately increase the risk of flooding.[6]

[6] See CDIA 2011 *Sector Guidelines for Pre-Feasibility Studies on Sollid Waste Management.*

Potential flooding in a city may depend on activities farther up in a river basin or a water catchment area. Thus, the PFS may suggest joint training and efforts to bring stakeholders together from a wider geographical and institutional area to learn more about water resource management, water governance, disaster management, and solid waste management (clogging of drainage).

The PFS team should explicitly plan activities for capacity development and training, designed and conducted to address the local situation and needs, during the PFS as well as part of a future capacity development program.

I. Conclusion

Although a CDIA PFS will not support urban planning studies, it may help a city to concretize its city development vision, examine alternatives to solve its flood and drainage management problems, and recommend investments for further feasibility study and/or implementation.

The criteria for a successful CDIA PFS, derived from the above, can be summarized as follows:

- *Technical effectiveness*—the extent to which proposed investments solve the flood and drainage related goals of a city and satisfy the needs of the people;
- *Impact*—the extent to which the investments impact, positively or negatively, the livability of the area, efficiency of land use, the local economy, air, soil and water, nearby natural resources, energy, the urban transport network and access to services, and others;
- *Cost effectiveness*—the extent to which the costs of the investments are commensurate with their benefits;
- *Financial sustainability*—the extent that funds required to build and operate the preferred options are likely to be available and affordable; and
- *Equity*—the costs and benefits of the alternatives are distributed fairly across different population groups.