

THE GOVERNMENT OF SRI LANKA

E2886 v6

Environmental Management Framework

Metro Colombo Urban Development Project

Ministry of Defence and Urban Development
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[Prepared by the University of Moratuwa]

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Abbreviations and Acronyms

CCD	Coast Conservation Department
CDF	Confined Disposal Facility
CEA	Central Environmental Authority
CMC	Colombo Municipal Council
DMDP	Department of Wildlife and Conservation
DWLC	Dredge Material Disposal Plan
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plans
EMF	Environmental Management Framework
GoSL	Government of Sri Lanka
GSMB	Geological Survey and Mines Bureau
GIS	Geographic Information Systems
ICTAD	Institute for Construction Training and Development
IA	Implementing Agency
IEE	Initial Environmental Examination
LA	Local Authorities
MCUDP	Metro Colombo Urban Development Project
MPPA	Marine Pollution Prevention Authority
NEA	National Environmental Act
SAP	Sediment Analysis Plan
SLLRDC	Sri Lanka Land Reclamation & Development Cooperation
SLPA	Sri Lanka Ports Authority
ToR	Terms of Reference
UDA	Urban Development Authority

PART 1 – OVERVIEW OF THE ENVIRONMENTAL SAFEGUARDS FRAMEWORK

1.5 Background

The Metro Colombo Urban Development Project (MCUDP) aims to provide early and timely support to the GoSL's long-term urban development program for Metro Colombo by focusing on (i) high-priority catalytic metropolitan investments aiming to reduce the physical and socio-economic impacts of flooding in the capital city area; and (ii) long-term capacity building for metropolitan management & local service delivery, and implementation support. The proposed project will consist of the following two main components:

Component 1: Flood and Drainage Management

This Component will finance both structural and non-structural activities related to flood control and drainage management identified as a priority by the inter-agency Flood Mitigation Task Force chaired by the SLLRDC. The investment packages under this component are essential and critical to reduce the impact of future floods in the catchment of the Colombo Basin. The bulk of the structural investments will be aimed to improve the system of primary and secondary canals, retention areas and drainage of the Colombo Water Basin. This component will also finance complementary interventions to enhance the economic value and aesthetic qualities of the water bodies. This component will include the following four sub-components: (1.1) Primary and Secondary Canals and Lakes; (1.2) Micro-Drainage System within CMC (localized floods); (1.3) Institutional and Capacity Enhancement for Flood and Drainage Management; and (1.4) Beira Lake Development and Beddagana Bio-diversity Wetland Management Park.

Components 2: Urban Development and Infrastructure Rehabilitation for Metro Colombo Local Authorities, and Implementation Support

Component 2 aims at (a) strengthening strategic planning processes at the metropolitan level and (b) supporting local authorities in the CMA to (i) rehabilitate and manage their drainage infrastructure and streets, and (ii) improve solid waste collection. It will comprise the following Sub-components:

- ***Sub-Component 2-1: Support to Metropolitan Strategic Planning (USD 2.30 million)***

This Sub-component will support improved metropolitan management and coordination by financing the following activities: (a) development of a City Development Strategy and Strategic Growth Plan for the Colombo Metropolitan Region, including a number of studies related to the revitalization of Colombo City' historical and cultural areas, and the (b) development of an Integrated Master Plan for the Colombo Metropolitan Region.

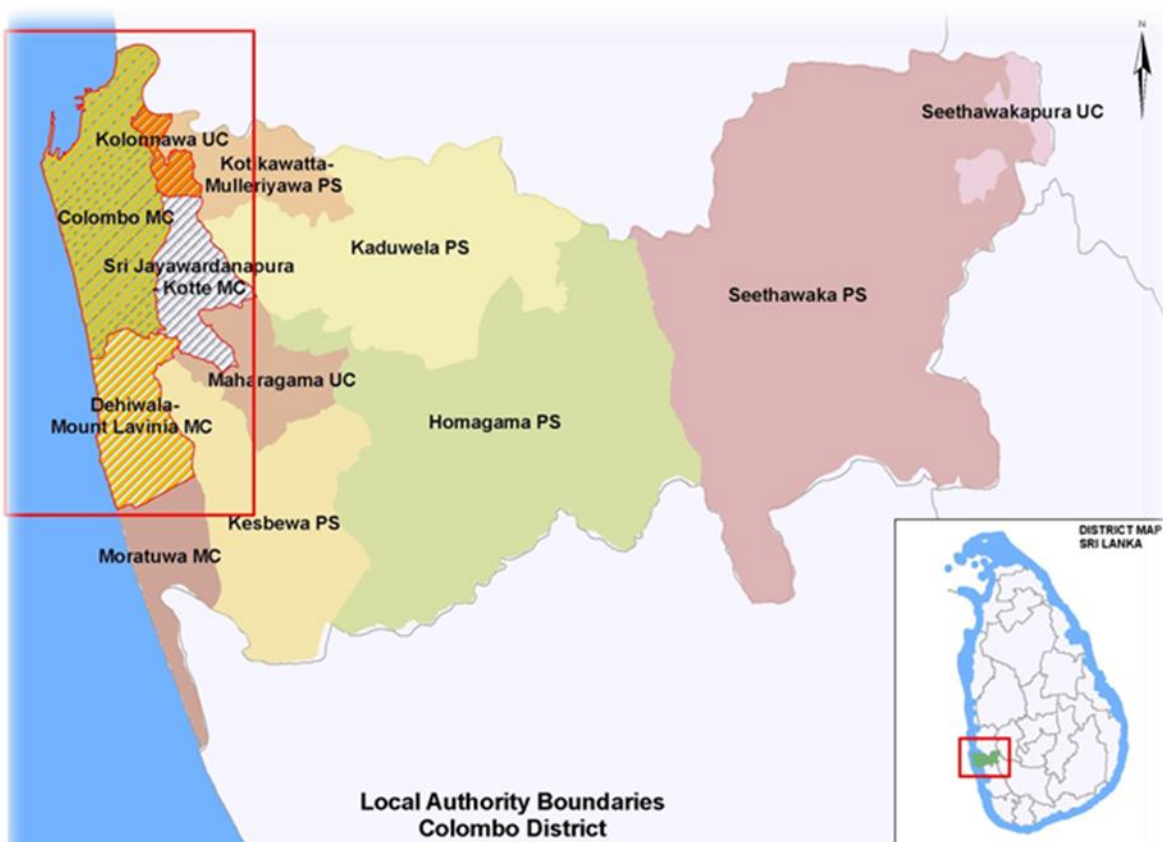
- ***Sub-Component 2.2: Support to Local Authorities (USD 38.95 million)***

This Sub-component aims at enhancing the capacity of the four core Local Authorities composing the CMCC to deliver sustainable local infrastructures and services, and coordinate at metropolitan level. Activities that will be financed under this Sub-component include a combination of (a) Investment Support to Local Authorities and (b) Institutional Strengthening Support for Local Authorities.

Refer Project Appraisal Document for detail project description

1.2 Project Location

The MCUDP will be carried out in the in the Colombo Metropolitan Area which comprises of the Colombo Municipal Council and the peripheral local authorities that include the Sri Jayawardena Pura Kotte Municipal Council (SJPKMC), Dehiwala Mount Lavinia Municipal Council (DMLMC) and Kolonnawa Urban Council (KUC) –as indicated in the map below. The project investments are at various stages of implementation readiness (as explained in section 1.3 below) and it is therefore necessary for the project to have a policy framework for environmental safeguards that can be applied for sub-project as and when they are implementation ready in order to achieve the objectives stated below.



Project Location Map

1.3 Objective of the Environmental Management Framework

Projects and Programs financed with IDA resources need to comply with World Bank Operational Policies. Therefore, sub-projects and components eligible for funding under this project will be required to satisfy the World Bank's safeguard policies, in addition to conformity with environmental legislation of the Government of Sri Lanka (GOSL). However, since detail designs for a majority of sub-projects or investments under MCUDP have not been finalized at this stage, site-specific Environmental Assessments (EA) cannot be conducted. What is possible at this stage would be to carry out an identification of generic issues that are typically associated with the type of sub-projects proposed and

determine safeguard procedures and instruments to be applied to sub-projects as and when they become technically ready for implementation.

Therefore, the purpose of this document is to outline a framework for environmental screening, assessment and management, giving details of potential environmental issues, screening criteria and guidelines on what type of environmental tools need to be applied for the various investments prior to commencement of activities. The EMF will serve as the basis for carrying out safeguards due diligence for all sub-projects under the MCUDP.

The objectives of this Environmental Management Framework are:

- i. To establish clear procedures and methodologies for environmental screening, planning, reviewing, approval and implementation of subprojects
- ii. To specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring environmental concerns related to subprojects
- iii. To determine the training, capacity building and technical assistance needed to successfully implement the provisions of the EMF and;
- iv. To provide practical resources for implementing the EMF

Specifically, the EMF includes the following sections;

- A description of proposed investments under MCUDP and the level of readiness at appraisal
- The technical framework for environmental safeguards management including screening, preparation of EA/EMP, review and approval of sub-projects
- Preliminary assessment of anticipated environmental impacts from the project, general mitigatory measures for construction related impacts, guidelines for anticipated significant environmental issues, preparation and approval of EA process and a description of EA tools
- Safeguards implementation arrangement and roles and responsibilities of various parties involved
- Procedures for stakeholder consultation and disclosure
- Key environmental issues in Metro Colombo area related to flood and drainage management
- Strategic planning needs of the MCUDP

As a detail description of the proposed project area in terms of key physical, hydrological and biological features has been provided in the Environmental Assessment (EA), repeating same information in the EMF has been avoided. Nevertheless, the EMF has been prepared within the same social, environmental and institutional context as the EA and hence much of the background information provided in the EA is relevant and will be referred to in the EMF, avoiding repetition of information. A generic EA was prepared in parallel to the EMF for a long list of sub-projects identified by the project for early implementation. The EA can be found disclosed on the same website as the EMF (www.defence.lk).

1.4 Proposed Investments of MCUDP

The MCUDP sub-projects will broadly fall in to the following thematic investment categories.

- i. Improvements to main canals and lakes: The activities that will come under these include protection of canal banks and clearing of reservations, repairs locks and gates in the canal systems, widening of bridges in the canal systems, tunnel constructions, restoration of lakes associated with the canals and wetlands through dredging and environmental enhancement of the immediate surrounding.

- ii. Rehabilitation secondary/tertiary canals: Dredging & widening of secondary canals, may require land acquisition or ejection of encroachment or resettlement in new sites, bank stabilization, landscaping
- iii. Improvement to storm water drainage in the CMC: These include improvements to localized micro drainage and interception of unauthorized effluent discharges.
- iv. Urban landscaping for recreation and city beautification: Creation of recreational space such as parks, walkways other public open spaces and improvement to existing places, Conservation of heritage around Beira lake and other important sites including natural habitats for promotion of urban tourism
- v. Public Health & Sanitation support: Solid waste management and interception of unauthorized discharges to the canal system, improving the public sanitary facilities
- vi. Rehabilitation/development of small/medium scale municipal infrastructure: rehabilitation and renovation of libraries, markets, public toilets, play grounds and common amenities
- vii. Urban/municipal Road resurfacing and road side drainage improvement

In terms of implementation readiness the investments in the pipeline has been divided into three categories;

1. Front runner project for which final designs are completed and ready for implementation at project onset. The EMF has been applied to these 8 sub-projects and as such screening has been completed and detail EMPs prepared.

Implementing Agency	Project description
Component 1	
SLLRDC	1. Embankment protection and demarcation of canal reservation of Dehiwela Canal
	2. Reconstruction of Aluth Mawatha culvert, and improvements to Mutwal Outfall (box drain, tunnel inlet and outlet)
UDA	3. Construction of bank protection wall along 2.5 Km of Beira lake and rehabilitation of Macculum lock gates
	4. Establishment of Beddagana Park and Kotte Rampart Park
CMC	5. Micro-drainage improvement in Marine Drive development from Dehiwala Bridge up to Bambalapitiya Station Road (sub-catchments 2, 4 and 5)
Component 2	
CMC	6. Model Zone Development of Town Hall Square
	7. Walkability Improvements in City of Colombo-Foot Walks

	<ul style="list-style-type: none"> • Sir James Pieris mw • Kumaran Ratnam road • Dr. Colvin R de Silva mw • T.B Jayah mw • Sir Chitthampalam A Gardiner Mw • Lotus road • Sir M.M Marker mw • Akbar Mw • Rifle street • Vauxall street • Kew road • Vauxall lane • Bahiathulla lane • Police lane • Barracks lane • Kew points road • Morgan road • Dawson road
	<p>8. Improving Public Convenience-construction of new public toilets and improvements to existing toilet blocks</p> <ul style="list-style-type: none"> • No. 112, Vauxhall Street, Colombo – 02 • Galle Road/W.A. Silva Mw., Colombo – 05 • Milagiriya, Colombo – 04 • Main Street, Colombo – 11 • Saunders Place, Colombo –11 • York Street, Colombo – 01 • Piyadasa Sirisena Mw., Colombo –10 • Nagalagam Street, Colombo – 14 • Vihara Maha Devi Park, Colombo – 07 • Gunasinghe Pura, Colombo – 11 • Madampitiya, Colombo – 14 • Timbirigasyaya , Colombo – 05 • Kotahena, Colombo – 13

	<ul style="list-style-type: none"> • Mattakkuliya, Colombo – 15
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2. Sub-projects for which (i) Component 1: final designs depending on updated rainfall data and (ii) Component 2: final designs under preparation, and could start implementation as soon as design work is completed and safeguard screening and its recommendations are carried out.

Implementing Agency	Project description
Component 1	
SLLRDC	9. Embankment protection and demarcation of canal reservation of St Sebastian South Canal
	10. Embankment protection and demarcation of canal reservation of Wellawatte Canal
	11. Embankment protection and demarcation of canal reservation of Main Drain
	12. Embankment protection and demarcation of canal reservation of Dematagoda canal
	13. Improvements to Madiwela East Diversion <ul style="list-style-type: none"> a. Design of control gates at spillway of Talangama tank b. Bank protection from Amaragoda culvert to Athurugiriya road
	14. Embankment protection of secondary canals of Sarana Mawatha and Sethsiripaya
	15. Formation of lakes No 06 and 07 in the parliament catchment
	16. Construction of foot bridges and nodal parks around Beira lake
CMC	Micro-drainage improvement in the following localities
	17. Flood prevention at Green Lane, George R. De Silva Mw. And Ratnam Play Ground Area
	18. Flood prevention at Garden No.175 and 211
	19. Flood prevention at Nagalagam Street
	20. Flood prevention Garden No.75 at Ferguson Road
	21. Upper catchment of Torrington North Canal
Component 2	
CMC	22. Rehabilitation of Roads in city of Colombo-Galle Road and R.A. De Mel Mawatha
	23. Pedestrian Overhead Bridges at Kollupitiya & Bamalapitiya Intersection with Galle Road
Sri	24. Rehabilitation of roads, consisting of overlaying of the roads with hot mixed

Jayewardene ura Kotte MC	Asphalt Concrete to line and level and construction of side drains and lead away drains (details TBD).
	25. Culvert at Pangiriwatta 1st Lane Across the Railway Line - Work consists of removal of the existing hume pipe culvert without effecting the railway line and constructing a new box culvert with a larger opening in its place
	26. Rehabilitation of canal from Waththa No.60 to Arunodaya Mawatha canal - Work consists of clearing of canal and embankment protection of canal banks.
	27. Rehabilitation of canal from Waththa No.60 to Arunodaya Mawatha canal
	28. Children play-ground and recreation park
Kolonnawa UC	29. Rehabilitation of about 6 kilometers of selected urban roads including their drainage
Dehiwala Mt. Lavinia MC	30. Rehabilitation of Roads consisting of overlaying of the roads with hot mixed Asphalt Concrete to line and level and construction of side drains and lead away drains (details TBD)
	31. Construction of Storm water drain from Ratmalana SLTB depot to
	32. Lunawa Canal
	33. Rehabilitation of Dharmarama Road (Drains)
	34. Construction of Hanger for heavy vehicles and utility center for Ratmalana DE
	35. Construction of Office for DE-Ratmalana
	36. Development of RatmalanaPola

3. Sub-projects for which (i) Component 1: final designs depend on updated Hydro modeling data; (ii) Component 2: final designs under preparation or staggered implementation and require more time to finalize designs and complete safeguard screening.

Implementing Agency	Project description
Component 1	
SLLRDC	37. Upgrade of set of North lock Gates & downstream improvement with embankment protection - continuation from Stage I
	38. Improvements to Main Drain Crossings at Ports Access Road & Railway
	39. Madiwela East Diversion: Additional opening to Amaragoda culvert (optional-will be decided upon the analyzing results of model studies which are ongoing.)
	40. Restoration & Creation of lakes around Parliament lake - continuation from Stage I
	41. Improvements to Galle road bridge across Wellawatta canal
	42. Pumping Station at North Lock (10m ³ /s)

	43. Rehabilitation of Pumping Station at South Locks & renovation of gates
	44. St. Sebastian South Diversion canal by passing Beira Lake (excluding upstream part of the Norris canal) including treatment at outlet
	45. Restoration of Kollonnawa retention area & pumping station at Gotatuwa (30m ³ /s)
	46. Implementation of Water-based transport services for better usage and management & investment for maintenance of water bodies – Bridge Improvements
	47. Improvement of the neighborhood of water bodies (canals & lakes) for recreational purposes - Foot Bridges
	48. Detailed designs for implementation of Real time Flood Monitoring & Forecasting system for Colombo Basin
CMC	Improvements to storm water drainage
	49. Flood prevention at Garden No.175 and 211 at Nagalagam Street and Garden No.75 at Ferguson Road
	50. Flood prevention along K.Cyril C. Perera Mw. From George R.De Silva Mw. Up to Arthur De Silva Mw. Junction
	51. Prevention of Flooding at Saunders Place
	52. Prevention of Flooding at Maligawatta Housing Scheme
	53. Storm Water improvements of Siridhamma Mawatha and surrounding area
	54. Flood Prevention at Poorwarama Rd, and Kandewatta Rd.
	55. Flood Prevention at Park Road
	56. Proposed Water Front Recreational Park at Crow Island
57. Marine Drive Promenade with Beach Front Leisure Park	
Component 2	
Dehiwala Mt. Lavinia MC	58. Redevelopment of Attidiya Grounds
	59. Canal Improvement at Aurban Side
Sri Jayewardenepura Kotte MC	60. Development of Chandra Silva Recreational Park at Rajagiriya
	61. Construction of Pitakotte Market and Medical Centre
	62. Redevelopment of Bandaranayakapura Open Space
	63. Redevelopment of Rajagiriya Junction Open Space
	64. Redevelopment of Esala Uyana Open Space
	65. Redevelopment of Palliya Patumaga Open Space
	66. Redevelopment of Senanayaka Mawatha Open Space
67. Redevelopment of Kolonnawa Road Open Space	
Kolonnawa UC	68. Dredging of Minor Canal at Wadullawatte
	69. Dredging of Kambikotuwawatte Canal
	70. Dredging of Canal near United Motors, Orugodawatte
	71. Dredging of Minor Canal at Wadugodawatte
	72. Machine Requirement
	i. Backhoe loader
	ii. Road Roller
	iii. Ambulance
	iv. Compactors (Garbage Collectors)-06 Nos
v. Waste Disposal Plastic Bin (10000 Nos)	

	vi. Office Equipment
UDA	73. Nodal Parks along Beira Lake

PART 2 – ENVIRONMENTAL SCREENING AND TECHNICAL FRAMEWORK FOR SAFEGARDS MANAGEMENT

2.1 Environmental Screening of sub-projects

Environmental screening is reckoned to be a useful tool to identify environmental safeguard issues with respect to each and every sub-project. Therefore, all sub-projects under the MCUDP will be subjected to a detail screening using the form provided in Annex 1. In addition to the list of sub-projects indicated, all resettlement sites that will be used by the project to relocate families from underserved settlements to enable certain sub-projects to be implemented will be subjected to the same screening process. The main objective of Environmental Screening of sub-projects will be to determine (a) the anticipated environmental impacts, risks and benefits based on the sub-project intervention and site-specific data of the proposed location (ii) determine if the anticipated impacts and public concern will warrant further stand alone environmental assessments and management plans, and if so, recommend the level of analysis. The environmental screening report should be prepared by an environmental expert/s on a rapid basis with field visits and available data and information (*the recommended implementation arrangements are given in Part 03*). Once the report is ready it will be made available to the project proponent to take necessary actions particularly in relation to the recommendation given in the report.

2.1.1 Sub-project criteria for screening

In the case of developing criteria for screening and assessing anticipated impacts all sub-projects are categorized into 7 generic themes based on the nature of work proposed, as presented in Chapter 1. The following table provides a template of a typical screening (anticipated outcomes based on potential environmental risks/impacts involved) and classifying all sub-projects in the pipeline in accordance with (a) safeguard categories of OP 4.01 and (b) recommended type of environmental analysis and/or feasibility studies to be undertaken for each type of investment commensurate with the magnitude of potential impacts and risks. According to this table it is evident that most of the sub-projects belong to safeguard Category B and do not need rigorous environmental studies to be undertaken and only the screening report with a site specific EMP would be adequate. Hence project proponents are requested to refer to Table 2.1 to be informed on the level of environmental studies that would typically be necessary to be undertaken prior to commencement of the project.

It is extremely important to note that this table has been prepared as a **broad guidance** to the PMU and the implementing agencies as possible screening outcomes commensurate with typical environmental risks/impacts associated with each sub-project and **should be re-evaluated** at the time of actual screening. The final decision will be based on the actual screening that will be undertaken for each project along with appropriate site investigations.

Table 2.1 – Anticipated Screening Outcomes For Proposed Sub Projects
1 – SEA ; 2 - Feasibility/Analytical study (mainly sediment quality analysis); 3 – EIA; 4 – EA; 5 – EMP only
Recommended Environmental Analysis - v; Safeguard Category of sub-project: A – Impacts are significant and irreversible; B – Significance of impacts vary, mitigatable and not irreversible; C – no impact

Project component and implementing agency	Sub-project type	Potential adverse environmental issues (<i>refer 2.2.1 for a more detail account of potential impacts</i>)	Safeguard Category According to OP 4.01	Type of recommended environmental analysis				
				1	2	3	4	5
Component 1								
	Improvement to Main canals and lakes (macro drainage)							
SLLRDC	Embankment protection of Dehiwela Canal and demarcation of canal reservation	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B		v			v
SLLRDC	Embankment protection and demarcation of canal reservation of St Sebastian South Canal	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B		v			v
SLLRDC	Embankment protection and demarcation of canal reservation of	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B		v			v

	Main Drain							
SLLRDC	Embankment protection and demarcation of canal reservation of Wellawatte Canal	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B		√			√
SLLRDC	Embankment protection and demarcation of canal reservation of Dematagoda canal	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B		√			√
SLLRDC	Reconstruction of Aluth Mawatha culvert, and improvements to Mutwal Outfall (box drain, tunnel inlet and outlet	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B					√
SLLRDC	Embankment protection of secondary canals of Sarana Mawatha and Sethsiripaya	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, restricted access, worker health an safety, increased traffic	B		√			√
SLLRDC	Formation of lakes in the	Dredging, transportation and disposal of dredged material, public safety, worker health and safety, temporary blockage of drainage paths, degradation of water quality, contamination of other water	A		√	√		

	parliament catchment	sources,						
SLLRDC	Upgrade of set of North lock Gates & downstream improvement with embankment protection	Disposal of demolished debris of existing gates, excavated soils, debris from downstream widening dust, noise and vibration from construction activity	B		√			√
SLLRDC	Improvements to Main Drain Crossings at Ports Access Road & Railway	Disposal/transportation of debris and soil resulting from cleaning and improvement to existing drain, dust, noise and vibration from construction activity, Traffic obstacle Public safety	B					√
SLLRDC	Madiwela East Diversion: a. Design of control gates at spillway of Talangama tank b. Bank protection from Amaragoda culvert to Athurugiriya road c. Additional opening to Amaragoda culvert (optional-will be decided upon the analyzing results of model studies which are ongoing.)	Disposal of debris and soil generation from excavation for all structures & improvements Dust, noise and vibration from construction activity Public safety	B		√			√
SLLRDC	Improvements to Galle road bridge across Wellawatta canal	Translocation of concrete debris. Over spill into canal during construction, traffic congestion and public safety Dust and noise	B					√
SLLRDC	Rehabilitation of the pumping Station at North Lock (10m ³ /s)	Disposal of construction debris, dust, noise	B					√
SLLRDC	Rehabilitation of Pumping Station at South Locks & renovation of gates	Transportation and disposal of concrete debris, dust and noise	B					√

SLLRDC	St. Sebastian South Diversion canal by passing Beira Lake (excluding upstream part of the Norris canal) including treatment at outlet	Soil and debris resulting from micro-tunneling and canal excavations, construction of treatment plant, public safety, dust, noise, traffic obstacle, impacts on marine habitats,	A			√		
SLLRDC	Restoration of Kolonnawa retention area & pumping station at Gothatuwa (30m ³ /s)	Dredging, transportation and disposal of dredged material, public safety, worker health and safety, temporary blockage of drainage paths, degradation of water quality, contamination of other water sources,	A		√		√	
SLLRDC	Implementation of Water-based transport services for better usage and management & investment for maintenance of water bodies – Bridge Improvements	Disposal of excavated material from canal banks and bed widening and excavation Water pollution from boat engines	B					√
SLLRDC	Improvement of the neighborhood of water bodies (canals & lakes) for recreational purposes - Foot Bridges	Spillage of construction material into water bodies, Dust and noise Public safety	B					√
SLLRDC	Detailed designs for implementation of Real time Flood Monitoring & Forecasting system for Colombo Basin.	Such monitoring & forecasting systems to be established during drought/ non rain period for emergency construction stability. since it's a study that the project will fund, no physical impacts to be handled	C					
Improvement to storm water drainage in the CMC								
CMC	Flood prevention at Garden No.175 and 211 at Nagalagam Street and Garden No.75 at Ferguson Road	Disturbance to ongoing urban activities, restricted access to residential areas, inconvenience to pedestrians, noise, dust and emissions during construction, water stagnation causing mosquito breeding, temporary drainage issues, design failures, removal of trees, disposal of excavated soil and construction debris etc	B					√
CMC	Flood prevention along K.Cyril C. Perera Mw. From George R.De Silva Mw. Up to Arthur De Silva Mw. Junction		B					√

CMC	Prevention of Flooding at Saunders Place		B						√
CMC	Prevention of Flooding at Maligawatta Housing Scheme		B						√
CMC	Storm Water improvements of Siridhamma Mawatha and surrounding area		B						√
CMC	Flood Prevention at Poorwarama Rd, and Kandewatta Rd.		B						√
CMC	Flood Prevention at Park Road		B						√
CMC	Flood prevention at Green Lane, George R. De Silva Mw. And Ratnam Play Ground Area		B						√
CMC	Flood prevention at Garden No.175 and 211		B						√
CMC	Flood prevention at Nagalagam Street		B						√
CMC	Flood prevention Garden No.75 at Ferguson Road		B						√
CMC	Upper catchment of Torrington North Canal		B						√
CMC	Micro-drainage improvement in Marine Drive development from Dehiwala Bridge up to Bambalapitiya Station Road		B						√
Component 2									
	Urban Landscaping for Recreation and City Beautification								
CMC	Model Zone Development of Town Hall Square	Public safety and inconvenience, road closure, traffic build up, nuisance to sensitive receptors such as schools and hospitals, temporary drainage issues, dust and noise	B						√
	Walkability Improvements in City of Colombo-Foot Walks (including road resurfacing)		B						√

CMC	Proposed Water Front Recreational Park at Crow Island	Disposal of solid waste littering the area, temporary restriction of access by public to the beach, dust and noise pollution, during construction	B						√
CMC	Marine Drive Promenade with Beach Front Leisure Park	Disposal of solid waste littering the area, temporary restriction of access by public to the beach, dust and noise pollution, during construction	B						√
Sri Jay. Kotte	Children play-ground and recreation park		B						√
Sri Jay. Kotte	Development of Chandra Silva Recreational Park at Rajagiriya	Off-site impacts from extraction of earth and turf, dust and noise pollution, during stockpiling and construction Soil erosion and sedimentation due to stockpiling and leveling (in wet weather)	B						√
Sri Jay. Kotte	Redevelopment of Bandaranayakapura Open Space	Disturbance to traffic, inconvenience to pedestrians, dust	B						√
Sri Jay. Kotte	Redevelopment of Rajagiriya Junction Open Space		B						√
Sri Jay. Kotte	Redevelopment of Esala Uyana Open Space		B						√
Sri Jay. Kotte	Redevelopment of Palliya Patumaga Open Space		B						√
Sri Jay. Kotte	Redevelopment of Senanayaka Mawatha Open Space		B						√
Sri Jay. Kotte	Redevelopment of Kolonnawa Road Open Space		B						√
Sri Jay. Kotte	Redevelopment of Kolonnawa Road Open Space		B						√
UDA	Nodal Parks along Beira Lake	Dust and noise pollution during construction spillage of construction material to the lake water, public safety, traffic congestion from material hauling	B						√
UDA	Construction of bank protection wall along 2.5 Km of Beira lake and rehabilitation of Macculum lock	Off-site impacts of quarrying, traffic congestion due to material haulage, impacts on lake water quality, disposal of debris from construction and lake bank	B						√

	gates	clearing.							
UDA	Establishment of Beddagana Park and Kotte Rampart Park	Improper selection of tree species for planting, possible introduction of invasives, maintenance and management, damage to native vegetation during removal of existing invasive species, disposal of vegetation of invasive species	B						√
Rehabilitation/development of small/medium scale municipal infrastructure									
Dehiwala MC	Redevelopment of Attidiya Grounds	Off-site impacts from extraction of earth and turf, dust and noise pollution, during stockpiling and construction, soil erosion and sedimentation due to stockpiling and leveling (in wet weather)	B						√
Dehiwala MC	Construction of Office for DE-Ratmalana	Dust, noise and inconvenience to adjacent office buildings	B						√
Dehiwala MC	Construction of Hanger for heavy vehicles and utility center for Ratmalana DE		B						√
Dehiwala MC	Development of Ratmalana Pola	Disposal of construction debris, site clearance for alternative pola site (temp), waste water discharge, dust, noise	B						√
Sri Jayawardanepura Kotte	Construction of Pitakotte Market and Medical Centre	Dust and noise pollution during construction	B						√
Urban/municipal road resurfacing and drainage improvement									
CMC	Rehabilitation of Roads in city of Colombo-Galle Road and R.A. De Mel Mawatha	Public safety and inconvenience, road closure, traffic build up, noise, dust and other emissions	B						√
CMC	Pedestrian Overhead Bridges at Kollupitiya & Bamalapitiya Intersection with Galle Road		B						√
Dehiwala MC	Rehabilitation of Roads consisting of overlaying of the roads with hot mixed Asphalt Concrete to line and	Dust ,smoke and notice pollution and traffic congestion during construction	B						√

	level and construction of side drains and lead away drains							
Dehiwala MC	Construction of storm water drain from Ratmalana SLTB to Lunawa Canal	Damages to property and dust, smoke and noise pollution during construction Disposal of soil and other debris from excavation and construction	B					√
Dehiwala MC	Rehabilitation of Dharmarama Road (Drains)	Disposal of drain silt and other debris, disturbance to residents	B					√
	Canal Improvement at Aurban Side	Disturbance to existing canal flow, in addition to dust and noise pollution, during construction, disposal of dredge material	B					√
Sri Jayawardanepura Kotte MC	Overlay of the roads with hot mixed Asphalt Concrete to line and level and construction of side drains and lead away drains.	Dust ,smoke and notice pollution and traffic congestion during construction	B					√
Sri Jayawardanepura Kotte MC	Culvert at Pangiriwatta 1st Lane Across the Railway Line - removal of the existing hume pipe culvert without effecting the railway line and constructing a new box culvert with a larger opening in its place	Disposal of construction debris, road closure for traffic, inconvenience to road users, dust and noise	B					√
Kolonnawa UC	Rehabilitation of about 6 kilometers of selected urban roads including their drainage	Air and notice pollution, traffic congestion, road closure, possible removal of trees						
Rehabilitation of Secondary/tertiary Canals								
Sri Jayawardanepura Kotte MC	Rehabilitation of canal from Waththa No.60 to Arunodaya Mawatha canal - clearing of canal and embankment protection of canal banks.	Disposal of sediments/debris, removal of trees, extraction of rocks for gabions, dust, noise, vibration, public safety, worker health an safety, restricted access, increased traffic	B					√
Kolonnawa UC	Dredging of Minor Canal at Wadullawatte	Disturbance in the vicinity and noise pollution, disposal of dredged material odour	B		√			√

Kolonnawa UC	Dredging of Kambikotuwawatte Canal	Disturbance in the vicinity and noise pollution, Disposal of dredged material	B		√			√
Kolonnawa UC	Dredging of Canal near United Motors, Orugodawatte	Disturbance in the vicinity and noise pollution, Disposal of dredged material	B		√			√
Kolonnawa UC	Dredging of Minor Canal at Wadugodawatte	Disturbance in the vicinity and noise pollution, Disposal of dredged material	B		√			√
Public Health and Sanitation Improvement								
CMC	Improving Public Convenience- construction of new public toilets and improvements to existing toilet blocks	Disposal of construction debris, public inconvenience due to temporary loss of access to toilets, on-site material stock piling causing disturbance to urban activities, dust, noise	B					√
	Solid waste management through increased efficiency of collection at the local authorities							

Note:

- Annex 2 provides a summary description of the various safeguard tools used in the table above.
- Details of World Bank's safeguard policy on Environmental Assessment (OP/BP 4.01) are provided in the Environmental Assessment report prepared for MCUDP (available at www.defence.lk)

2.1.2 Screening Method

Preparation of the screening reports will be conducted in four distinct stages, namely (i) field visits, data collection and stakeholder consultation; (ii) data analysis and interpretation; (iii) impact identification; and (iv) filling screening reports and preparing EMPs. The methodologies for each of these steps are explained briefly below. The proposed screening report format is given in Annex 1.

Data collection and stakeholder consultations

Data for this study will be primarily collected through field visits, discussion with stakeholder agencies and literature reviews. In addition, supportive tools such as GIS based mapping using GPS coordinates covering the sub project sites, where ever possible is encouraged.

Literature Survey will broadly cover the following aspects and attributes necessary for environmental screening:

- Project details/ Reports/ Maps/ documents including design details available with SLLDRC, UDA, CMC and other local authorities
- Literature on flora/ fauna/ biodiversity/land use/soil/geology/ hydrology/ climate /socio economic profiles and environmental planning collected from GOSL agencies
- Hydrological/ rainfall/ drainage datasets

Field Visits:

Each sub-project sites will be visited by the expert/s filling the screening form together with representatives from the implementing agency to assess the existing environment (physical, biological and socio economic environment) and gather information with regard to the proposed sites and scale of the proposed sub projects and any prevalent issues. During these visits rapid reconnaissance surveys will be conducted in order to record the faunal, floral diversity, where necessary, to verify and support information gathered through the literature survey.

Focus Group Discussions/ Meetings:

Focus group discussions will be carried out with other stakeholder agencies (as the expert will represent the project proponent sub-project related technical discussions are expected to take place internally) and local authorities to discuss pertinent issues. In addition, the public will be consulted (at least 5 such consultations in each site) to record their views and opinions about the proposed MCUDP and the given site-specific investments.

Data Analysis and Interpretation

Data collected from field visits and stakeholder discussions will be analyzed by the expert and discussed with the technical team of the project proponent for feedback.

Impact identification

This will be carried out by the project proponent's expert through discussion with the technical team.

Filling screening reports and preparing EMPs

The screening report will be filled with details on project activities, physical baseline conditions of the site, feedback from public consultations. Finally, site specific EMPs will be prepared for each sub-project with details on impacts and mitigation. **Annex 3** provides guidelines for EMP preparation.

2.2 Preliminary assessment of environmental impacts of MCUDP

With the preliminary assessment of impacts all types of impacts triggered by MCUDP could be generalized under (i) typical generic construction impacts which can be mitigated with good construction practices and (ii) specific impacts that can arise due to the engineering interventions proposed for some sub-projects and hence require careful planning.

In general following is the list of broad positive and negative impacts that are very likely to arise from the sub-projects funded by the MCUDP.

Overall positive impacts of the project

- Benefits of improved flood management
- Reduction in public health hazards due to improved flow and WQ in canals
- Prevention of encroachments
- Improved public health and services
- Traffic improvement
- City beautification – potential for tourist attraction
- Wetland protection and conservation

Negative impacts of the project

- Impacts on water quality due to canal bank protection and dredging
- Impacts of dredge material disposal
- Soil erosion and siltation
- Impacts on air quality from use of machinery and construction activities
- Impacts (off-site) of material extraction (earth, rocks, turf)
- Impacts on traffic flow caused by construction activity and vehicles transporting materials to the site etc
- Impacts of noise from construction activity
- Occupational hazards and impacts to public safety
- Impacts of vibration on structural safety of buildings adjacent to construction sites
- Impacts on wetland ecosystems and bio-diversity
- Socio-economic impacts

These impacts though occurring in most of the sub-projects will vary in extent and significance **hence individual assessment is of utmost importance**. However for ease of presentation and reference typical construction impacts related to the project have been discussed under the 7 thematic groups as indicated in Chapter 1 and below.

- i. Improvements of main/primary canals and lakes: The activities that will come under these include protection of canal banks and clearing of reservations, repairs locks and gates in the canal systems, widening of bridges in the canal systems, tunnel constructions, restoration of lakes associated with the canals and wetlands through dredging and environmental enhancement of the immediate surroundings.
- ii. Rehabilitation of secondary/tertiary canals: Dredging & widening of secondary canals, may require land acquisition or ejection or encroachment or resettlement in new sites, bank stabilization, landscaping

- iii. Improvement of storm water drainage in the CMC: These include improvements to localized micro drainage and interception of unauthorized effluent discharges
- iv. Urban landscaping for recreation and city beautification: Creation of recreational space such as parks, walkways other public open spaces and improvement to existing places, Conservation of heritage around Beira lake and other important sites including natural habitats for promotion of urban tourism
- v. Public Health & Sanitation support: Solid waste management and interception of unauthorized discharges to the canal system, improving the public sanitary facilities
- vi. Rehabilitation/development of small/medium scale municipal infrastructure: rehabilitation and renovation of libraries, markets, public toilets, play grounds and common amenities
- vii. Urban/municipal Road resurfacing and road side drainage improvement

The following section lists out the probable impacts under each theme separately.

2.2.1 General Construction related Impacts for the 7 thematic groups of sub-projects

Investment category of MCUDP sub-projects	
<p>1. Improvements of main/primary canals and lakes: The activities that will come under these include protection of canal banks and clearing of reservations, repairs locks and gates in the canal systems, widening of bridges in the canal systems, tunnel constructions, restoration of lakes associated with the canals and wetlands through dredging and environmental enhancement of the immediate surroundings.</p>	
Key project activities	Construction related Impacts
Site preparation including provision of access roads, material storage yards	Emission of dust; Disturbance to pedestrian movement, problems of accessibility to houses.
Dredging, dewatering and disposal of bottom sediments	Degradation of water quality; Reduce pore pressure build up, slope instability and transport of fines; Surface ponding of removed water; Stock piling of dredged material, soil, debris; Blocking of surface drainage paths causing localized flooding; Odour problems; Smothering of benthic fauna
Removal of temporary structures, debris, demolition waste and other solid waste along the banks	Emission of dust and noise; Disturbances to traffic and pedestrians during storage of material and debris; Inconvenience to present residents and pedestrians.
Excavation for the gabion wall construction and coffer damming	Collapse of vertical soil faces; Increased susceptibility to erosion; Liquefaction leading to bank failures; Excessive noise and vibration; Inconvenience to present residents and pedestrians; Temporary distraction of fish
Material transport and storage	Emission of dust and noise due to transport of material; Inconvenience to the neighbours
Construction of flow guidance walls for bank protection: Sheet pile walls, gabion walls etc.	Diversion of flows, increased flow velocities, erosion of soil embankments, loosening bank support and weakening of the interlocking of rubble used causing immature failure of gabion structure; Inconvenience to present residents and pedestrians.

Reinstatement of storm water drainage connections through protection walls.	Erosion of soil embankments, loosening bank support and weakening of the interlocking of rubble used causing immature failure of gabion structure; Blockage due to accumulation of fines due to cross drainage flows
Backfilling of banks behind the gabions, turfing and replanting of trees	Differential settlements causing the gabion walls to misalign and fail; Inconvenience to present residents and pedestrians and potential accidents
Reinstatement of maintenance roads and construction of road side drain and cross drainage	Localized ponding; weakening of soil sub-base
2. Rehabilitation of secondary/tertiary canals: Dredging & widening of secondary canals, may require land acquisition or ejection or encroachment or resettlement in new sites, bank stabilization, landscaping	
Key project activities	Construction related Impacts
Site preparation including provision of access roads, material storage yards	Emission of dust; Disturbance to pedestrian movement, problems of accessibility to houses.
Dredging, dewatering and disposal of bottom sediments	Degradation of water quality; Reduce pore pressure build up, slope instability and transport of fines; Surface ponding of removed water; Stock piling of dredged material, soil, debris; Blocking of surface drainage paths causing localized flooding; Odour problems; Smothering of benthic fauna
Removal of temporary structures, debris, demolition waste and other solid waste along the banks	Emission of dust and noise; Disturbances to traffic and pedestrians during storage of material and debris; Inconvenience to present residents and pedestrians.
Widening of secondary canals, Excavation for the gabion wall construction and coffer damming	Collapse of vertical soil faces; Increased susceptibility to erosion; Liquefaction leading to bank failures; Excessive noise and vibration; Inconvenience to present residents and pedestrians; Temporary distraction of fish

Material transport and storage	Emission of dust and noise due to transport of material; Inconvenience to the neighbours
Construction of flow guidance walls for bank protection: Sheet pile walls, gabion walls etc.	Diversion of flows, increased flow velocities, erosion of soil embankments, loosening bank support and weakening of the interlocking of rubble used causing immature failure of gabion structure; Inconvenience to present residents and pedestrians.
Reinstatement of storm water drainage connections through protection walls.	Erosion of soil embankments, loosening bank support and weakening of the interlocking of rubble used causing immature failure of gabion structure; Blockage due to accumulation of fines due to cross drainage flows
Backfilling of banks behind the gabions, turfing and replanting of trees	Differential settlements causing the gabion walls to misalign and fail; Inconvenience to present residents and pedestrians and potential accidents
Reinstatement of maintenance roads and construction of road side drain and cross drainage	Localized ponding; weakening of soil sub-base
3. Improvement of storm water drainage in the CMC: These include improvements to localized micro drainage and interception of unauthorized effluent discharges	
Key project activities	Construction related Impacts
Site Surveying, Testing & Data Collection	Obstructions to vehicular movement
Estimation of parameters, Detailed design of sewers, pipelines, and related structures	Impacts due to design failures, inadequate capacities, difficulties in maintenance, shortened life spans, structural failures; the drainage network not functioning as intended; excessive silt accumulation; loss of capacity of manholes, gullies etc.
Land clearing along road side	Disposal of spoilage; Disturbance to native flora and fauna; Generation of cleared vegetation stockpiles; Potential for the spread of weeds
Temporary parking lots	Impediment to traffic flow; Reduction of on road parking for other users
Traffic diversion/Generation of additional	Obstruction to vehicular movements; Disturbances to residents due to traffic diversions and

traffic due to construction	restricted entry to by-roads; Increased traffic on alternate roads
Pavement rehabilitation	Emission of dust; Generation of noise
Excavation of trenches and shoring	Closure of roads for traffic; Disturbance to pedestrian movement and safety issues due to deep excavations and material piles; Emission of dust and air pollutants from equipment and machinery; Generation of high levels of noise and vibration; Slope failures; Loosen soil structure and weaken soil stability; Subsurface soil layers susceptible to collapse and fail under outward seepage flow
Dewatering and site drainage	Reductions of pore pressure build up; slope instability and transport of fines. Local surface ponding
Stockpiling of material	Emission of dust; Erosion of material during rains; Stock piling of soil, debris and other material may block surface drainage; localized flooding
Transport of construction material	Emission of dust; noise and vibration
Trenching, construction of pipelines, filling and re-surfacing/overlay	Emission of air pollutants; Slope failures in vertical faces; Undesirable ponding, spilling and excessive siltation or erosion/cavitations; Establishment of weed species
Construction of structures such as gullies, manholes, catch pits etc.	Emission of dust; noise and vibration
Compaction & Soil Stabilization	High noise and vibration level; Uneven settlements: cracks and eventual failure of anchorages and pipelines.
Spoilage disposal	Contamination of surface runoff
Maintenance of drainage pipes, catch pits, manholes, gullies etc. and removal of material and disposal	Emanation of foul odor; Collection of floating matter and blocking catch pits, gullies and manholes; Contamination of water due to improper disposal of debris and sediments

4. Urban landscaping for recreation and city beautification: Creation of recreational space such as parks, walkways other public open spaces and improvement to existing places, Conservation of heritage around Beira lake and other important sites including natural habitats for promotion of urban tourism	
Key project activities	Construction related Impacts
Demolition/dismantling of existing pavements and structures: Disposal of debris; Re-orientation of service provisions and instrumentation (telecom, power, water and drainage); Construction of new foot walks and paved areas, including material transportation and storage; Temporary drainage; Permanent drainage; Traffic management	Blocking of existing drainage paths; Increased flows due to altered land use types with less permeable paving surfaces; Inconvenience to people, commercial establishments due to: (i) elevated noise during construction; (ii) air borne particles, and blocking of drainage paths; (iii) due to closure of roads, pavements; impacts due to material storage, spoilage piles, material transportation and construction equipment and vehicles; lose of parking facilities; Inconvenience to people, school children, commercial establishments due to temporary disruption of access to buildings, work places, residential areas etc.; Interruption of livelihoods of pavement vendors, hawkers, middlemen etc.
Construction of storm water drainage: Traffic diversion/ Generation of additional traffic due to construction; Pavement demolition; Excavation of trenches and shoaling; Dewatering and site drainage; Stockpiling of material; Transport of construction material; Trenching, construction of pipelines, filling and re-surfacing/overlay; pipelines, filling and re-surfacing/overlay; Construction of structures such as gullies, manholes, catch pits etc.; Compaction & Soil Stabilization; Spoilage disposal; Maintenance of catch pits, manholes, gullies etc. and removal of material and disposal	Reduction of on road parking; Obstruction to vehicular movements; Disturbances to residents; Increased traffic on alternate roads; Disturbance to pedestrian movement and safety issues Interruption of livelihoods of pavement vendors, hawkers, middlemen etc. Emission of dust during excavation; Emission of air pollutants; High levels of noise and vibration Surface ponding of removed water; Erosion of material during rains; Stock piling of soil, debris and other material may block surface drainage paths causing localized flooding during constructional and operational periods; Degradation of water quality Slope failures in vertical faces, Undesirable ponding, spilling and excessive siltation or erosion/cavitations; uneven settlements may cause leakages. Establishment of weed species in the project area due to introduction through imported raw material; Construction equipment, or unplanned dumping of cleared weed species. Contamination of surface runoff; Emanation of foul odor due to stagnant water; Collection of floating matter and blocking catch pits, gullies and manholes
Landscaping and beautification	Introduction of exotic species as part of landscaping need to be planned carefully as invasive can be introduced involuntarily.

5. Public Health & Sanitation support: Solid waste management and interception of unauthorized discharges to the canal system, improving the public sanitary facilities	
Key project activities	Construction related Impacts
Demolition/dismantling of existing sanitary facilities, pavements and structures; Disposal of debris; Diversion of traffic and traffic management plan; Diversion of pedestrian pathways	Blocking of existing drainage paths; Inconvenience to the public and neighborhood; Diversion of traffic; Inconvenience to present users of toilets and bathing facilities; Inconveniences to pedestrians and motorist due to demolition work, closure of pavements and parts of the roadway.
Material Transport; Material storage and handling	Obstruction to vehicular movements; Disturbances to residents; Establishment of weed species
Construction of super structure, pipelines and drainage for the new toilet	Inconvenience to people, commercial establishments due to: (i) elevated noise during construction; (ii) air borne particles, and blocking of drainage paths
Provision of temporary sanitary facilities	Impacts on good sanitary practices
Maintenance of sanitary facilities after commissioning; Gulley operations and disposal of sewage/solid waste	Overflow of gullies, drainage provisions, toilet pits etc. due to blockages; Foul odours, breeding grounds for mosquitoes, vermin, cockroaches etc.
6. Rehabilitation/development of small/medium scale municipal infrastructure: rehabilitation and renovation of libraries, markets, public toilets, play grounds and common amenities	
Key project activities	Construction related Impacts
Demolition/dismantling of existing facilities, pavements and structures; Disposal of debris;	Blocking of existing drainage paths; Inconvenience to the public and neighborhood; Diversion of traffic; Inconvenience to present users of public facilities; Inconveniences to pedestrians and

Diversion of traffic and traffic management plan; Diversion of pedestrian pathways	motorist due to demolition work, closure of pavements and parts of the roadway.
Material Transport; Material storage and handling; Stockpiling of material	Obstruction to vehicular movements; Disturbances to residents; Emission of dust; Erosion of material during rains; Stock piling of soil, debris and other material may block surface drainage; localized flooding; Establishment of weed species
Construction of super structure, pipelines and drainage for the new toilet	Inconvenience to people, commercial establishments due to: (i) elevated noise during construction; (ii) air borne particles, and blocking of drainage paths
Provision of temporary facilities	Impacts on uninterrupted common amenities and facilities
Maintenance of sanitary facilities after commissioning; Gulley operations and disposal of sewage/solid waste	Overflow of gullies, drainage provisions, toilet pits etc. due to blockages; Foul odours, breeding grounds for mosquitoes, vermin, cockroaches etc.
7. Urban/municipal Road resurfacing and road side drainage improvement	
Key project activities	Construction related Impacts
Resurfacing of roads Transport of material; Traffic management/diversions, including timing of project activities (time of the day and year); Parking bays for project machinery and vehicles; Drainage diversions during construction; Provision of permanent drainage	Air pollution due to volatile material emanated from bituminous material, paints, solvents etc. Temporary drainage blockages Obstruction to vehicular movements on roads under construction and increased traffic on alternate roads Disturbances to day-to-day activities of residents, road-users due to traffic diversions and restricted entry to by-roads Delays for office workers and school children in attending to their daily routines Closure of roads for traffic: inconveniences to residents and other road users, especially commercial establishments for their delivery vehicles Disturbance to pedestrian movement and safety issues due to excavations and material piles

	<p>Interruption of livelihoods of pavement vendors, hawkers, middlemen etc. and their inability to night parking of carts</p>
<p>Road side drainage improvement: Traffic diversion/ Generation of additional traffic due to construction; Pavement demolition; Excavation of trenches and shoaling; Dewatering and site drainage; Stockpiling of material; Transport of construction material; Trenching, construction of pipelines, filling and re-surfacing/overlay; pipelines, filling and re-surfacing/overlay; Construction of structures such as gullies, manholes, catch pits etc.; Compaction & Soil Stabilization; Spoilage disposal; Maintenance of catch pits, manholes, gullies etc. and removal of material and disposal</p>	<p>Reduction of on road parking; Obstruction to vehicular movements; Disturbances to residents; Increased traffic on alternate roads; Disturbance to pedestrian movement and safety issues Interruption of livelihoods of pavement vendors, hawkers, middlemen etc. Emission of dust during excavation; Emission of air pollutants; High levels of noise and vibration Surface ponding of removed water; Erosion of material during rains; Stock piling of soil, debris and other material may block surface drainage paths causing localized flooding during constructional and operational periods; Degradation of water quality Slope failures in vertical faces, Undesirable ponding, spilling and excessive siltation or erosion/cavitations; uneven settlements may cause leakages. Establishment of weed species in the project area due to introduction through imported raw material; Construction equipment, or unplanned dumping of cleared weed species. Contamination of surface runoff; Emanation of foul odor due to stagnant water; Collection of floating matter and blocking catch pits, gullies and manholes</p>

2.2.2 Potential issues that require specific guidelines

In some of the sub-projects specific issues that are not very likely from ordinary construction activities may arise. Such issues have to be addressed with specific guidelines so that the real impacts could be evaluated successfully and mitigation measures proposed accordingly. Two such issues have been identified;

1. *Dredging and dredged material disposal*

Themes such as the improvement of main canals and lakes and rehabilitation of secondary and tertiary canal may involve dredging that could lead to potentially serious environmental impacts if sediments of the lakes/canals dredged are contaminated with hazardous material. If that is the case, disposal of dredged material should be handled and planned carefully, especially in view of limited options available in the country for dealing with contaminated dredged material, in order to ensure that risks to the environment, public and the workers are mitigated and managed well. The exact impact of this engineering intervention will depend on the type of dredger to be used, quantity of material, method of mobilization of machinery and the degree of contamination etc. As such, for sub-project that involve substantial dredging generating significant volumes of dredge material specific guidelines need to be used. Since the GoSL does not have specific environmental guidelines for dredging and dredge material disposal, guidelines developed by the United States Environmental Protection Agency (USEPA), given below, can be used as useful references.

- Evaluation of dredged material proposed for discharge in Waters of the U. S. – Testing Manual, Feb. 1998, EPA-823-B-98-004 (can be downloaded from www.epa.gov)
- Evaluating environmental effects of dredged material management alternatives – A technical framework, revised in May 2004, EPA842-B-92-008 (can be downloaded from www.epa.gov)

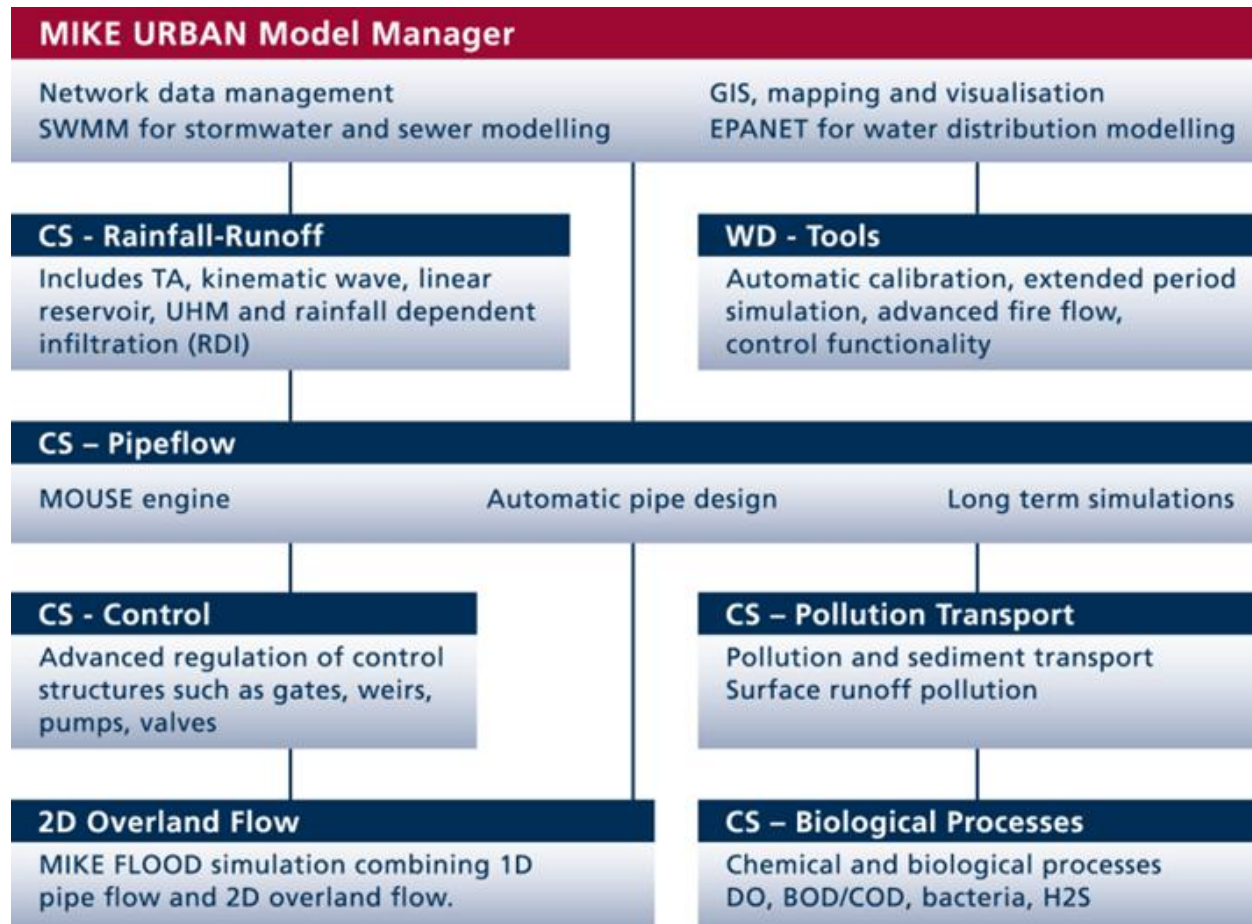
These two guidelines should be adopted in the context of the MCUDP and as such it will provide the necessary information as to how dredging and dredged material disposal be handled in an environmental safe under the project.

2. *Design of storm water drainage network*

It is well known fact that the thematic group consisting of improvement of storm water drainage requires extensive modeling tool and designing sizes by proper soft-ware in order to capture the holistic picture rather than the individual design with empherical formula manually. Hence the urban cities with flooding events could be addressed effectively and efficiently with more accurate scenarios if well accepted versatile software package will be procured. Following is one such software with which all the engineering decisions on the topic of storm water issues could be addressed.

- MIKE URBAN – modeling water in the city (details can be downloaded from www.mikebydhi.com) - MIKE URBAN is the urban water modeling software of choice when the important parameters for model selection are usability, work flow, openness, flexibility and GIS integration as well as physical soundness, efficiency and stability of simulation engines. MIKE URBAN covers all water in the city, including:
 - ✓ sewers - combined or separate systems or any combination of these
 - ✓ storm water drainage systems, including 2D overland flow
 - ✓ water distribution systems

MIKE URBAN is a complete integration of GIS and water modeling. All GIS licenses and components required are embedded in the MIKE URBAN license. MIKE URBAN is modular and comes in different sizes - making it easy to find a package which fits your project needs as well as your budget. Even the smallest MIKE URBAN package allows you to edit network data in GIS and run simulations of collection systems as well as water distribution systems. The framework given below enumerates the capabilities of MIKE URBAN in flood control programs.



Capacity building in terms of on the job training and basic training will be of paramount importance in using such programs for urban planning and improvement, as planned under the project.

2.3 Mitigation of potential environmental impacts

As explained, environmental impacts from majority of sub-projects under MCUDP will be associated with general construction related activities which can be effectively mitigated with good construction planning, site management, debris disposal and public safety practices. For such impacts, environmental codes of practices (relevant to the sub-project) as highlighted in the table below would be sufficient where impacts of a particular activity are minor and easily arrested. As for, specific impacts such as those that could potentially arise from dredging and dredge material disposal will need specific guidelines to plan mitigation. For specific impacts of dredging, the subsequent section presents a

technical framework for planning dredging and dredge material disposal for sites proven to be contaminated.

2.3.1 Environmental Codes of practices

Type of Impact	Mitigation measures	Standards applied
Dust	<ul style="list-style-type: none"> • Regular watering of roads for dust suppression in urban, residential areas and in areas with sensitive receptors • Covering of excavated soil temporary stored on site • Daily cleaning of tires of vehicles • covering up any vehicle transporting materials and spoil to and from construction sites • Daily cleaning of streets and pathways in vicinity of construction site that are affected by soil and dust • Imposing speed controls for construction vehicles 	ICTAD Publications: SCA/5; SCA/3/1
Air pollution	<ul style="list-style-type: none"> • Employ construction machines with low emissions to reduce pollution, arranging sources of emission far from people's houses and public places • All construction machines and vehicles should meet the standard on emissions and have passed the emission test • No burning of wastes on site • Limit traffic congestion through proper planning and operating of traffic diversions • Do not let machines idle when not necessary 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3; CEA Air quality standards;
Noise and Vibration	<ul style="list-style-type: none"> • Apply appropriate schedule to avoid any works that may cause noise and vibration during 10 pm – 6 am. Any nighttime activities should be done using noise reducing means or low-noise technologies • Use vehicles and equipment that meet standards for noise and vibration in Sri Lanka. • Publishing and registering working time of construction machines with local authorities and strictly compliance therewith. • Restricting use of noisy machines near sensitive receptors such as schools and hospitals, use noise-reducing means for construction machines, if required. 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3; CEA noise & vibration standards
Solid waste (demolition, construction and excavation)	<ul style="list-style-type: none"> • Work sites should be cleared of residual solid waste and wastewater before work commences • Temporary storage of solid wastes shall be done with appropriate containment to avoid spreading of waste, odor and avoid dust • Temporary storage of solid waste should be done to avoid interfering with traffic obstacles and aesthetics • Sites for collecting solid waste in each sub-project area should be determined prior to commencement of construction. These sites must be suitable with the transport, in order not to 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3; CEA guidelines on Solid Wastes

Type of Impact	Mitigation measures	Standards applied
	<p>obstruct the activities of human beings and the waste must be transported during the day</p> <ul style="list-style-type: none"> • Construction wastes should be removed as much as possible within 24 hours from the site to ensure public safety in urban areas • All waste should be collected and disposed in compliance with the local and national laws, in sites identified by the respective LA • Excavated soil, if suitable, should be used for leveling and backfilling • No solid waste can be burned at the site • Clean the construction site of solid wastes, wastewater etc. before its closing 	
Domestic waste	<ul style="list-style-type: none"> • Construction camps should be sited appropriately with consent from the necessary public authority or the implementing agency, • Labour camps shall be provided with adequate and appropriate facilities for disposal of sewage and solid waste • Domestic solid waste shall be collected and disposed of daily at the LA designated site or given for collection by the LA • Discharge and disposal domestic waste from worker camps into water sources should be strictly avoided • Burying and burning domestic waste in the project site should also be strictly avoided • Avoid construction workers staying overnight in the construction sites 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3; CEA guidelines on Solid Wastes, Code of practices by SLSI
Dredge material disposal	<ul style="list-style-type: none"> • Dredge material identified as contaminated will need special handling, transportation and disposal. For contaminated sites, confirmed by the on-going sediment quality analysis, a dredge material disposal plan will need to be prepared. • The contractor should be trained and made aware of the requirements prior to commencement of the sub-project. Special guidelines for handling of contaminated dredge material should be prepared and published by the PMU. • Dredge material that are uncontaminated should be either dumped on-site for canal/lake bank stabilization or removed to landfill/dumpsite designated by the LA/CEA as appropriately. 	ICTAD Publications: SCA/3/3; EPA guidelines on dredged material
Oil and lubricant waste	<ul style="list-style-type: none"> • Oil and lubricant waste should not be buried or burnt in the project site, but collected and stored in proper oil-cans and disposed for re-use or LA approved designated sites. 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3
Soil erosion	<ul style="list-style-type: none"> • Earthwork should be carried out during dry weather periods and all exposed surfaces should be covered with suitable grass species (turf) to prevent siltation in canal/lake beds • Stockpiling of earth should be done a safe distance away from 	ICTAD Publications: SCA/5; SCA/3/1; SCA/7

Type of Impact	Mitigation measures	Standards applied
	<p>waterways</p> <ul style="list-style-type: none"> • Other construction materials containing small/ fine particles shall be stored in a place not subjected to flooding and in such a manner that these materials will not be washed away by runoff. • If necessary, silt/sedimentation traps should be used to prevent soil particles from getting into drains and canals 	
Extraction of earth and quarry	<ul style="list-style-type: none"> • All quarry/burrow sites operated by the contractor should be licensed with the LA/CEA/GSMB, as appropriate. • All burrow pits /areas shall be rehabilitated at the end of their use by the contractor in accordance with the requirement of the EMP or as instructed by the Engineer of the IA • Establishment of burrow pits/areas and its operational activities should not endanger properties and cause a health hazard to the people. • At contract closing, all burrow/quarry sites should be fully rehabilitated • If contractor would procure earth/quarry material, he should do so from sources that are operating with the required licenses 	ICTAD Publications: SCA/5; SCA/3/1;; SCA/3/3, GSMB guidelines
Traffic Congestion	<ul style="list-style-type: none"> • All sub-project should have a traffic management plan • Temporary home and business accesses should be provided where necessary and transport along main roads during rush hours should be avoided where possible. • Temporary access roads should be identified before construction begins and upgraded if necessary. • All roads and access sites must be restored to their original state as soon as possible • Speed limits and operating times for the construction vehicles should be imposed • Travel route for construction vehicles should be designed to avoid areas of congestion. • If project works occur after dark, a lighting system should be maintained such that vehicles and pedestrians can clearly see the construction area. • One-way flow of traffic should be promoted whenever practical • Contractor should supply traffic co-coordinators to manage traffic flow in areas that are subject to congestion. • Project should maintain fences throughout construction areas. These fences should define clearly the construction boundary that does not occupy the remaining road and ensure traffic flow in residential areas • Awareness programs can be conducted on safety and proper traffic behavior in densely populated areas near the 	ICTAD Publications: SCA/5

Type of Impact	Mitigation measures	Standards applied
	construction sites.	
Access roads	<ul style="list-style-type: none"> • Before construction, the pre-project state of site access roads should be recorded by the project/contractor • During construction, site access roads should be inspected regularly and repairs made as required • After construction, site access roads used by the Project should be inspected and compared to records taken during Pre-construction. • If notable road quality differences exist, the road should be repaired to its original condition 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3
Safety	<p>All sub-projects should observe safety regulations during construction. Some key aspects;</p> <ul style="list-style-type: none"> • Barriers/fence and dangerous warning signs should be raised to keep the public away from any hazards posed by construction sites • Installation of transport signs and lighting systems should be applied to assure transport safety. Transport signs should be installed at places where accidents may be easily happened (populated centers, schools, hospitals, commercial areas etc) • All digging and installing work items that are not accomplished should be isolated and warned of by signposts and flash lamps in nighttime. • Progressively rehabilitate the trenches once works completed, if possible. • Appropriate safety equipment, tools and protective clothing should be provided to the workers and ensured that safe working methods are applied. • The constructors should carry out suitable training programs on occupational health and safety for workers • An emergency aid service should be in place. • Easily flammable materials should not be stored in construction site; they must be transported out of project site. • Installation of adequate construction camps and sanitation facilities for construction workers to control of transmission of infectious diseases. • Experienced and well trained workers should be used for the handling of machinery, equipment and material processing plants. • It is recommended to develop and establish contractor's own procedure for receiving, documenting and addressing complaints that is easily accessible, culturally appropriate and understandable to affected communities. • An advance notice should provide to local communities about the schedule of construction activities. 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3, Guidelines of Department of Labour
Impacts on	<ul style="list-style-type: none"> • A compensatory tree planting program should be developed to 	ICTAD

Type of Impact	Mitigation measures	Standards applied
flora and fauna	replant native species wherever available space beside the proposed project. <ul style="list-style-type: none"> • Workers should be instructed to protect flora and fauna including aquatic life as well as their habitats. • Hunting and poaching should be strictly prohibited. • Washing, maintenance and service of vehicles and machinery should not be done closer to the freshwater habitats. • Solid waste, construction debris should not be dump into wetlands. 	Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3; SCA/7, CEA, Department of Wildlife and IUCN guidelines
Impact on water resources	<ul style="list-style-type: none"> • Identification of the reliable water resources and obtain necessary approvals from the relevant authorities to extract water prior to commencement of construction work. • Contractor should not obstruct or prevent water flow when working closer to water bodies. • Silt traps and erosion control measures should be used where the construction carry out closer proximity to the water bodies to avoid entering of construction materials which cause turbidity and sediments. • Construction material and stock piles should be covered to avoid wash off to water bodies. 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3, Mahaweli, Irrigation Department guidelines
Worker camps	<ul style="list-style-type: none"> • Mobilizing maximum capacity of skilled and unskilled labour force from the surrounding project area • Identify location of camps with consultation of LA. • Camps should not be located near water ways, human settlements or near drinking water intakes. 	ICTAD Publications: SCA/5; SCA/3/1; SCA/3/2; SCA/3/3 Code of practices by SLSI

2.3.2 Technical guideline for disposal of dredge material

Dredging operations have been carried out in Sri Lanka since early seventies. The Beira Lake as well as some of our major water bodies including the Polgolla barrage of the Mahaweli reservoir system has been subjected to dredging on several occasions. In addition, maintenance dredging (as well as capital dredging) in the Port of Colombo is regularly carried out to ensure the required depth is maintained for incoming vessels.

The potential environmental effects of dredging are generally two-fold, firstly as a result of the dredging process itself and secondly as a result of the disposal of the dredged material. During the dredging process impacts may arise due to the excavation of sediments at the bed, loss of material during transport to the surface, whilst loading and during transport to the designated location and will include removal of benthic communities, short-term changes in the water quality with increased turbidity and the possible release of organic matter, nutrients and or contaminants (depending upon the nature of the material in the dredging area), smothering of fish and other fauna by settling suspended matter etc.

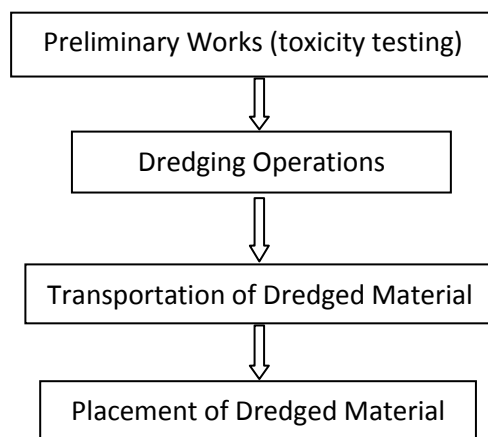
The second is the impact of dredged material disposal which largely depends on the nature of the dredged material (inorganic, organically enriched, contaminated) and the characteristics of the disposal area (accumulative or dispersive areas in the case of open sea dumping). Dredging would generate large

volumes of sediments and sludge, the quality of which would determine how and where it can be disposed to. Haphazard disposal of contaminated dredge material can lead to many adverse environmental and public health risks, and as such the project must adopt a cautious approach and undertake adequate assessments, as highlighted in the guidelines given below.

Given the level of urban/industrial activity, the risk of pollution by hazardous elements could particularly be relevant for lake/canals sediments in the lower part of the Colombo basin. This risk was highlighted in the Beira Restoration Study undertaken in 1993¹ which confirmed that the Beira sediments are contaminated with heavy metals to a moderately high degree. However, since then, several measures have been implemented to improve the environmental quality of the Beira Lake and its catchment including interventions to reduce the load of incoming pollution and mechanical cleaning such as dredging, aeration etc. Given the history of land use and drainage patterns in the basin, this risk of contamination should diminish from lower to upper catchment areas. In addition, the periodic cleaning and desilting carried out by the SLLRDC on the main/secondary canal network reduces the likelihood of sediment toxicity resulting from long-term accumulation of contaminants in these waterways. However, since the study in 1993, no systematic data collection on sediment quality has been pursued by any of the authorities and in the absence of such data no conclusions should be drawn.

In considering the environmental effects of dredging and disposal, the potential benefits of these operations should not be overlooked. Dredging helps remove nutrient rich and/or contaminated sediments and their safe disposal. The result is the lower in-take of nutrient concentrations, less algae production, prevention of eutrophication in the water bodies leading to an overall improvement in the water quality by the restoration of water depth and flow.

The process of dredging has several key steps and they are outlined below



Key steps in a Dredging Operation

¹ Beira Restoration Study Volume I – Environmental Description, Metropolitan Environmental Improvement Project, 1993

2.3.2.1 Preliminary Work

(i) Cleaning

Dredging has to be preceded by few preliminary works to clean up the water body enabling the machinery to be used safely. The first such work would be to remove the floating and sunken debris from canals and lakes identified for dredging. These need to be removed to have a smooth operation and a self-propelled grab digger is usually used for such cleaning. The other activity is the removal of the sunken barges from the water body. In the Beira Lake, there may be submerged barges of previous operations and other metallic or wooden debris present in the bottom. The removal of these is essential or else hydraulic equipment used in dredging can be damaged.

In addition to these an environmental impact study on the disposal of the dredged material need to be undertaken. Except the disposal at sea all other sites have been ruled out according to the available information (Beira Restoration study Volume I & II). However this study needs to be undertaken covering the aspects of studying the composition of the dredged material, methods and machinery to be used, mode of transportation of dredged material and the place of disposal etc.

(ii) Evaluation of Sediment Quality

Since there is inadequate sediment quality data the project would be required to develop a **Sediment Sampling and Analysis Plan (SAP)** for the basin to determine the environmental acceptability of the canal/lake sediments proposed to be dredged. The SAP would provide the technical framework for sampling and analysis for each identified location and would determine the presence/absence of potential toxic chemicals. In the case of a negative determination the project can commence dredging activity any time as there would be no specific restriction on the disposal of dredged material. **A TOR for SAP is presented under Part 6 of the EMF.**

Within the basin, the composition of the dredged material will differ from the upper to lower catchment areas in relation to the changing land-use and industrial/commercial activity. The Beira lake restoration study done in 1993 has indicated that contamination with heavy metals is a concern, especially towards the lower par of the basin where the prevalent land-use may include potential sources for such contamination. Since Organo-chloride levels and PCB levels have been found to be of minute levels even in the Port of Colombo as confirmed in the Environmental Appraisal of Port of Colombo study carried out in 1999 and funded by the World Bank, they need not to be of great interest for sediment quality testing under MCUDP. Even PAH contents were found to be in very low levels. As the port of Colombo, which receives a greater load of pollutants both from land and marine sources, has indicated low levels of contamination (not needing any intervention) from micro-organic pollutants, such testing for these compounds is not necessarily needed to be included in the SAP. It is presumed that the risk of contamination by heavy metals should decrease/diminish from the lower to upper catchment areas and as such a high risk of contamination is not considered to be present around the Parliament lake catchment area. However, sampling should cover all these areas in order for the MCUDP to be able to make fully informed decisions.

As such, it is required that all stake holders agree on a process for sediment quality evaluation so that the proper disposal alternative with all the environmental safeguards for minimum cost could be selected. This process would comprise the following key steps:

- The implementing agency proposing the dredging work (with assistance from consultant as needed) determines project-specific sampling and analysis requirements.

- Dredging proponent (implementing agency of the particular sub-project) develops a sampling and analysis plan (SAP) for sediment and water column evaluation
- Dredging proponent submits SAP to the PMU
- PMU coordinates review of the SAP with the World Bank and the other regulatory agencies
- PMU sends a SAP approval letter to the dredging proponent
- Dredging proponent conducts the necessary field sampling and laboratory testing through a competent authority hired in order to perform this exercise.
- Dredging proponent submits a final report to the PMU
- PMU together with the Dredging Proponent coordinates the review of the testing data with regulatory agencies such as CEA, as the need be.
- Project proponent gets the feedback from CEA on the method of disposal to go ahead

Annex 5 shows a proposal prepared for MCUDP for chemical methods of sediment quality testing. No bioassay testing at this stage is considered necessary. If the contamination levels are high only bioassay tests would be important to be carried out and this should be determined based on sediment quality results.

2.3.2.2 Evaluation of dredge material management and disposal alternatives

Depending on the degree of toxicity, disposal options could be decided. In the case of a positive determination, disposal would be carefully planned and the project would need to prepare a **Dredge Material Disposal Plan (DMDP)**. Classification of the sediment according to the level of contamination detected and quantification of the dredged material would be pre-requisites to preparing this plan. This is important to check the suitability of the sediments for different alternative disposal/use options. While Sri Lanka does not have any standards or regulations to control disposal of dredged material, several countries have developed useful guidelines/references which can be adapted to plan and address dredging related issues under the MCUDP (Refer USEPA Guidelines on the link given earlier).

It has to be noted that different options are available for disposal of dredged material based on its quality. Multi tier approach is usually suggested based on the degree of contamination present in the dredged material. As such, establishing sediment quality is of paramount importance and the project will have to determine the most suitable disposal alternative based on the results from the SAP prior to dredging and disposal.

The Beira lake restoration study concluded that the dredged material should be disposed at an identified place in the sea off the coast of Colombo. However it may not be the appropriate place for disposal of the canal and Parliament lake dredged material due to their distance from the sea. More over the composition of these materials may not be contaminated with heavy metals like in the case of the lower basin and could be used for other suitable work such as canal bank stabilization, land filling, use as land fill cover for solid waste dumping yards and pond construction for holding water based on its physical

and chemical characteristics. The section below presents a brief alternative analysis for disposal of dredged material from large-scale dredging, in the Sri Lankan Context.

- **Open Sea Disposal**

The open-water disposal is the placement of dredged material in rivers, lakes, estuaries or oceans via pipelines or release from hopper dredges or barges. Here the potential for environmental impacts is affected by the physical behavior of the open-water discharge. The physical behavior is dependent on the type of dredging and disposal operation used the nature of the material and the hydrodynamics of the disposal site.

This has been practiced in the past for disposal of dredged material from Beira and the Port of Colombo. The Port of Colombo has been regularly dumping sediments from harbour maintenance dredging in a site called Onagala which is north of the Port and 5-4-5 Km offshore. The study done in 1999 for Port of Colombo funded by World Bank has suggested that the open dumping at Onagala has no environmental degradation according to chemical and biological sampling and monitoring carried out at the site and hence the practice adopted by SLPA for both maintenance and emergency dredging is considered to be not a risk environmentally. Hence even today the same is in force and no complaints or adverse impacts have been detected. The heavy metal levels, PCBs have been measured at Onagala where dumping is done but no toxicity levels requiring major interventions have been reported. Benthic faunal analysis carried out at Onagala and a reference site which is not subject to such dumping has revealed that only 5 benthic species were present at the dredging site while dumping and reference sites reported 23 and 26 species respectively. This scenario suggests that Onagala and the reference site have no marked differences hence both sites are inhabited by the same types of species indicating both site to be not polluted as opposed to that of the dredging sites inside the harbour. As such, in the case of dredging to be done for some sub-projects under MCUDP, same open dumping would be most likely possible hence coordination with SLPA would give an appropriate method of disposal. Selection of a different open sea sump site will require feasibility studies including an EIA.

- **Incineration**

In the case of thermal destruction it is important that we select the right technology available in Sri Lanka. So far it is only Geocycle, one of the Holcim Cement groups is capable of handling such toxic or hazardous material and they have been authorized to do so by CEA by means of a license. They could collect such dredged material and transport to Puttlum, Palavi to mix them with their fuel (coal) to burn it in their cement kiln. The kiln maintains a temperature of 1400°C which is high enough to degrade all toxic material present in the dredged material. Even the bottom ash that remains can be mixed as an inert material with cement without any leaching out of toxic metals. However when the dredged material contains high levels of Mercury or Arsenic it may not be possible to go for thermal destruction as they become volatiles and then air pollution is apparent. Also the cost factor and difficulty in handling to transport far are other restrictions to be considered. In the aftermath of the tsunami, Geocycle handled vast quantities of solid waste and debris that was generated as a result of the destruction left by the wave, in their incinerator, as the level of contamination in the debris was likely to be high.

- **Confined Disposal**

Confined disposal is the placement of dredged material within a confined disposal facility (CDF). The CDFs may be constructed as upland sites, near shore sites with one or more sides in water.

The beneficial use includes a wide variety of options, which utilize the material for some productive purpose. Dredged material is a valuable soil resource with beneficial use and should be included in project plans.

- **Disposal at the two (and only) semi-engineered sanitary landfill sites in Sri Lanka**

Sri Lanka has two (and only) small semi-engineered landfills in Nuwara Eliya and Mawanella operated by the Nuwera Eliya Urban Council and the Mawanella Pardheshiya Sabha respectively. If the dredged material does not contain contaminants, it can be dumped as a cover material to any landfill sites in Sri Lanka. However if the contamination is there, no judgment can be given to dump them at Nuwara Eliya landfill site as the permeability characteristics of bottom liners have not been studied by any. Hence one has to perform such tests at the Nuwara Eliya semi-engineered landfill site if the dredged material is to be disposed of there. The natural attenuation, soil characteristics, rain fall intensity, climatic conditions are some of the governing factors to be studied before the decision is taken. The project also should explore the possibility of using the newly constructed Mawanella landfill for possible use by the MCUDP for small quantities of contaminated sediments, such as what would be accumulated during canal embankment construction. These sites cannot be used for large quantities.

Other aspects to consider in the Dredge Material Disposal Plan

Dredging equipment and techniques

The DMDP should also specify the dredging equipment and techniques used for excavation and material transport, which would depend on a number of factors such as (EPA, May 2004);

- a. Physical characteristic of material to be dredged
- b. Quantities of material to be dredged
- c. Dredging depth
- d. Distance to disposal area
- e. Physical environment of the dredging and disposal areas
- f. Contamination level of sediments
- g. Method of disposal
- h. Type of dredges available
- i. Cost

In general dredging is basically done by only two mechanisms:

- Hydraulic dredging- Removal of loosely compacted materials by cutter heads, dustpans, hoppers, hydraulic pipeline plain suction, and side casters usually for maintenance dredging projects
- Mechanical dredging-Removal of loose or hard compacted materials by clamshell, dipper or ladder dredges, either for maintenance or new work projects.

The Beira Lake Restoration study, which is a very useful reference to the MCUDP, emphasizes that the reduction of pollution loading from the catchment is a prerequisite to begin the dredging works because the presence of important silt and organic matter loadings would limit the effectiveness of the dredging operation and require additional dredging after a few years.

Different types of dredges are being used particularly depending on the above-mentioned factors. Some of them are

- **Hopper dredge**

When the hoppers have been filled, the diagrams are raised and the hopper dredge proceeds to the disposal site. At the disposal site, hopper doors in the bottom of the ship's hull are opened and the entire hopper contents are emptied in a matter of seconds; the dredge then returns to the dredging site to reload. This procedure produces a series of discrete discharges at intervals of perhaps one to several hours. Upon release from the hopper dredge at the disposal site, the dredged material falls through the water column as a well-defined jet of high-density fluid which may contain blocks of solid material. Ambient water is entrained during descent. After it hits bottom, some of the dredged material comes to rest. Some material enters the horizontally spreading bottom surge formed by the impact and is carried away from the impact point until the turbulence of the surge is sufficiently reduced to permit its deposition. The SLPA has two hopper dredgers which they use for regular harbor maintenance. However, the use of this technique in the inland waters seems to be impractical as most of them are not directly connected to open waters where disposal can be done.

- **Bucket or clamshell dredge**

Bucket dredges remove the sediment being dredged at nearly its *in situ* density and place it in barges or scows for transportation to the disposal area. Although several barges may be used so that the dredging is essentially continuous, disposal occurs as a series of discrete discharges. The dredged material may be a slurry similar to that in a hopper dredge, but often sediments dredged by clamshell remain in fairly large consolidated clumps and reach the bottom in this form. Whatever its form, the dredged material descends rapidly through the water column to the bottom, and only a small amount of the material remains suspended. This technique seems to be ideal for inland dredging applications as it can be done in localized way. Also disturbance of bottom sediment in the form of re-suspension would also be low in this compared to the above-mentioned one.

- **Cutter-head or pipeline dredge**

The operation of a cutterhead dredge produces a slurry of sediment and water discharged at the disposal site in a continuous stream. As the dredge progresses up the channel, the pipeline is moved periodically to keep abreast of the dredge. The discharged dredged material slurry is generally dispersed in three modes. Any coarse material, such as gravel, clay balls, or coarse sand, will immediately settle to the bottom of the disposal area and usually accumulates directly beneath the discharge point. The vast majority of the fine-grained material in the slurry also descends rapidly to the bottom in a well-defined jet of high-density fluid, where it forms a low-gradient circular or elliptical fluid mud mound. Approximately 1 to 3 percent of the discharged material is stripped away from the outside of the slurry jet as it descends through the water column and remains suspended as a turbidity plume. This technique seems to be ideal for large volumes of dredging but not suitable for minute quantities encountered in sub-projects.

However in Sri Lanka usual practice is to use a Back hoe for dredging canals and streams where water level is very shallow. This is acceptable provided that the dredged material does not pose any contamination issues downstream. This method is ideal as it can be manipulated easily in restricted areas. SLPA owns both hopper and cutterhead dredges and SLLRDC possesses back

hoe specifically meant for dredging. A large number of private sector contractors do engage in dredging with back hoe machines.

Transportation of Dredged Material

The transportation of dredged material of Beira Lake, canal system and the Parliament lakes may differ in methods and place of disposal depending on the factors highlighted above. The generally used methods for transportation of dredged material are as follows:

- Pipelines
- Barges or scows
- Hopper dredges

In all three methods transportation of dredged material can be done for several kilometers.

Environmental Monitoring Program

Dredging and the process of bringing the dredge material to the surface of the lake/canal, loading, transporting and unloading all can lead to various water/air/land contamination. As such, the DMDP will need to specify the required environmental monitoring framework at the site of the dredging and the site of disposal (depending on method of disposal) including environmental parameters to be tested, frequency, control methods, costs involved, reference standards to be used etc.

(iv) The Regulatory Process

It is imperative to understand as to how the national regulatory process will apply for dredging and disposal of dredged material. Since there is no standard process stipulated in the regulations, particularly in reference to this subject, two relevant provisions under the NEA that might become applicable should be assessed.

- Under National Environmental Management regulations (EIA regulations) any project that involves reclamation of wetlands exceeding 4 ha qualifies for an EIA/IEE assessment. However, the project is not reclaiming wetlands as all these are existing wetlands which will be deepened to have more water holding capacity. As such, this provision is very unlikely to apply. However, under special projects the CEA can make an independent decision.
- Under National Environmental Protection and Quality regulation (Scheduled Waste Management Guidelines) any project that involves the disposal of hazardous waste that belongs to the prescribed categories should obtain CEA clearance. Dredged material is not a separately prescribed category, however, under the category of scheduled waste from non-specific sources the CEA can decide the need to apply for a Scheduled Waste License based on the level of contamination of certain chemical compounds. As such, this is a grey area and the project needs to have formal consultations with the CEA in order to determine the relevance of its regulations for dredging under MCUDP.

As such it is prudent for the PMU and the Implementing Agencies to submit project information on the Basic Information Questionnaire (BIQ) and the Environmental Impact Identification Form (EIIIF) (attached as Annex 5) for early consultation and feedback as soon as the sub-project involving dredging has been technically defined and prepared. The key steps that would involve can be summarized as below;

- Submission of the BIQ, EIIIF to the CEA including submission of the project report to other relevant agencies such as the Coast Conservation Department (CCD) and Marine Pollution Prevention Authority (MPPA), if disposal at sea is considered as a strong option.

- Decision of the CEA whether IEE or EIA, scheduled waste license is required to be carried out by the implementing agency.
- If not, review and incorporate comments from other agencies for further improvement
- If IEE or EIA required, obtain a Terms of Reference from the CEA/CCD.
- Final decision by CEA/CCD for the proposed method or recommendations for any other method

Once all approvals have been obtained by the PMU and the Implementing Agency, the project could go ahead with the disposal method intended.

(v) Project planning and Information management

The SAP and the DMDP should be closely linked to the project work plan and effectively communicated to key stakeholders directly involved, so that proper sequencing and scheduling of activities as well as implementation and monitoring of control measures can take place effectively. The Dredging Proponent together with the PMU should ensure this.

PART 3 – INSTITUTIONAL FRAMEWORK FOR SAFEGUARDS MANAGEMENT

In order to ensure environmental safeguard requirements of the MCUDP are satisfactorily complied with, it is necessary to have a well defined institutional and implementation mechanism for identifying, appraising, managing and monitoring safeguards at all level. The focus of this chapter is to lay out the roles, responsibilities of various parties and the due diligence process that will need to take place from the preparation of an investment through implementation completion.

3.1 Overall project implementation arrangements

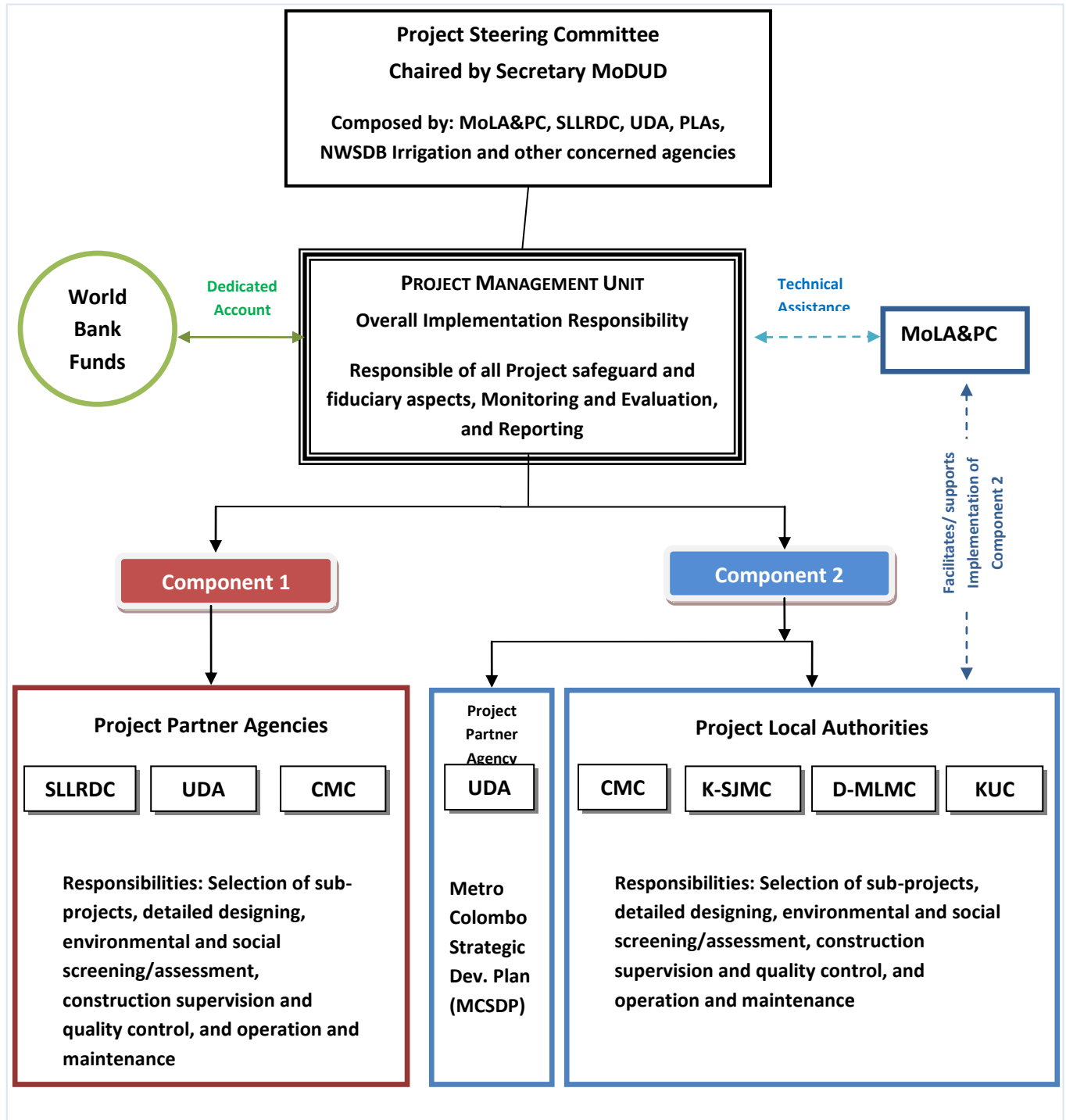
The project will be implemented and managed by a self-standing and ring-fenced Project Management Unit (PMU) which has been established under the Ministry of Defence and Urban Development (MoDUD). The PMU will operate under the oversight of a Steering Committee, chaired by MoDUD's Secretary and composed by SLLRDC, UDA, the PLAs, the Ministry of Provincial Councils and Local Authorities, the National Water Supply and Drainage Board and the Ministry of Irrigation. Other ministries and agencies, such as the Central Environmental Authority (CEA) and other regulatory agencies, will be identified as stand-by members, to be called when relevant issues need to be dealt with. As per Management Circular 33 issued by the Management Services Department of the Ministry of Finance and Planning (the Management Circular 33), the PMU is staffed with a Project Director and a core staff composed by a full-time fully accredited Accountant, a Procurement Specialist, an Environmental Specialist, a Civil Engineer and a Social Scientist. (*Ref: PAD*)

While the PMU will remain responsible towards the Bank for the overall project, implementation responsibilities will be decentralized to the Project Partner Agencies (PPAs = SLLRDC and UDA) and to the Project Local Authorities (PLAs). The PMU will play a critical role in coordinating the agencies involved in project implementation, ensuring overall quality and timeliness of investments and providing administrative support and facilitating required technical services to the various agencies involved in the project. In order to carry out project functions a Project Implementation Cell (PIC) will be created at each of the implementing agencies.

The MCUDP will be designed and supervised as indicated below:

- The SLLRDC and UDA will select sub-projects and prepare tender ready detailed designs;
- The SLLRDC and UDA will directly supervise implementation of sub-projects and report to PMU on progress and quality;
- The project's Local Authorities (that is the CMC, DMLUC, KUC and SJKMC) will select sub-projects and submit them to the Councils for approval;
- The Local Authorities will prepare implementation plans. The PMU will make available Design and Supervision consultants to work with DMLUC, KUC and SJKMC to carry out the design tasks while the CMC will outsource design and supervision only when its capacity is exceeded (as of now they have agreed to take up 50% of the design work).
- The Local Authorities will primarily be responsible for the future Operation & Maintenance of delivered infrastructures.

The flowchart below summarizes the overall project implementation arrangements:



(Ref: PAD)

3.2 Implementation arrangements for environmental safeguards

Planning, implementation and supervision of environmental safeguards will take place at three levels;

- **MODUP (through PMU)** - The overall responsibility of ensuring compliance with environmental safeguards requirements of the project will be borne by the PMU. It will be supported by a full-time environmental specialist who is suitably qualified and experienced in managing urban environmental issues and directly report to the Project Director. Among its key tasks, the PMU will be responsible for providing the overall policy direction, technical assistance, review and endorsement of screening reports, environmental assessment and management plans, capacity building for effective safeguards management to the implementing agencies, monitoring of environmental compliance and progress reporting to the World Bank.
- **Project Partner Agencies and Project Local Authorities (through the PICs)** - The responsibility of day to day planning, implementation and supervision of environmental safeguards specific to sub-projects will be borne by the PPAs and PLAs. The PICs of these agencies will report directly to the PMU through its program manager/director.
 - The PPAs will appoint an environmental officer to the Project Implementation Cell in each agency who will ensure the timely and sound application of the EMF to the planned investments. As both these agencies are regularly staffed with Environmental Officers, the project will benefit from the available expertise. The Environmental Officer through the Project Manager in charge of the MCUDP program under SLLRDC and the UDA will report progress to the PMU on safeguards compliance under each sub-project investment.
 - Of the PLAs, the CMC will appoint a full-time Environmental Officer to support its projects while the KUC, DMLMC and the SJKMC will only require assistance of a part-time Environmental Officer given the relatively lower number and complexity of investments involved. All Local Authorities in Sri Lanka are required to employ Environmental Officers, especially in view of functions designated to LAs by the NEA to issue Environmental Protection Licenses (EPL) to low polluting industries. However, none of the LAs involved with the MCUDP employ Environmental Officers at present, even though cadre positions have been included in the LA organizational structure.
- **Contractor** – Implementation of EMPs will largely be the contractor’s responsibility (apart from those provisions relating to technical designs and other specified tasks indicated in the EMPs) and for this the contractor will nominate a site engineer as the focal person who will be directly responsible for ensuring compliance with the EMP during construction.

Staff availability for project implementation

Implementing Agency	No of staff allocated	Environmental Officers
SLLRDC	X	1 – Full time
UDA	X	1 –Full time

CMC	X	1 – Full time
SJKMC	X	1 - Part-time
DMLMC	X	1 - Part-time
KUC	X	1 - Part-time

3.3 Illustration of the environmental safeguards due diligence process (screening, review and approval) at the sub-project level

	Key steps in a sub-project cycle (in chronological order)	Responsibility			
		PMU	PPA/PLA	Contractor	WB
1	Identification of sub-project ; Application preparation and its submission to PMU		X		
2	Review of sub-project application; Endorsement/rejection	X			
3	Completion of environmental screening		X		
4	Review and endorsement of screening report and decision Category B and C type Category A type	X			X
5	EA/EMP financing and preparation (if determined by screening output)	X financing	X preparation		
6	Review and clearance of EA/EMP	X			
7	Obtain clearances from local environmental/regulatory authorities		X		
8	Implement sub-project in line with EMP		X	X	
9	Monitor environmental compliance based on EMP	X sample	X	X	

		basis			
10	Reports to PPA and PLA on EMP compliance			X	
11	Reports to PMU on EMP compliance		X		
12	Maintaining records of safeguards documents for all sub-projects		X		

3.4 Key roles and responsibilities of various parties involved in environmental management safeguards

Environmental Specialist - Project Management Unit / Ministry of Defense and Urban Development

- Provide overall policy and technical direction for environmental safeguards management under the MCUDP (as defined by this framework).
- Ensure suitably qualified and experienced personnel are in place for the specified environmental positions in the PPAs and PLAs
- Co-ordinate closely with the Environmental Officers in the PPAs and PLAs in planning and managing the EA cycle in relation to the project implementation schedule; and provide necessary technical assistance to facilitate the implementation, management and monitoring of environmental safeguards
- Review and endorse environmental screening reports, site specific environmental assessment and management plans prepared for each Category B and C sub-project ; Obtain concurrence from the environmental safeguards specialist in the World Bank team for Category A type of sub-projects
- Facilitate recruitment of Environment Consultants (EC) to assist PPAs and PLAs to prepare safeguard documents as part of sub-projects preparation, when needed; Assist in drafting necessary TORs
- Ensure that applicable measures in the EMP are included in the design, and condition on compliance with EMP is included in the bidding documents
- Develop, organize and deliver environmental training programs and workshops for the staff of PPAs and PLAs, contractors, field supervision staff and other implementing agency officials (responsible for the supervision of Maintenance works), as needed, on safeguard requirements and their management
- Develop programs to build long-term capacity in the participating agencies for improved urban environmental management and monitoring
- Prepare additional technical guidelines, if necessary, to support the EMF in order to strengthen the implementation of environmental safeguards

- Assist the PPAs and PLAs in obtaining clearances from local environmental/regulatory authorities, where applicable.
- Report to WB and MoDUD on the overall environmental performance of the project as part of PMU's periodic progress reporting.
- Maintain close cooperation with the relevant enterprises in charge of water supply, sanitation, solid waste collection, etc. to monitor the O&M during the operation of the project;
- Hold regular review meetings with the environmental officers of the PPAs and PLAs and visit selected construction sites to monitor implementation of the EMP by the Contractors
- Promote community participation in the process of planning, management and monitoring of environmental impacts of sub-projects; provide guidelines on community participation in environmental monitoring to the PPAs and PLAs

Environmental Officers – Project Implementation Units at the SLLRDC, UDA, CMC,

- Ensure environmental screening is carried out for each sub-project as soon as its technical design and scope have been defined; the agencies will receive adequate training on environmental screening (refer 3.7 on capacity building); Closely co-ordinate with the PMU for review and endorsement of the screening decision and recommendation
- Ensure timely preparation of Environmental Assessments/Management Plans for sub-projects, as necessary (depending on screening outcome); co-ordinate with PMU for hiring technical assistance, where necessary, and for review and endorsement of these safeguard documents
- Ensure consistency of safeguard documents with national environmental regulations; obtain necessary clearances from local environmental/regulatory authorities for sub-projects, where applicable.
- Ensure relevant EMP provisions are included in the design; and EMPs are included in the bid documents; and condition on compliance with EMP is included in the contractor's agreement.
- Ensure compliance with EMPs during the construction period and maintain close co-ordination with the site engineer of the implementing agency and the Environmental focal point of the contractor.
- Co-ordinate with PMU for planning and delivering short training programs and workshops for the contractors and field supervision staff on the project's safeguards requirements and procedures
- Prepare and submit regular environmental monitoring and implementation progress reports to the PMU
- Ensure adequate public consultation during environmental screening and EA/EMP preparation; encourage community participation in sub-project planning, management and monitoring
- Ensure public complaints relating to nuisance and inconvenience caused by sub-project

implementation are addressed with corrective action and adequately documented
Environmental Focal Point - Contractor
<ul style="list-style-type: none"> • Ensure implementation of relevant provisions of the EMP during sub-project implementation; prepare contractor's plan for implementing the EMP • Ensure close co-ordination with the Environmental Officer from the PPAs and PLAs and report progress on compliance on a regular basis
World Bank
<ul style="list-style-type: none"> • Provide close supervision and necessary implementation support in the initial stages of the project in conducting screening, preparation of EAs and EMPs • Undertake prior review of screening reports, EA/EMPs for all Category A type projects and a sample of Category B type projects (in the initial stages to ensure quality of output and consistency with EMF guidelines); Subsequently, undertake post review of sub-projects on a sample basis • Ensure regular missions to review overall safeguards performance and provide further implementation support • Share knowledge on technologies and best practices • Provide training support on Bank's safeguard policies and requirements of the project.
Design and Supervision Consultants –Project Local Authorities
<ul style="list-style-type: none"> • Ensure technical supervision arrangement and contract management including environmental aspects; • Help PLAs in ensuring contractor compliance with mitigation measures stated in the EMP • Report on progress of EMP compliance, issues and suggested remedial measures as part of periodic reporting to the PLAs
Environmental Consultants
<p>The PMU will hire environmental consultants to provide technical support the PMU, PPAs and PLAs where specialized services are required. Some of the consultancies identified include:</p> <ul style="list-style-type: none"> • Preparation of 5 screening reports for each implementing agency – to ensure that the Environmental Officer PPAs and PLAs are adequately trained in environmental screening as required by the project • Preparation of EAs/EMPs for category A type projects • Preparation of the sediment sampling analysis plan; carrying out environmental sampling; preparation of a dredge material disposal plans for sites proven to carry contaminated

sediments

- Conducting annual independent environmental audits

3.5 Environmental Monitoring

The MCUDP will focus strongly on effective environmental monitoring. As majority of the anticipated environmental impacts from the project are general in nature and related construction and civil works, site management, public safety etc, monitoring will be largely carried out in the form of compliance monitoring through regular site supervision by the responsible officers. A monitoring checklist to be used and filled during site supervision is provided in **Annex 6**.

Monitoring of environmental parameters (such as air, water, salinity, sediment quality, etc.) will be conducted based on the requirements specified in the individual EMPs. However, given the ambient levels of noise and emissions in the city, pollution in the waterways etc no significant impact on the city's environmental quality is anticipated as a result of project activities. As such, the need for regular and systematic measuring of air, noise and water quality to monitor contribution to environmental degradation from the project per se is not considered essential.

The MCUDP is essentially environmentally beneficial and is expected to result in improved flood and drainage management, reduced disaster risk and improved local infrastructure and services in the Metro Colombo region. The overall project impacts will be monitored during project implementation through a number of selected indicators (*refer Results Framework in PAD*) which reflect the positive environmental contribution from the project to the city's environment. As such, no additional environmental indicators are proposed.

Most importantly, the project will support independent environmental audits on an annual basis throughout project implementation. The TOR for the proposed annual independent Environmental Audit is included in Part 06 of the EMF.

3.6 Progress Reporting

Progress reporting on safeguards compliance will take place as indicated below.

1. Contractor's environmental compliance reports to the PPA and PLA on a monthly basis
2. PPAs' and PLAs' environmental progress reports to the PMU on a bi-monthly basis
3. PMU's environmental progress reports to the WB, Steering Committee and the MODUD on a quarterly basis (this will be part of the quarterly project progress report produced by the PMU)

3.7 Capacity Development Requirements

For effective environmental safeguards management, the project agencies will require implementation support in three main areas; (i) dedicated staff and resources (ii) technical assistance and (ii) training and awareness. While (i) has been addressed above, the following section will specify assistance under (ii) and (iii)

3.7.1 Short-term training and awareness programs

In order to ensure safeguard procedures, instruments and monitoring needs of the MCUDP are well understood by the PMU and its implementing partners, short-term training and awareness workshops

will be conducted targeting primarily project and contractor staff on (i) World Bank's safeguard policies (ii) national environmental regulations and (iii) safeguards planning, management and monitoring requirements of the MCUDP as specified in the EMF.

In addition, the PMU will hire consultants to aid the implementing agencies in carrying out sub-project specific screening for the first 5 sub-projects under each agency. The respective environmental officers of each agency will work closely with the consultants in order to receive an on-the-job training. The technical assistance thus provided will ensure creating the necessary understanding, standards and capacity within the agencies to carry out screening for subsequent sub-project independently.

3.7.2 Technical assistance

Where stand alone Environmental Assessments and Management Plans are required as screening outcomes, the PMU will hire independent consultants. In addition, for contracts such as dredging in sites proven to be contaminated and for the subsequent disposal of such dredged material, the PMU will hire specialist services who will prepare disposal plans, carry out additional sampling (if needed) and site monitoring, conduct awareness for implementing agencies and contractors of disposal plan, monitor compliance and ensure control measures are adequately implemented.

3.7.3 Long-term capacity building

The project will also explore the possibility of building long-term capacity, within the sector agencies and local authorities in urban environmental planning and management through a well structured and modular training program. Urban environmental management requires both scientific and managerial expertise to plan spatial and other forms of urban intervention within the context of environmental carrying capacities and resources bases. As such it would be critically important for urban development officials, urban environmental planners, engineers in the sector agencies and municipal officials etc to upgrade and update their knowledge and skills in analyzing existing and emerging urban environmental issues as Colombo transforms into a Metropolitan city and to learn appropriate strategies to minimize adverse effects caused by rapid urbanization. Some suggested training topics;

- **Urban Environmental Planning and Management**
Overview of urbanization and associated environmental impacts, good governance and urban environment improvement, land use zoning, city beautification and clean city initiatives.
- **Integrated Urban Waste Management**
Urban waste control and minimization, solid waste management, wastewater management, technology choices for urban waste management, urban waste minimization measures.
- **Strategic Urban Environmental Management**
Strategic environmental planning, cross sectoral co-ordination for mainstreaming environmental plans and strategies etc

3.8 Operating requirements - Legislative/Regulatory Considerations

While it has been determined that the National Environmental Act, the basic national decree for environmental management/protection in the country from development initiatives, will not be triggered by project investments in the pipeline as of now, the following operating requirements have been identified for the sub-projects indicated below in compliance with various other national regulations. The sub-project proponent with the help of the PMU will ensure that the necessary consultations are made and clearances obtained prior to the commencement of these activities.

Agency	Sub Project	Institutions Responsible For Clearances/Permits
SLLRDC	Canal/lake embankment protection work	Local Authority OR CEA clearance for disposal method and site for dredged material (depending on quality of sediments); Clearance from Coast Conservation Department (CCD) and Marine Pollution Prevention Authority (MPPA) in the event disposal of dredged material at sea is selected.
	Improvements to Main Drain Crossings at Ports Access Road & Railway	Ports Authority Department of Railway CCD clearance
	Madiwela East Diversion: Improvements to Madiwela Diversion canal up to Athurugiriya Road, Additional opening to Amaragoda Culvert	Clearance from Department of Irrigation
	Restoration & Creation of lakes around Parliament lake	CEA clearance for disposal method and site for dredged material
	Restoration of Kolonnawa retention area & pumping station at Gothatuwa (30m ³ /s)	Clearance from Coast Conservation Department (CCD) and Marine Pollution Prevention Authority (MPPA) in the event disposal of dredged material at sea is selected.
	St. Sebastian South Diversion canal by passing Beira Lake (excluding upstream part of the Norris canal) including treatment at outlet	CEA clearance for treatment plant
	Implementation of Water-based transport services for better usage and management & investment for maintenance of water bodies – Bridge Improvements	No such clearance but in consultation with CEA, SLLRDC may develop guidelines for operation of Water-based transport services.
UDA	Beddagana and Kotte Ramparts Park	Clearance from the Department of Wildlife Conservation
CMC	Proposed Water Front Recreational Park at Crow Island	CCD clearance with conditions to be adopted
	Marine Drive Promenade with Beach Front Leisure Park	CCD clearance with conditions to be adopted
KUC	Dredging of Minor Canal at Wadullawatte	Local Authority OR CEA clearance for disposal method and site for dredged material (depending on quality of sediments)
	Dredging of Kambikotuwawatte Canal	
	Dredging of Canal near United Motors, Orugodawatte	

Detail descriptions of the NEA and other national regulations relevant to the MCUDP and the World Bank's safeguard policy on Environmental Assessment are provided in the EA, hence not repeated here.

3.9 Timeframe for planning and carrying out safeguards assessment

Timely planning and execution of environmental screening and follow up assessments/plans for sub-project investments would be crucial in achieving the overall project implementation and completion targets. Any delay in obtaining relevant environmental approvals/clearances would hold back commencement of sub-project activities thus causing project implementation to be delayed. Such delays can be costly in terms of project time as well as resources. Hence, it is extremely important that the PMU and the PPAs/PLAs initiate sub-project specific screening and follow up assessments as soon as the investments packages become ready. All environmental assessments/plans should be completed by the time of tendering and the EMPs should be a part of the bidding document so that the contractor is made duly aware of his commitments towards environmental safeguards management under each sub-project.

As a guide, the following table provides a tentative timeline for completion of the safeguards cycle for different types of safeguard instruments. This timeline is intended to guide the PMU in planning screening and safeguards assessment ahead and to determine a realistic timeframe to commence the tender process for the sub-project investments. Please note the table below does not include time taken for procurement of consultancy services to conduct the EAs.

Stages in the process	EIA	IEE/ EA	EMP	Remarks
Scenario 1: Sub-project which trigger OP 4.01 only				
Environmental Screening	1 week	1 week	1 week	The need for follow on assessments will be determined by the screening outcome
Scoping and setting of TOR	2 weeks	1 week	1 week	
Report preparation	4 months	2 months	1 month	Length of time will be determined by the complexity of issues involved. What is considered here is an average based on the type of projects.
Report appraisal	2 weeks	1 week	1 week	
Public consultation	1 month	1 month	1 month	
Report Finalization	2weeks	2 weeks	1 week	
Clearance	Clearance will be provided as soon as review comments and public concerns are adequately addressed in the report.			
Tentative time for EA cycle (min – max)	7 months	4.25 months	2–3 months	
Scenario 2: Sub-projects which trigger both OP 4.01 and EIA under national regulations.				
<i>NOTE: None of the sub-projects in the pipeline as of now are likely to require approval under the NEA. However, in the case of dredging and dredge material disposal from sites proven to be contaminated the CEA may request for an EIA/IEE under the special projects clause. As such, this section has been included to cover such as eventuality as well as to cover any sub-project that may be added to the pipeline in the future which would require NEA approval.</i>				
Provision of preliminary project information	1 week	1 week	-	
Scoping & determine IEE OR EIA and TOR preparation	1 month	2 weeks	-	WB will review TOR and provide consent/comment
IEE/EIA report preparation	NS*	NS*	-	One report to satisfy both local and WB requirements

Checking adequacy of IEE/EIA report	NS	NA	-	WB will review and submit comments
Provision of additional information if required	NS*	NA	-	
Public consultation	1 month	NA 1 month under OP 4.01	-	If it's a category A project, WB safeguard policies will require a period of 120 days public commenting period
Forwarding Comments to the PP	1 week	NA	-	
Responding to public comments	NS*		-	
Decision	1 month	3 weeks	-	WB clearance will be provided concurrently
Concurrence on the decision				
Appeal against rejection (If rejected)				
Final Decision				
Tentative time for EA cycle	12–15 months approx.	6–8 months approx.		

3.10 Estimation of Environmental Safeguards implementation cost

Activity	Quantity	Unit Rate in US\$	Total in US\$
Environmental Staff			
- PMU Environmental Specialist	1	1,000	48,000
- SLLRDC Environmental officer	In-house	-	-
- UDA Environmental officer	In-house	-	-
- Environmental officer for CMC	1	700	33,600
- Environmental officer for KUC (part-time)	1	350	16,800
- Environmental officer for SJPK (part-time)	1	350	16,800
- Environmental officer for DML (part-time)	1	350	16,800
Sub-total			132,000

Environmental training and capacity building - Recruitment of consultants to build capacity of the implementing agencies to conduct environmental screening and prepare stand alone EMPs	20 Assignments	1000	20,000
Training and awareness programs (short-term and long-term) - Training on urban sector env management issues - Training programs on env safeguards, monitoring for project staff, contractors etc	1 8	40,000 1500	40,000 12,000
Recruitment of consultants to prepare stand alone EAs and EMPs			50,000
Consultancy for annual environmental audit	5	12,000	60,000
Consultancy for the preparation of a Dredge Material Disposal Plan and implementation monitoring			50,000
Environmental monitoring that includes sampling and laboratory testing -Sediment samples -Water quality samples - Unspecified	10 10	1300 100	13,000 1,000 10,000
Environmental screening and monitoring by project staff (will be part of transport and O/H budget of the MCUDP)			40,000
<i>Costs associated with mitigation measures</i>	<i>Included in the construction costs</i>		
Contingencies			20,000
Sub-total			276,000

PART 4 – STRATEGIC FRAMEWORK FOR MCUDP

The Metro Colombo Urban Development Project (MCUDP) aims to facilitate the Government's long-term urban development program for Metro Colombo by focusing on two main components: (i) Flood and Drainage Management, which aims to enhance the economic value and aesthetic qualities of the water bodies; and, (ii) Urban Development and Infrastructure Rehabilitation for Metro Colombo Local Authorities, and implementation support, which aims at strengthening strategic planning processes at the metropolitan level and supporting local authorities in the CMA to rehabilitate and manage their drainage infrastructure and streets, and improve solid waste collection.

This strategic framework outlines (i) a suggested approach for the MCUDP on how it will protect and restore Metro Colombo's urban waters and maintain municipal infrastructure to reconnect public/communities to their urban environments and (ii) relevant guidelines as to how MCUDP can contribute towards pertinent environmental issues that are closely associated with achieving economically and aesthetically valuable urban waters. Connecting people to urban waters require new and renewed efforts on the part of the stakeholders to help the public grow in ways that protects their health and the environment, expand economic opportunity, and create and enhance the places where people live. The efforts to protect urban water resources, should aim at moving forward to achieve the vision and goal of the MCUDP and support community efforts to build healthy, sustainable green neighborhoods. Urban landscaping for recreation and city beautification, improvements in public health and sanitation, solid waste management, rehabilitation/development of municipal infrastructure, and common amenities should aimed at revitalizing the urban living.

This strategic framework outlines an organizing framework for strategically aligning current and future actions to be taken by the MCUDP, its implementing agencies: UDA, SLLRDC, Local authorities and other stakeholders; the many partners already active on urban waters of Metro Colombo; and new partners who can join in these efforts. It outlines the overall philosophy and approach to achieving a vision.

4.1 Vision of the MCUDP

The project's combined efforts will restore urban water quality, revitalize our communities and reconnect communities to their urban waterways. This vision revolves around four key elements:

- **Connecting** communities and people to water bodies
- **Engaging** the people in conserving and restoring of water bodies
- Working together to **improve** water quality
- All of above, which are aimed at **Revitalizing** communities together with improved municipal infrastructure facilities

The interconnections can be illustrated as in Figure 1.

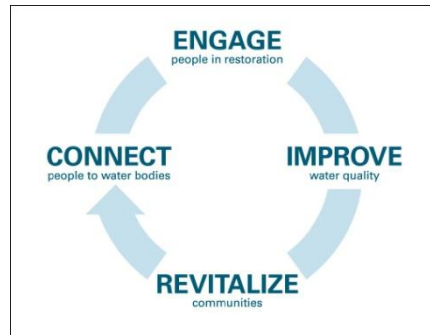


Figure 1: Key elements in achieving the vision

It is pertinent that communities and people who have access and opportunity to experience and enjoy their waterways and viewing their urban waters and adjacent lands are intrinsically valuable. Community members should be motivated, informed and engaged with governmental institutions and local governments, centers of learning, community institutions, businesses and non-profits in order to revitalize their waterways, waterfronts, and adjacent communities. As water issues and other urban priorities become linked, it is possible to envision new and previously unlikely partnerships being created to transform previously degraded urban waters and adjacent lands into community assets. Urban waters will no longer be undervalued but will be treasured as centerpieces of urban revival.

4.2 Goal of the MUCDP

Through its diverse partners, the MUCDP should seek to engage communities in restoring and protecting urban water quality, maintaining municipal infrastructure and revitalizing adjacent neighborhoods by engaging communities in activities that increase their connection to, understanding of, and stewardship of local urban waterways and municipal infrastructure.

Intended Outcomes

- 1. Connection to urban waters:** Greater access to urban waterfront and greater public participation in waterfront activities, such as recreation, volunteer monitoring, clean-ups, education and leisure.
- 2. Understanding of urban waters and their potential:** Greater public involvement and awareness of urban waters including canals, lakes and wetlands. The consequent improvement of public health, quality of life and the economic development by protecting and enhancing these resources. Alleviation of problems related to poor micro drainage.
- 3. Protection and restoration of urban waters:** Acceleration of the measurable improvements to urban water quality.
- 4. Sense of public ownership of municipal infrastructure:** Greater public benefit from improvement services and infrastructure, especially in underserved communities, and consequent increased priority given to the sustainable use of these.
- 5. Community revitalization:** Promoting equitable community improvements that capitalize on the social and economic benefits derived from improved urban facilities, improved sanitation,

common amenities, and improvised drainage and alleviation of flood menace and related problems on adjacent lands.

In addition to what the MCUDP will address and achieve, it is important that the GOSL views this urban program as a longer term involvement and ensure the above can be achieved by

1. Aligning other government programs and investments in these communities along the vision/goal specified,
2. Expanding partnerships,
3. Building local capacity, and
4. Finding innovative ways to communicate the environmental and economic development potential of safe and clean urban waters.

MCUDP's existing efforts to protect water-related resources, and improve municipal infrastructure can be significantly enhanced by:

1. Better alignment of the programs and resources to assist a broader set of communities; and
2. Engaging communities more actively in protecting these urban waters, and municipal infrastructure especially those communities not engaged today.

Communities will be more engaged if:

1. They view urban waterways, and adjacent lands as intrinsically valuable;
2. Efforts to improve municipal infrastructure and lands are made more relevant to their everyday lives and priorities; and
3. They have greater resources and capacity (both skills and efficacy) to make an impact.

4.3 Implementation and Evaluation

The objectives in this EMF will be achieved through the implementation of programmes outlined in the sections 1-4 of this report. Progress in implementing these actions will be tracked on a periodic basis in order to assess what is working and not working. This will help identify opportunities for spreading effective practices and opportunities to make course corrections based on learning. A summary of the project's proposed investments and its link to restoring Metro Colombo's urban waters and maintain municipal infrastructure to reconnect public/communities to their urban environments are summarized in the table below.

	Potential Activities	Objectives	Out come	Vision
1	<ol style="list-style-type: none"> 1. Embankment protection and demarcation of canal reservation of Dehiwela Canal 2. Construction of bank protection wall along 2.5 Km of Beira lake and rehabilitation of Macculum lock gates 3. Reconstruction of Aluth Mawatha culvert and improvements to Mutwal Outfall (box drain, tunnel inlet and outlet) 4. Embankment protection and demarcation of canal reservation of St Sebestian South Canal 5. Embankment protection and demarcation of canal reservation of Wellawatte Canal 6. Embankment protection and demarcation of canal reservation of Main Drain 7. Embankment protection and demarcation of canal reservation of Dematagoda canal 8. Improvements to Madiwela East Diversion <ol style="list-style-type: none"> a. Design of control gates at spillway of Talangama tank b. Bank protection from Amaragoda culvert to Athurugiriya road 9. Formation of lakes No 06 and 07 in the parliament catchment 10. Rehabilitation of canal from Waththa No.60 to Arunodaya Mawatha canal - Work consists of clearing of canal and embankment protection of canal banks. 11. Rehabilitation of canal from Waththa No.60 to Arunodaya Mawatha canal 	<p>Improvements of main/primary canals and lakes:</p>	<p>Connection to urban waters</p> <p>Understanding of urban waters and their potential</p> <p>Protection and restoration of urban waters</p>	<p>Restore urban water quality, revitalize our communities and reconnect communities to their urban waterways. This vision revolves around four key elements</p>
2	<ol style="list-style-type: none"> 1. Embankment protection of secondary canals of Sarana Mawatha and Sethsripaya 2. Dredging of Minor Canal at Wadullawatte 3. Dredging of Kambikotuwawatte Canal 	<p>Rehabilitation of secondary/tertiary canals</p>	<p>Connection to urban waters</p> <p>Understanding of urban</p>	

	<ol style="list-style-type: none"> 4. Dredging of Canal near United Motors, Orugodawatte 5. Dredging of Minor Canal at Wadugodawatte 6. St. Sebastian South Diversion canal by passing Beira Lake (excluding upstream part of the Norris canal) including treatment at outlet 7. Upgrade of set of North lock Gates & downstream improvement with embankment protection - continuation from Stage I 8. Improvements to Main Drain Crossings at Ports Access Road & Railway 9. Madiwela East Diversion: Additional opening to Amaragoda culvert (optional-will be decided upon the analyzing results of model studies which are ongoing.) 		<p>waters and their potential</p> <p>Protection and restoration of urban waters</p>	
<p>3</p>	<ol style="list-style-type: none"> 1. Micro-drainage improvement in the following localities <ol style="list-style-type: none"> a. Flood prevention at Green Lane, George R. De Silva Mw. And Ratnam Play Ground Area b. Flood prevention at Garden No.175 and 211 c. Flood prevention at Nagalagam Street d. Flood prevention Garden No.75 at Ferguson Road e. Upper catchment of Torrington North Canal 2. Construction of Storm water drain from Ratmalana SLTB depot to Lunawa Canal 3. Rehabilitation of Dharmarama Road (Drains) 4. Improvements to storm water drainage 5. Flood prevention at Garden No.175 and 211 at Nagalagam Street and Garden No.75 at Ferguson Road 6. Flood prevention along K.Cyril C. Perera Mw. From George R.De Silva Mw. Up to Arthur De Silva Mw. 	<p>Improvement of storm water drainage in the CMC and flood prevention</p>	<p>Understanding of urban waters and their potential</p> <p>Protection and restoration of urban</p>	

	<p>Junction</p> <ol style="list-style-type: none"> 7. Prevention of Flooding at Saunders Place 8. Prevention of Flooding at Maligawatta Housing Scheme 9. Storm Water improvements of Siridhamma Mawatha and surrounding area 10. Flood Prevention at Poorwarama Rd, and Kandewatta Rd. 11. Flood Prevention at Park Road 		<p>waters</p>	
4	<ol style="list-style-type: none"> 1. Construction of foot bridges and nodal parks around Beira lake 2. Establishment of Beddagana Park and Kotte Rampart Park 3. Model Zone Development of Town Hall Square 4. Walkability Improvements in City of Colombo-Foot Walks 5. Implementation of Water-based transport services for better usage and management & investment for maintenance of water bodies – Bridge Improvements 6. Improvement of the neighborhood of water bodies (canals & lakes) for recreational purposes - Foot Bridges 7. Redevelopment of Attidiya Grounds 8. Children play-ground and recreation park at Sri Jayewardenepura Kotte MC 9. Proposed Water Front Recreational Park at Crow Island 10. Marine Drive Promenade with Beach Front Leisure Park 11. Restoration & Creation of lakes around Parliament lake - continuation from Stage I 12. Development of Chandra Silva Recreational Park at 	<p>Urban landscaping for water recreation and city beautification</p>	<p>Connection to urban waters</p> <p>Protection and restoration of urban waters</p>	

	Rajagiriya 13. Redevelopment of Bandaranayakapura Open Space 14. Redevelopment of Rajagiriya Junction Open Space 15. Redevelopment of Esala Uyana Open Space 16. Redevelopment of Palliya Patumaga Open Space 17. Redevelopment of Senanayaka Mawatha Open Space 18. Redevelopment of Kolonnawa Road Open Space			
5	1. No. 112, Vauxhall Street, Colombo – 02 2. Galle Road/W.A. Silva Mw., Colombo – 05 3. Milagiriya, Colombo – 04 4. Saunders Place, Colombo –11 5. York Street, Colombo – 01 6. Piyadasa Sirisena Mw., Colombo –10 7. Nagalagam Street, Colombo – 14 8. Vihara Maha Devi Park, Colombo – 07 9. Gunasinghe Pura, Colombo – 11 10. Madampitiya, Colombo – 14 11. Timbirigasyaya , Colombo – 05 12. Mattakkuliya, Colombo – 15	Public Health & Sanitation support	Sense of public ownership of municipal infrastructure Community revitalization	
6	1. Construction of Hanger for heavy vehicles and utility center for Ratmalana DE 2. Construction of Office for DE-Ratmalana 3. Development of Ratmalana Pola 4. Improvements to Galle road bridge across Wellawatta canal 5. Pumping Station at North Lock (10m ³ /s) 6. Rehabilitation of Pumping Station at South Locks & renovation of gates 7. Restoration of Kollonnawa retention area & pumping station at Gotatuwa (30m ³ /s) 8. Construction of Pitakotte Market and Medical Centre	Rehabilitation/development of small/medium scale municipal infrastructure	Sense of public ownership of municipal infrastructure Community revitalization	
7	1. Rehabilitation of Roads in city of Colombo-Galle Road and R.A. De Mel Mawatha	Urban/municipal Road resurfacing	Sense of public ownership of municipal	

	<ol style="list-style-type: none"> 2. Pedestrian Overhead Bridges at Kollupitiya & Bamalapitiya Intersection with Galle Road 3. Rehabilitation of roads, consisting of overlaying of the roads with hot mixed Asphalt Concrete to line and level and construction of side drains and lead away drains (details TBD). 4. Culvert at Pangiriwatta 1st Lane Across the Railway Line - Work consists of removal of the existing hume pipe culvert without effecting the railway line and constructing a new box culvert with a larger opening in its place 5. Rehabilitation of about 6 kilometers of selected urban roads including their drainage 6. Rehabilitation of Roads consisting of overlaying of the roads with hot mixed Asphalt Concrete to line and level and construction of side drains and lead away drains (details TBD) 	<p>and road side drainage improvement</p>	<p>infrastructure</p> <p>Community revitalization</p>	
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4.4 Guidelines for MCUDP in addressing larger urban environmental issues directly linked with sustaining project outcomes

In achieving the goals of MCUDP it is required to note that issues such as solid waste mismanagement leading to waste being found in canals and water bodies choking and blocking the capacity of water flows, poor wastewater management in urban areas resulting in fecal pollution due to mixing with sewage and mismanagement of wetlands particularly with indiscriminate filling and utilizing them for dumping of municipal solid waste and construction debris need to be addressed strategically. Though the MCUDP does not directly solve such problems there will be limited interventions towards minimizing such grave issues faced by many in the urban sector. Hence it is of utmost importance to perceive the present status of such topics at a national level particularly in relation to the strategic decisions taken in order to lessen such issues by GOSL. The MCUDP will help address these issues to a certain extent but due to the link towards other non performing interventions that need total eradication of such issues, the total expectations or goals may not be realized unless the holistic picture is visited at large.

Following sub-sections are therefore to understand the strategic planning done by the GOSL in order to address such problems with various stakeholders. Project proponents are thus expected to be aware of such planning tools and need to be aligning in the same direction in achieving MCUDP's goals rather than violating them.

4.7.1 Municipal Solid Waste Management

A National Policy on solid waste management drafted in 2007. Some of the direct policy decisions implicated in the policy that are addressed by the MCUDP are:

- Institutional strengthening and capacity building needs of stakeholders with special emphasis on Local Authorities will be addressed to promote effective waste management
- Best Available Technologies (BAT) and Best Environmental Practices (BEP) will be transferred to all sectors including informal sector
- Sustainable financing mechanisms shall be made mandatory to ensure the sustainability of solid waste management programmes
- Social and corporate responsibility and accountability towards solid waste management will be ensured.

In addition there are two gazette notifications which came out as regulations for which would provide the strategic base for MCUDP contributions' to solid waste management.

- National Environmental (Municipal solid waste) Regulations No 1 of 2009
- Municipal solid waste management rules No 1 of 2008 of the western Province

Furthermore gestures taken by GOSL to set up Environmental Police at every Police Station in order to capture the garbage throwers into public places would also be regarded to be an effective method of curbing indiscriminate dumping.

In the urban areas growth appears to be very high with the end of the war and people flock into main cities for better prospects. In this attempt, increased generation of MSW and decreased space for management of such MSW would be the main challenges faced by many local authorities. Though the subject of managing MSW is vested with local authorities some are struggling to find ways and means of managing it properly due to many reasons. Hence helping them to resolve their issues pertaining to MSW management would be a timely gesture however needs monitoring closely as the management itself is connected with numerous activities. In general management involves from generation, household sorting, storing, collection, transport up to disposal respectively. The way they are handled by different local authorities differ from one another. Hence it has to be understood how such activities are carried out by a particular local authority prior to giving a helping hand. For example Kollonnawa PS will be given some machinery and vehicles to transport MSW, which are very timely looking at their present capacities. However lack of final disposal plan would be the most pressing issue faced by many local authorities in the Project Area. At present Kollonnawa (Meethotamulla) and Karadiyana are the two open dumps that are in use by all the CMC, Kollonnawa and Dehiwala and Mt. Lavana. Though strict legislation is in place people are yet to be disciplined enough to dispose of their waste in a proper manner. Hardly any household sorting is carried out and very limited efforts are put in for 3R principle to be implemented. Collection seems to be much more refined by many local authorities but due to the lack of vehicles transport in time may be questionable in many local authorities. Hence it is required that an integrated approach must be practiced in order to have sound management of MSW for which there have to be many actions to be decided upon. Political leadership in this context seems to be very important and without it the best management practices may not be realized.

The GOSL under the preview of Ministry of Environment, a project to handle MSW issue in large for all local authorities called Pilisarua has been established with a view to helping any local authority who needs both technical and financial support in order to go ahead with sound MSW management. It has also been understood that the urban sector must develop final disposal techniques which can be reckoned to be sustainable. However up to now nothing has come out tangibly but several sanitary landfills are in the pipeline. Some are to address the urban sector requests with the financial support from KOICA, Korea.

In addition several waste to energy projects are also in the pipeline which are said to be realistic after a couple of years. Another gesture that the GOSL has done was the increased tariff for waste to energy project so that they are now financially very attractive for private investors to come in. In spite of all the instruments given many investors are unable to go ahead mainly due to the lack of proper lands in which such plants are to be built. Hence for proper management of MSW at strategic level lands must be allocated with provision of all necessary infrastructure.

4.4.2 Canal water quality improvement and monitoring

It has been a common picture that most of our urban canal network is highly polluted mainly with gray and black waters leading to fecal pollution. This has degraded the water quality depleting the dissolved oxygen (DO) creating an environment devoid of DO. This scenario leads to emanating of bad odors resulting in fish kills and making the water body entirely not suitable for biological life. One can observe

much illegal connection of sewer lines and industrial discharges into canal network other than storm water drainage causing the present situation to prevail in the long run. Indiscriminate dumping of MSW into water bodies are common sights in many area. Hence project proponent should perceive the linkages of achieving the goal even through other means with whatever powers vested with them for the better management of the canal systems. The coverage of the sewerage network is limited within the Metro Colombo area. The existing system which is in a highly dilapidated state leading to many leakages is being rehabilitated under a project funded by the ADB. The MCUDP would support these on-going initiatives by investing in feasibility studies that will eventually pave the way for follow on projects for better sewerage management in the city. Until the treatment and disposal of sewerage in a sustainable manner is addressed, the canals and lakes will continue to be at the receiving end with continued degradation of water quality and low economic value.

It is also an important step to understand the trends of water quality degradation or improvement over time and how these interventions would help in achieving the goal of the project in terms of the macro picture. To realize this effort, it is therefore required that a proper water quality monitoring plan be implemented in order to check whether the predicted outcomes are achieved or not. Therefore project proponents need to have their own water quality monitoring plans ready to be deployed to get an insight into the effectiveness of the project activities over the next couple of years and to detect the sources of pollution so that corrective action can be taken. At present, availability of water quality and sediment quality data is very limited.

4.4.3 Conservation of the remaining flood detention wetlands in the upper basin

The remaining wetlands in the upper basin are increasingly in danger due to the anthropogenic activities in the region. The wetlands which were estimated to be 400 ha in extent in the early 80's have shrunk to almost 286 ha at present, thus placing the city and its suburbs at great risk of flooding. These wetlands, known better as the Colombo Flood Detention wetlands, have been persistently subjected to indiscriminate land filling, dumping of garbage and channeling of wastewater and effluents etc. Sri Lanka has a comprehensive wetland conservation strategy and ample experience in wetland management work. In addition, the UDA has carried out a wetland zoning exercise for the Western Province which has declared the upper basin wetlands as protection zones with a master plan prepared for the protection and integration of these areas with city expansion plans. However, these have not been very effective due to poor enforcement. These strategies need to transform in to action plans with greater public participation where the urban population learns to realize the benefits of these green areas. The proposed Beddagana and Kotte rampart park is a very positive initiative proposed by the MCUDP and the project should seek to facilitate similar systems (with linkages) to other wetlands in accordance with the master plan. The wetland strategy may be used as the base document for this.

4.7.4 Metro Colombo Strategic Development and Growth plan and Subsequent Integrated Master Plan

The MCUDP will support improved metropolitan planning and development by financing a Strategic Development and Growth Plan for the Colombo Metropolitan Area and subsequently an integrated Master Plan. This will be a major output and the road map for development of city of Colombo and the

nearby suburbs. The strategic plan could be developed with a Strategic Environmental Assessment which can bring in elements of sustainability and green city planning based on natural assets/ecology to the city development master plan. The role the SEA can play in lessening environmental risk and enhancing its outlook while economic development is facilitated in future city development will be an important one due to the complex nature of issues the Metro Colombo area is facing and the close linkages of the prevailing issues. The TOR for the SEA will be best understood once the vision for the Metro Colombo Strategic Development and Growth plan has been conceptualized. This is on-going.

PART 5 – STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

For all types of environmental analyses conducted under the MCUDP (including screening), communities in the project sites should be consulted within a structured and culturally appropriate manner. Further, environmental assessment documentation and EMPs should be made available to the public (in accordance with the World Bank's policy on information disclosure) by the PMU prior to tendering of works contracts through the websites of the project and the implementing agencies and notices through media, as appropriate. In addition, it may be necessary to conduct discussion with the regulatory agencies (such as the CEA, CCD on relevant issues) and other implementing agencies who would have a stake in the project due to various reasons. Consultation will enable the project implementing agency to understand the stakeholder's requirements and for the stakeholders to develop an understanding of the project so that potential conflicts could be eliminated or minimized.

The process of consultation should be documented and account taken of the results of consultation, including any actions agreed resulting from the consultation. Public disclosure of the relevant safeguards documentation will be a pre-requisite for tendering civil works contracts. The contract documents for each contract package will mandatorily include the relevant environmental mitigation provisions stipulated in the EMPs (which would have community concerns reflected, if any) for the given sub-projects in order to ensure contractor compliance with the safeguards requirements.

Given below is a brief framework for planning consultation under MCUDP. It has to be noted that only the appropriate consultation method will be applied to sub-projects during implementation and the responsibility of consultation lie primarily with the project implementing agencies.

5.2 Objectives of stakeholder consultations

The prime objectives of stakeholder consultation are;

- Provide the stakeholders an opportunity to inform and influence the decision making process.
- To partner with the stakeholders so as to make the project widely accepted and to lower the potential impacts

5.3 The Elements of Effective Stakeholder Consultations

Some of the most concerned elements of effective consultations are as follows;

- well targeted
- early enough so as to make sure to get the stakeholder views adequately reflected in the project decisions
- transparent – provide all the information without hiding anything
- make the consultation process very simple and understandable so that clear answers and comments can be obtained
- ensure gender equity
- documentation of consultation
- based on the principle of "Two way Process"
- focus the consultation on Risks, impacts, mitigation measures and opportunities.

5.4 Suggested Methods

Participatory workshops, focus group meetings and face to face and informal individual interviews are the three most commonly adopted methods of stakeholder consultations and a mix of these can be employed under MCUDP, as determined by the requirement.

5.4.1 Participatory workshops

Participatory workshops are effective when a large number of stakeholders with different interests and specializations get involved. Conducting effective participatory consultation workshops should consist of following elements;

- (i) Orient the workshop towards a clear destination. In this connection it is necessary for the evaluator to present a very good project brief and the purpose of the consultation.
- (ii) The evaluator should be able to build bridges and consensus among stakeholders.
- (iii) Divide the participants into sub groups to represent adequate mixture of different interest groups and allow the sub groups to brainstorm among the group members and submit their views and comments as those of not individuals but of the sub groups.

This method is recommended for projects such as Restoration & Creation of lakes around Parliament Lake, Linear Park and Nodal Parks development along Beira Lake etc. where mostly professionals (Town Planners, Architects, Engineers, Landscape Architects, and Environmental Planners), infrastructure provision institutions, NGOs and business people can get involved in.

5.4.2 Focus groups

The focus group consultation meetings are relevant when the stakeholders have similar interest thus their objectives are focused towards one common objective. This kind of consultation meetings are recommended only for projects that involve relocation of families to carry out the project.

5.4.3 Individual - face to face interviews

When the stakeholders are not large in number and represent specialised areas of interest face to face interviews which are informal are very effective. This system is very flexible, permits in depth discussions to understand the issues and is low cost. However individual stakeholder consultations should be well planned as if not it may lead to "heavy focus on individual issues and interest". This method is recommended for majority of the sub-projects under MCUDP as they are relatively small in size, potential impacts are very specific, and stakeholders are small in numbers.

The stakeholder consultation process should be continuous. However since practical difficulties exists for continued consultation, at least consultation needs to be carried out at three stages; project preparatory / design stage, project implementation stage and project end stage so as to make sure that stakeholder concerns, interest, comments are adequately built into the whole project management process.

PART 6 – SAMEPLE TERMS OF REFERENCE

6.4 Terms of Reference for Environmental Assessment for sub-projects involving major dredging

Task 1 – Explain the objective of the project and what the propose interventions are going to achieve.

Task 2 – Description of the Proposed Project’s Sub-Component.

The Consultant shall discuss with the implementing agency the detail design and project investment report to familiarize themselves with the contents of the proposed canal/lake rehabilitation and capacity enhancement work and shall, if deemed necessary, make comments on the contents of the designs at an early stage where it is considered that significant changes to the designs may be required to minimize environmental impacts. For each sub-component proposed under the investment, the Consultant shall provide a brief description of the work involved and the following using maps (at an appropriate scale) where necessary.

- i. Site location and general layout
- ii. Detail designs
- iii. Preconstruction activities
- iv. Construction methodology including type of dredging equipment to be used
- v. Method of dredge material loading and transporting
- vi. Implementation schedule

Task 3 - Description of the Environment

Present baseline data on the relevant environmental characteristics of the proposed project area.

(a) *Physical environment*: topography, land-use, soils, water sources, quality and distance from the project site, air quality, noise, vibration levels (if available)

(c) *Biological environment*: eco-system types and structure in the project area, bio-diversity in terms of fauna and flora, rare or endangered species, sensitive or significant natural habitats in both terrestrial and aquatic environments

(c) *Sociocultural environment*: key socio-economic features, uses and benefits from the project area

Task 4 - Determination of the Potential Impacts of the Proposed Project’s subcomponents.

In this analysis, the Consultant will point out significant positive and negative impacts of the activities of, direct and indirect impacts, and immediate and long-term impacts. The Consultant will identify impacts that are unavoidable or irreversible. Special attention should be given to impacts during construction such as impacts on water quality, drainage, aquatic fauna, air quality, ordour, noise, recreation etc and most importantly dredge material handling, transport and disposal.

(Please note that the implementing agency would be in possession of sediment quality data for the Colombo basin. Hence, it would be extremely important for the consultant to determine the extent of the impacts mentioned above based on the data and in reference to acceptable reference standards).

Task 5 - Analysis of Alternatives to the Proposed Project.

- The Consultant will describe alternatives that were examined in the course of developing the proposed project and identify other alternatives that would achieve the same objectives. The concept of alternatives extends to project concept and design, selection of dredging technology and machinery, dredge material management etc.

- The Consultant will compare alternatives in terms of potential environmental impacts, operating costs, reliability, suitability under local conditions, and institutional, training, and monitoring requirements.
- To the extent possible, the Consultant will quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. Include the alternative of not constructing the project to demonstrate environmental conditions without it.

Task 6 - Development of an Environmental Management Plan (EMP).

The Consultant will develop an EMP in order to provide for control and execution of the excavation and construction work in compliance with GOSL and World Bank environmental regulations and requirements.

The EMPs should include measures to mitigate negative environmental impacts, identified in Task 4 above; The Consultant will estimate the impacts and costs of the mitigation measures and of the institutional and training requirements to implement them; Specifically, the EMP should dedicate a section as a dredge material disposal plan which will address the issue of dredge material handling and disposal and provide detail on the recommended method of disposal, controls to be implemented when loading, transporting and unloading the material, especially if contamination within the site has been established.

The EMPs should include a plan to monitor the environmental changes and the effectiveness of the mitigation measures; a regular schedule of monitoring the quality of surface and ground waters; including proposed work programs, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures, monitoring, etc., measures for emergency response to accidental events (e.g. spillage of contaminated dredged material), as appropriate, timely decision making process to resolve any significant impacts that are identified during the monitoring program, and a clear and transparent reporting procedure for environmental monitoring.

The EMP should also include measures to promote capacity building for environmental management in the implementing agency staff and contractors. In the EMP, the Consultant should provide a review of the authority and capability of institutions implementing the project and recommend steps to strengthen or expand them so that the EMP may be effectively implemented. The recommendations may extend to new laws and regulations, new agencies or agency functions, intersectoral arrangements, management procedures and training, staffing, operation and maintenance training, budgeting, and financial support.

Task 7 - Assist in Inter-Agency Coordination and Public Participation.

The Consultants shall assist the PMU and the implementing agencies in carrying out two public consultations (the first to present the projected impacts, collect public supplemental opinions and views, the second upon the completion of the draft EA Report) with project affected people and assist Inter-Agency Coordination as required by the OP 4.01. Assistance should be provided to PMU and the implementing agency in coordinating the EA with other government agencies, in obtaining their comments and views. In addition, the draft EA should be placed in the website of the project and the implementing agency for feedback from the general public. Feedback and comments from the public consultation process should be recorded and reflected in the EIAs and later on be incorporated in the final project design, if necessary.

6.2 Terms of Reference for an Environmental Management Plan for a typical sub-project

The EMP should address the following sections in detail.

1. Introduction

2. Project concept and detailed designs as approved by the PMU and Implementing Agency
(The activities of the sub-project must be approved by the PMU for funding. Activities that need further studies should not be included into the EMP as it may mislead the outcomes. As the EMP would need to identify impacts and mitigation measures specific to the site and proposed interventions, detailed designs are of utmost importance to have been finalized at the time of EMP preparation)

3. Project Implementation Schedule

(It is indeed necessary to understand at what time the proposed measures are to be implemented. Hence implementation schedule is of paramount.)

4. Significant Impacts and mitigation Measures

(Identification of impacts and their mitigation measures must be highlighted.)

5. Organization Chart, Responsibilities & Implementation Budget

(Management commitment in accordance to organization chart is mandatory and also the allocated funds must be mentioned for each intervention so that it is the responsibility of the management to spend it as planned. Such costing particularly for mitigation activities must be highlighted)

6. Operating Requirements

(Application of related standard and regulations stipulated under the NEA and other legislation pertaining to environmental management should be highlighted. All the approvals needed for the project to go forward must be obtained with the EMP with copies of any written approval or permission by different authorities)

7. Requirements of environmental monitoring and its frequency

(It is obvious that proper monitoring requirements are worked out in order to realize the monitoring needs for the sub-project planned; including if necessary Baseline studies for air, water, noise, vibration, soil flora and fauna etc. as needed. The frequency of producing monitoring reports and its contents should be mentioned.)

8. Environmental Contingency Plan

(Contingency plan should be made available in the case of high risk interventions so that the project never comes to a halt with proper alternative plan. All the health and safety issues must be addressed under this section.)

9. Frequency and type of training related to special issues

(Training needs must be highlighted that will enable proper management of environment in which the sub-project is implemented.)

10. Estimated budget for implementing the Environmental Management Plan.

(Total cost of EMP must be worked out so that the amount mentioned can be kept aside without spending for main activities.)

11. Conclusion and recommendations

(Concrete conclusions and recommendations must be worked out so that they can be technically feasible and economically viable solutions for the implementation.)

Annex

- Name of environmental consultants involved in the EMP preparation
- Any analytical reports
- Recommended name of a certified laboratory to analyze and complete monitoring report for the monitoring requirement

NOTE:

All the stake holders should agree on the proposed interventions so that the common goals could be achieved without much problem. Stakeholder consultation process is therefore an important integral step through which this goal is realized. If some stake holders are not in agreement it is necessary to change the goals so that all are in agreement. EMP will therefore propose measures that are agreeable to all parties

EMP preparation guidelines are provided in the Annex 3

6.3 Terms of Reference for the Development of Sediment Sampling and Analysis Plan for Colombo Basin

Metro Colombo Urban Development Project

1. Project Background

Metro Colombo Urban Development Project aims is to provide early and timely support to the GoSL's long-term urban development program for Metro Colombo by focusing on high-priority catalytic metropolitan investments aiming to reduce the physical and socio-economic impacts of flooding in the capital city area; and long-term capacity building for metropolitan management & local service delivery, and implementation support. The project has two main components.

Under component 1 which is focused on Flood and Drainage Management, it is expected that the project would finance both structural and non-structural activities related to flood control and drainage investments identified as a priority by the inter-agency Flood Mitigation Task Force chaired by the Sri Lanka Land Reclamation and Development Corporation (SLLRDC). It is proposed that the bulk of the structural investments will be aimed at improving the system of primary and secondary canals, lakes, retention areas of the Colombo Basin and the micro drainage system within the CMC areas. Under component 2, the project would support institutional strengthening for sustainable metropolitan and local infrastructure & service provision, and implementation support. **A detail description of the project is attached as annex 1.**

2. Implementation strategy - The proposed project will be implemented in a way that sub-projects that less complex in term of preparation will be taken up for implementation at project onset while those that require detail hydrological, analytical and feasibility studies will be taken subsequently when the sub-projects full designed technically, environmentally and socially.

3. Environmental risks – The proposed project interventions are expected to generate many positive environmental and public health impacts through improved flood/drainage management and local services in the Colombo metropolitan area. However, achieving the desired outcomes and sustaining them in the long-term would also critically depend upon how the project will address environmental risks and challenges when planning and implementing sub-projects. One of the key environmental concerns associated with the project is the disposal of dredged material, especially in lakes and low-lying areas where sediment quality could be a concern that options for disposal would need to be carefully planned. As such, this project is categorised as A under the World Bank's safeguard policies given the risks involved in disposing potentially hazardous dredge material as well as other social complications such as resettlement. The project has proposed the deepening of canals and lakes through dredging to create and increase retention capacity in a number of locations through out the basin. While there is very limited data on sediment quality, information from 1993 Beira Lake restoration project indicate the presence of heavy metals that exceed permissible levels in its bottom sediments. Given the drainage patterns, flow rates, land-use and industrial activity in the Colombo basin, especially the lower part, it is considered necessary to assess the presence of potentially toxic chemicals in canal/lake bottoms, where dredging is proposed to be carried out, which would require special disposal methods.

4. Purpose of TOR and Scope of Work- The purpose of this TOR is to design and develop a sediment sampling and analysis plan to assess the potential toxicity of canal/lake sediments in selected locations within the Colombo basin and to assess the possible environmental risks of dredging these areas.

The consultant shall submit a proposal consisting of a method statement for the development of a sediment sampling and analysis plan in order to achieve the objectives set out in section 4 above. It shall cover the following.

1. Specify the overall sampling strategy for the proposed project area that includes phasing, if any, spatially and temporally.
2. Identify sampling locations, in line with the proposed sampling strategy, within the Colombo basin with the rationale for such selection explained in terms of site history, current site use, sources of contamination, industrial processes at or near the site (and hazardous substances used/generated), location of storm/wastewater drainage, results of any previous sampling and testing, proposed dredging locations under the MCUDP etc. The locations should be marked on a map of the basin.
3. Specify sampling and analytical requirements for the selected locations in terms of sample type, number and frequency, sampling methodology, physical and chemical laboratory testing including grain-size analysis, organic/inorganic parameters to be tested, analysis methods, quality assurance requirements and other field measurements. Indicate testing laboratory and compliance of it with accreditation requirements.
4. Indicate the reference standards to be used for different sample types and any hazard level categorization for analyzed sediments.
5. Indicate a tentative time outline for the sampling, analysis, data evaluation and reporting for each phase. The first phase of the assignment should not be more than 2 months.

5. Team - The consultant shall specify the personnel involved with the assignment and their respective responsibilities, including project planning and coordination, field sampling, chemical and other testing, QA management and final report preparation.

6. Deliverable – The consultant shall deliver a full report on sediment characterization with data computed, evaluated and findings fully interpreted. The report shall also carry detail information on sampling strategy and methodology used, explained in its entirety, and recommendations on the suitability of the dredge material to be disposed on land or whether it would require special disposal methods based on hazard levels identified.

6.4 Terms of Reference for the Annual Environmental Audit

Metro Colombo Urban Development Project

1. Introduction to the project

The Metro Colombo Urban Development Project (MCUDP) is implemented to support the GoSL's long-term urban development program for Metro Colombo by focusing on (i) high-priority catalytic metropolitan investments aiming to reduce the physical and socio-economic impacts of flooding in the capital city area; and (ii) long-term capacity building for metropolitan management & local service delivery, and implementation support. The proposed project will consist of the following two main components:

Component 1: Flood and Drainage Management

This Component is financing both structural and non-structural activities related to flood control and drainage management identified as a priority by the inter-agency Flood Mitigation Task Force chaired by the SLLRDC. The investment packages under this component are essential and critical to reduce the impact of future floods in the catchment of the Colombo Basin. The bulk of the structural investments will be aimed to improve the system of primary and secondary canals, retention areas and drainage of the Colombo Water Basin. This component will also finance complementary interventions to enhance the economic value and aesthetic qualities of the water bodies.

This component includes the following four sub-components: (1.1) Primary and Secondary Canals and Lakes; (1.2) Micro-Drainage System within CMC (localized floods); (1.3) Institutional and Capacity Enhancement for Flood and Drainage Management; and (1.4) Beira Lake Development and Beddagana Bio-diversity Wetland Management Park.

Components 2: Urban Development and Infrastructure Rehabilitation for Metro Colombo Local Authorities, and Implementation Support

Component 2 aims at (a) strengthening strategic planning processes at the metropolitan level and (b) supporting local authorities in the CMA to (i) rehabilitate and manage their drainage infrastructure and streets, and (ii) improve solid waste collection. It will comprise the following Sub-components:

- **Sub-Component 2-1: Support to Metropolitan Strategic Planning (USD 2.30 million)**

This Sub-component will support improved metropolitan management and coordination by financing the following activities: (a) development of a City Development Strategy and Strategic Growth Plan for the Colombo Metropolitan Region, including a number of studies related to the revitalization of Colombo City' historical and cultural areas, and the (b) development of an Integrated Master Plan for the Colombo Metropolitan Region.

- **Sub-Component 2.2: Support to Local Authorities (USD 38.95 million)**

This Sub-component aims at enhancing the capacity of the four core Local Authorities composing the CMCC to deliver sustainable local infrastructures and services, and coordinate at metropolitan level. Activities that will be financed under this Sub-component include a combination of (a) Investment Support to Local Authorities and (b) Institutional Strengthening Support for Local Authorities.

2. The Need for Environmental Assessment

All sub-projects financed under MCUDP are required to comply with World Bank Operational and Safeguard Policies, in addition to conformity with the environmental legislation of GOSL. Thus all sub-projects are required to conform to:

- (a) the Environmental Management Framework (ESAMF) adopted by GOSL and accepted by the World Bank, and
- (b) the terms of the Central Environmental Authority (CEA) as mandated by the National Environmental Act (NEA) of Sri Lanka, where it is applicable.

According to the EMF, each sub-projects needs to be subjected to an environmental screening using the recommended template. Based on the screening information and concerns of the public the need to pursue further stand-alone assessments and if so the type of assessment is determined. All screening forms are filled by the environmental officer of the project proponent, initially with the help of a consultant, and reviewed and cleared by the PMU. For sub-projects with Category A type impacts a prior review of the screening is carried out by the World Bank. When stand alone assessments and management plans are considered necessary, the project proponent is responsible for carrying them out while the PMU reviews and clears them.

According to CEA procedures, all sub-project requiring NEA approval need to fill in a Basic Environmental Information Questionnaire (BEIQ). Upon reviewing the BEIQ, the CEA will determine whether no further environmental analysis is required or whether the proponent is required to prepare an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA).

3. Objectives

The primary objective of this assignment is for the Consultant to carry out an environmental audit for MCUDP. The consultant will review the application of the EMF to the MCUDP. In particular, the consultant will review a sample of (i) the screening forms prepared by each implementing agency (ii) stand alone environmental assessments/management plans (iii) application of the NEA and its clearance procedures followed by the project, as the case may be, and based on site visits ensure conformity with conditions, guidelines and comments stipulated in these and other related documents. The Consultant is expected to be familiar with the EMF, NEA and the approval procedure of the CEA.

4. Tasks of the Consultant

- Obtain the required information from the sub-project proponent, PIU in implementing agencies and PMU, on the sub-project financed under MCUDP. This may include, but not be limited to, relevant plans, drawings, screening reports, social analysis, stand alone EA/EMP (if it has been necessary), comments of the World Bank.
- Review the above documents, discuss with the sub-project proponent as well as the surrounding community and visit the location and environs of the sub-project.
- Check for conformity of the sub-project in relation to the guidelines, conditions and comments stipulated in the item above.
- Examine monitoring reports and whether standards, procedures and controls are in place to respond to safeguards requirements stipulated in EMF.
- Examine significant new risks and propose remedial actions
- Highlight any deviations from the guidelines, conditions and comments stipulated in the aforesaid documents and assist the sub-project proponent to improve the safeguard documents incorporating the necessary mitigatory measures.

- Document any adverse environmental impacts that were not anticipated in the screening and follow up assessments that may have occurred during project construction and implementation.
- Examine procedures of corrective action if monitoring parameters are out of monitoring limits and if such incidents are actually reported, investigated and followed up

Document and submit the environmental audit report which should include (i) an Executive Summary, (ii) Overall audit opinion on the level of compliance, (iii) for each sub-project reviewed (a) a description of the sub-project, (b) the list of documents reviewed and persons interviewed, (c) observations made at the site, (d) conformity and/or deviations to guidelines (CEA and EMF), clearance conditions (World Bank and GOSL) and plans, (e) status of progress reporting and actions taken to address issues (f) actions need to be taken to respond to negative deviations, (g) new risks and recommendations to address the risks (mitigation actions), (h) any other relevant information to support the findings.

5. Application Procedure

Qualified consulting firms may apply for the assignment listed above. Applications should be submitted using the format below:

- Title of assignment
- Name and address of the firm
- Name, designation and telephone number of contact person
- Brief company profile
- Key staff members (giving priority to assignment-specific staff; for each staff member provide name, position in the team, number of years in the firm, relevant qualifications and assignment-specific experience and proficiency in languages – read, write and speak)
- Relevant experience of the firm (Details of assignment-specific tasks undertaken during the past 10 years with client references)

Expressions of interest should focus on aspects relevant to the particular assignment, and reach the PMU by [Date].

ANNEXES

ANNEXE 1 - Format for the questionnaire to be filled for screening sub-projects

Metro Colombo Urban Development Project
Environmental Screening Report

1. Project Identification

Project title	
Project Proponent	

2. Project Location

Location <i>(relative to the nearest town, highway)</i>	
Definition of Project Area <i>(The geographical extent of the project & areas affected during construction)</i>	
Adjacent land and features	

3. Project Justification

Need for the project <i>(What problem is the project going to solve)</i>	
Purpose of the project <i>(what is going to be achieved by carrying out the project)</i>	
Alternatives considered <i>(different ways to meet the project need and achieve the</i>	

<i>project purpose)</i>	
-------------------------	--

4. Project Description

Proposed start date	
Proposed completion date	
Estimated total cost	
Present land ownership	
Description of the project (with supporting material such as maps, drawings etc attached as required)	
Project Management Team	Agency – Contact person - Nature of consultation and input received

5. Description of the existing environment

5.1 Physical features – Ecosystem components	
Topography and terrain	
Soil (<i>type and quality</i>)	
Surface water (<i>sources, distance from the site, local uses and quality</i>)	
Ground water (<i>sources, distance from the site, local uses and quality</i>)	
Flooding	
Air quality (<i>any pollution issues</i>)	
Noise level and vibration (<i>Any anticipated issues</i>)	
5.2 Ecological features – Eco-system components	
Vegetation	

<i>(trees, ground cover, aquatic vegetation)</i>	
Presence of wetlands	
Fish and fish habitats	
Birds (<i>waterfowl, migratory birds, others</i>)	
Presence of special habitat areas (<i>special designations and identified sensitive zones</i>)	
Other features	
Residential/Sensitive Areas (<i>Eg, Hospitals, Schools</i>)	
Traditional economic and cultural activities	
Archeological resources (<i>recorded or potential to exist</i>)	

6. Public Consultation

Public consulted	Consultation method	Date	Details/Issues raised

7. Environmental Effects and Mitigation Measures

7a. Screening for Potential Environmental Impacts

	Screening question	Yes	No	Significance of the effect (Low, moderate, high)	Remarks
1	Will construction and operation of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc)				
2	Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?				
3	Will the Project produce solid wastes during construction or operation?				
4	Will the Project release pollutants or any hazardous, toxic or noxious substances to air?				
5	Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?				
6	Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater or coastal waters?				
7	Will the project cause localized flooding and poor drainage during construction Is the project area located in a flooding location?				
8	Will there be any risks and vulnerabilities to public safety due to physical hazards during construction or operation of the Project?				
9	Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?				
10	Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?				
11	Are there any areas or features of high landscape or scenic value on or around the location which could be affected by the project?				
12	Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other water				

	bodies, the coastal zone, mountains, forests which could be affected by the project?				
13	Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, migration, which could be affected by the project?				
14	Is the project located in a previously undeveloped area where there will be loss of green-field land				
15	Will the project cause the removal of trees in the locality?				
16	Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?				
17	Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?				
18	Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?				
19	Are there any areas on or around the location which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project				
20	Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project?				
21	Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?				

7b. Environmental Management Plan

Key project activities	Potential Environmental Effects	Mitigation Measures

8. Conclusion and Screening Decision

Summary of environmental effects:

Assuming that all mitigation measures are implemented as proposed, the following effects can be predicted

Project Activity	Environmental impact (N/S - Effect not significant, or can be rendered insignificant with mitigation; SP - Significant positive effect SN - Significant negative effect)

Screening Decision Recommendation (check one):

Key recommendations	<ul style="list-style-type: none"> • All potentially adverse effects can be classified as general construction related impacts and are mitigatable with known technology. Public concern does not warrant further assessment. • Therefore, stand alone Environmental Assessment not required, an Environmental Management Plan would be sufficed. • Potential adverse impact are significant, hence, stand alone Environmental Assessment and Management Plan needed before the project can proceed • Potential adverse impact are significant, hence project cannot be justified • Also specific recommendations based on sub-project are welcome here.

9. Details of Persons Responsible for the Environmental Screening

Screening report completed by <i>Name/Designation/Contact information</i>	Date <i>Signature</i>
Screening report reviewed by <i>Name/Designation/Contact information</i>	Date <i>Signature</i>
Approved by <i>Name/Designation/Contact information</i>	Date <i>Signature</i>

ANNEX 2 – Summary description of safeguards instruments that will be used in the project

Environmental Management Tools

The following sections aim to provide a description of the EA tools recommended in table 3.1 which are being extensively used in environmental assessments the world over to evaluate the impacts of the project interventions extensively. Depending on the magnitude and importance of the resulting impact and the scale and extent of the spread of the impact these tools one or more is selected.

The Environment Management tools aim to anticipate the environmental impact of decisions at the early stages of planning and decision-making, with respect to selection of environmental mitigation/technologies, identification and characterization of risks to the environment, health and safety, and planning environmental programs for cities and municipalities. Since the MCUDP has been categorized as A under the World bank O.P 4.01 during the detail design stages of the stage II investments we need to carefully screen the respective sub projects with regard to the impacts created by the activities.

3.3.1. Environmental Impact Assessment (EIA)

EIA and IEE are effective tools for evaluating the environmental risks and opportunities of project proposals and improving the quality of outcomes. Ideally the EIA/IEE should be carried out at the end of the preliminary design phase so that the impacts of each planned activity can be evaluated and alternatives can be worked out for activities that have major impacts. The outcomes of the EIA/IEE should then be used to finalize the project design which should ensure that the impacts of the given project are minimal. The importance of this management tool as means of foreseeing potential environmental impacts caused by proposed projects and its use in making projects more suitable to the environment has been highly effective. Since its introduction in 1969 in the US, many countries and international organizations have accepted EIA as an important planning and environmental management tool.

As a decision making tool, EIA has its strengths and weaknesses. It plays a crucial role at the project level decision making. However, in the entire development process application of EIA as a tool to bring in environmental sustainability comes fairly at a late stage. At this point, it may be too late to change certain policy decisions and the choices are limited. With SEA, environmental decisions can be moved further upstream where better alternatives to environmentally unsustainable policies and programs can be sought at a broader strategic level. See the section below for a comparison between SEA and EIA.

3.3.2. Strategic Environment Assessment (SEA)

Development agencies have years of experience in using environmental impact assessment (EIA) to integrate environmental concerns into their funding programmes. EIA procedures, methods and techniques, used to address environmental impacts of development projects, will continue to be applied. However, EIA has limited utility when applied to the more strategic levels of development assistance such as policies, plans and programmes, as these are also influenced by political bargaining in addition to technical criteria. Further, significant indirect or secondary environmental effects can arise as a result of changes in people's behavior induced by policy reforms. But these changes, and their

environmental consequences, are extremely difficult to predict. For these reasons, SEA has been developed and is being increasingly used as a tool to be applied at the level of policies, plans and programs.

Table 3.3: Comparison between SEA and EIA

	EIA	SEA
1	Applied to specific and relatively short-term (life-cycle) projects and their specifications	Applied to policies, plans and programmes with a broad and long-term strategic perspective
2	Takes place at early stage of project planning once parameters are set	Ideally, takes place at an early stage in strategic planning
3	Considers limited range of project alternatives.	Considers a broad range of alternative scenarios
4	Usually prepared and/or funded by the project proponents	Conducted independently of any specific project proponent
5	Focus on obtaining project permission, and rarely with feedback to policy, plan or programme consideration	Focus on decision on policy, plan and programme implications for future lower-level decisions
6	Well-defined, linear process with clear beginning and end (e.g. from feasibility to project approval)	Multi-stage, iterative process with feedback loops
7	Preparation of an EIA document with prescribed format and contents is usually mandatory. This document provides a baseline reference for monitoring	May not be formally documented
8	Emphasis on mitigating environmental and social impacts of a specific project, but with identification of some project opportunities, off-sets, etc	Emphasis on meeting balanced environmental, social and economic objectives in policies, plans and programmes. Includes identifying macro-level development outcomes
9	Limited review of cumulative impacts, often limited to phases of a specific project. Does not cover regional scale developments or multiple projects	Inherently incorporates consideration of cumulative impacts

An SEA is not an alternative to EIA and it does not replace the need to do project specific environmental assessment. A good SEA can reduce the scope of EIAs within its geographical scope and make it limited to specific project level issues. The SEA ideally will identify opportunities to minimize the range of environmental issues that will have to be dealt at the project level.

At present SEA is not mandatory in Sri Lanka. However, all Ministries, Departments and Authorities who are responsible for implementing a new policy, plan or programme should carry out a SEA for the new policy, plan or programme prior to its implementation and submit a copy of the SEA report to the CEA for review and comments. To facilitate this process a document has been developed by the CEA titled "A Simple Guide to Strategic Environmental Assessment (SEA)" that can be downloaded from the CEA website.

3.3.3. Environmental Management Plan (EMP)

Certain activities will have explicit impacts on the natural environment and thus require a specific plan to institute and monitor mitigation measures and take desired actions as timely as possible. An Environmental Management Plan (EMP) must be kept as simple as possible, clearly describing adverse impacts and mitigation actions that are easy to implement. The scale of the subproject will determine the length of the EMP. A small-scale subproject's EMP can be elaborated in a few paragraphs or in tabular format, keeping it as simple as possible with concrete mitigation actions, timelines and responsible persons.

The basic elements of an EMP are;

- a. A description of all possible significant adverse impacts that are likely to arise due to the project that the EMP is intending to deal with;
- b. A description of planned mitigation measures, and how and when they will be implemented;
- c. A programme for monitoring with measurable indicators that will allow determining the effectiveness of the mitigation actions
- d. A description of who will be responsible for implementing the EMP
- e. A cost estimate and source of funds

It is essential to involve local communities during the development of the EMP since they are likely to be the most affected parties due to the proposed development. Further, most of the local knowledge is important in identifying, designing and planning the implementation. In addition, the success of the implementation of the EMP will depend on community support and action.

3.3.4. Environment Audits

Most of the development projects go through the SEA and EIA process and develop EMP's that are not implemented at the end which will render the entire process an exercise in futility. Therefore, monitoring of the project during the construction and implementation phase is a must to ensure environmental compliance of a project. This could be achieved through regular environmental audits.

The purpose of the environmental audit is to;

- Collect, analyze and interpret monitoring results to detect changes related to implementation and operation of specific activities
- To verify the monitoring parameters are in compliance with national set standards
- To compare the predicted impacts with actual impacts and evaluate the accuracy of predictions
- To evaluate the effectiveness of implementation of the EMP
- To identify shortcomings in the EMP if any and incorporate it into the EMP if deemed necessary
- To identify and report if there is noncompliance with the EMP
- The auditors must first develop a structured questionnaire based on the EMP for the purpose of conducting the audit. Then during the site visit data can be collected using this questionnaire through interview surveys of officers responsible for implementation of the EMP and site records, logs etc., The audits can be carried out at regular intervals or on an ad hoc basis or when mitigation is not carried out as defined by the EMP leading to public concern.
- Expected outcomes of the Environment Audit are
- Ensure that EMP is implemented properly
- Ensure that the mitigation measures are effectively minimizing the identified impacts as well as identify new impacts that may have been excluded in the EMP that require mitigation. Then

make necessary adaptive changes to the EMP to ensure that all significant impacts are effectively mitigated.

- Identify non compliance with EMP if any and provide recommendations as to how to deal with such non compliance

3.3.5. Environmental Checklists

Environmental Checklists are forms containing a series of questions on environmental aspects, designed to screen potential environmental impacts of the proposed project. Environmental checklists can be used for an initial screening of impacts which is to be followed by a more detail analysis or in projects where the level of activity (as in the example of constructing a small to medium scale building in an already built up area) is not meant to cause much harm a checklist only would suffice.

3.3.6. Environmental Codes and Best Management Practices

In addition to the above tools following environmental codes and best practices may be sufficient where impacts of a particular activity are minor and easily arrested.

In annex 2, the basic information questionnaire for CEA environmental checklists for sub projects and guidelines for developing EMPs are included.

ANNEX 3- Guidelines for preparation of Environmental Management Plans

Having identified the potential impacts of the relevant sub-component, the next step of the EA process involves the identification and development of measures aimed at eliminating, offsetting and/or reducing impacts to levels that are environmentally acceptable during implementation and operation of the project (EMP). EMPs provide an essential link between the impacts predicted and mitigation measures specified within the EA and implementation and operation activities. World Bank guidelines state that detailed EMP's are essential elements for Category A projects, but for many Category B projects, a simple EMP alone will suffice. While there are no standard formats for EMPs, it is recognized that the format needs to fit the circumstances in which the EMP is being developed and the requirements, which it is, designed to meet. EMPs should be prepared after taking into account comments from both the PAA and IDA as well as any clearance conditions. Annex C of OP 4.01 of the World Bank safeguards outlines the important elements of the EMP and guides its preparation. Given below are the important elements that constitute an EMP.

a. Identification of impacts and description of mitigation measures

Firstly, Impacts arising out of the project activities need to be clearly identified. Secondly, feasible and cost effective measures to minimise impacts to acceptable levels should be specified with reference to each impact identified. Further, it should provide details on the conditions under which the mitigatory measure should be implemented (ex; routine or in the event of contingencies) The EMP also should distinguish between type of solution proposed (structural & non structural) and the phase in which it should become operable (design, construction and/or operational).

b. Enhancement plans

Positive impacts or opportunities arising out of the project need to be identified during the EA process. Some of these opportunities can be further developed to draw environmental and social benefits to the local area. The EMP should identify such opportunities and develop a plan to systematically harness any such benefit.

c. Monitoring programme

In order to ensure that the proposed mitigatory measures have the intended results and complies with national standards and donor requirements, an environmental performance monitoring programme should be included in the EMP. The monitoring programme should give details of the following;

- Monitoring indicators to be measured for evaluating the performance of each mitigatory measure (for example national standards, engineering structures, extent of area replanted, etc).
- Monitoring mechanisms and methodologies
- Monitoring frequency
- Monitoring locations

d. Institutional arrangements

Institutions/parties responsible for implementing mitigatory measures and for monitoring their performance should be clearly identified. Where necessary, mechanisms for institutional co-ordination should be identified as often monitoring tends to involve more than one institution.

e. Implementing schedules

Timing, frequency and duration of mitigation measures with links to overall implementation schedule of the project should be specified.

f. Reporting procedures

Feedback mechanisms to inform the relevant parties on the progress and effectiveness of the mitigatory measures and monitoring itself should be specified. Guidelines on the type of information wanted and the presentation of feedback information should also be highlighted.

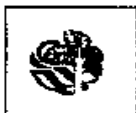
g. Cost estimates and sources of funds

Implementation of mitigatory measures mentioned in the EMP will involve an initial investment cost as well as recurrent costs. The EMP should include costs estimates for each measure and also identify sources of funding.

h. Contract clauses

This is an important section of the EMP that would ensure recommendations carried in the EMP will be translated into action on the ground. Contract documents will need to be incorporated with clauses directly linked to the implementation of mitigatory measures. Mechanisms such as linking the payment schedules to implementation of the said clauses could be explored and implemented, as appropriate.

ANNEX 4: Basic questionnaire to be filled in for CEA approval for sub-projects



APPLICATION NO

CENTRAL ENVIRONMENTAL AUTHORITY

BASIC INFORMATION QUESTIONNAIRE

(Essential information to determine the environmental approval requirement of projects)

- 1 Name of the Project:
- 2 Name of the Developer:
(Company/firm/individual).....
Postal Address:.....
Phone No: Fax No:
- Contact person
Name
Designation:
Phone No: Fax No:
- 3 Brief description of the project (Use a separate sheet)
Attach copy (ies) of pre-feasibility / feasibility study report (s) if available
- 4 Scale / magnitude of the project:
(eg. For a road project: Length of the trace; Tourist hotel: No. of rooms; Agriculture project: Extent of land etc.)
- 5 Main objective(s) of the project:
- 6 Investment and Funding sources:
- 7 Location of the Project
 - i Pradeshiya Sabha:
 - ii Divisional Secretariat:.....
 - iii District
 - iv Provincial Council

Provide a location map indicating the project site, access to the site, surrounding development and infrastructure within 500 m of the site (1:50000 scale).

8 Extent of the project area (in ha):

9 Does the project wholly or partly fall within any of the following areas?

Area	Yes	No	Unaware
100m from the boundaries of or within any area declared under the National Heritage Wilderness Act No 4 of 1988			
100m from the boundaries of or within any area declared under the Forest Ordinance (Chapter 451)			
Coastal zone as defined in the Coast Conservation Act No 57 of 1981			
Any erodible area declared under the Soil Conservation Act (Chapter 450)			
Any Flood Area declared under the Flood Protection Ordinance (Chapter 449)			
Any flood protection area declared under the Sri Lanka Land Reclamation and Development Corporation Act 15 of 1968 as amended by Act No 52 of 1982			
60 meters from the bank of a public stream as defined in the Crown Lands Ordinance (Chapter 454) and having width of more than 25 meters at any point of its course			
Any reservations beyond the full supply level of a reservoir			
Any archaeological reserve, ancient or protected monument as defined or declared under the Antiquities Ordinance (Chapter 188).			
Any area declared under the Botanic Gardens Ordinance (Chapter 446).			
Within 100 meters from the boundaries of, or within, any area declared as a Sanctuary under the Fauna and Flora Protection Ordinance (Chapter 469)			
100 meters from the high flood level contour of or within, a public lake as defined in the Crown Lands Ordinance (Chapter 454) including those declared under section 71 of the said Ordinance			
<i>Within a distance of one mile of the boundary of a National Reserve declared under the Fauna and Flora Protection Ordinance</i>			

10 Present ownership of the project site:

State	Private	Other-specify

If state owned, please submit a letter of consent of the release of land from the relevant state agency

11 Present land use :

12 Present land use : (Please tick the relevant cage/s)

Land use Type	Land use Type
Paddy	Marsh / Mangrove
Tea	Scrub / Forest
Rubber	Grassland / Chena
Coconut	Built-up area
Other Plantations / Garden	Other (pl. specify)

13 Does the site /project require any

	Yes	No	If yes give the extent (in ha)
Reclamation of land, wetlands			
Clearing of forest			
Felling of trees			

14 Does the project envisage any resettlement

Yes	No	If yes, give the number of families to be resettled

15 Does the project envisage laying of pipelines

Yes	No	If yes, give the length of the pipeline (km)

16 Does the project involve any tunneling activities

Yes	No

17 Proposed timing and schedule including phased development:

18 Applicable laws, regulations, standards and requirements covering the proposed project:

19 Clearances / permits obtained or should be obtained from relevant state agencies and / or local authorities. (Attach required copies of the same)

The above information is accurate and true to the best of my knowledge. I am aware that this information will be utilized in decision-making by the relevant state authorities.

Date

Signature of Applicant

FOR OFFICE USE ONLY

1. Date of receipt of the application :
2. A site inspection done,
If yes,
Date of the inspection:
Name(s) of the officer(s):
Inspection fee
Amount: Rs..... Date of payment:.....
Receipt No:
Special comments regarding significant environmental concerns (Based on site inspection):
3. Require approval under part IVC of NEA?
(ie. Need to go through the EIA / IEE process)

Yes	No

4. If need to go through the EIA process appropriate PAA:
.....
5. Other Remarks :

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CENTRAL ENVIRONMENTAL AUTHORITY
QUESTIONNAIRE ON
ENVIRONMENTAL IMPACT IDENTIFICATION

Sector:

No:

Category:

Date of Receipt:

1. **Name of Industry:**
2. **Type of Industry:**
3. **Location:**
(Location map and a clear route sketch with land marks to the proposed site to be annexed).
4.
 - i. **Name of Local Authority:**
 - ii. **AGA's Division:**
5. **Is the site within an approved industrial zone?**
6. **Name and address of applicant:**

Tel. No.:

7. **Contact official/s for questionnaire —**
Names and Designations:

Address:

9. **Factory Layout Plan — (Layout Plan to be annexed):**
9. **Amount of capital investment — Local
Foreign**
10. **Date of commencement of operation:
Any phased programs (Details):**
11. **Number of shifts per day and times:**
12. **Number of workers in each shift:**
13. **i. Area of the land to be developed: Acres / Hectares
ii. Ownership — Private land/Crown land**
14. **Extent of buffer zone that can be provided around the operation:(Metr**
15. **Present use of land:**
16. **Land use of the area within 5 km. radius:**
17. **List of existing industries/institutions/agricultural land within 2 km radius:**
18. **List of main manufactured products and capacities:**
19. **List of by-products:**
20. **Processes used — brief description:
(Attach process flow diagram)**

21. All raw-materials used:
(State itemwise quantity/day at design capacity)
22. Water — Total water requirements:
State requirements/consumption for
- a. Domestic :
 - b. Cooling :
 - c. Process :
 - d. Any other use:
23. Source of water (Delete whichever is inapplicable)
- a. Public supply
 - b. Ground water (Wells, Springs)
 - c. Surface water (Stream, River etc.)
24. Quality of waste water
25. Proposed method of discharge of waste water: Open channel/Pipeline/Covered drains/
Other (specify): (Delete whichever is inapplicable)
26. Final point/s of discharge of waste water:
27. Proposed method/s of treatment of waste water:
28. Type and quantity of solid wastes generated daily:

{ }

29. Proposed method/s of disposal of solid wastes:

30. Total energy consumption:

a In plant generation (kw)

b Public supply (kw)

31. Details of machinery to be used in the industry and their horse power ratings:

Type

HP Rating

No. of Units

32. Details of fuels used:

a Type

b Purposes

c Daily consumption

33. Number of stacks/chimneys and their heights:

34. Possible emissions:

a Oxides of nitrogen: Yes/No (Delete whichever is inapplicable)

b Oxides of sulphur : Yes/No

c Dust and soot : Yes/No

d Any other (Specify)

(4)

- 85. Possible sources of noise:

- 86. Methods proposed to minimise excessive noise:

- 87. Possible salvage of any waste material for use — specify:

- 88. Describe your plans for future expansion of your industry at the proposed location. State whether the expansion alters the type, nature and manufacturing process of the industry. Also state the proposed time span.

I hereby certify that the particulars furnished by me in this application are true and correct. I am aware that if any particulars herein are found to be false or incorrect, my application will be refused and the licence, if issued, will be cancelled. Further, I am also aware that one month prior to the commencement of operations of the proposed industry/ activity, the Central Environmental Authority shall be so informed through the relevant Local Authority and that I shall not commence the said operations without obtaining an Environmental Protection Licence from the Central Environmental Authority or the relevant Local Authority.

Name :

Designation:

Signature :

Date :

ANNEX 5 - Development of Sediment and Water Sampling and Analysis Plan for Colombo Basin, Metro Colombo Urban Development Project

1. Introduction

Metro Colombo Urban Development Project aims is to provide early and timely support to the GoSL's long-term urban development program for Metro Colombo by focusing on high-priority catalytic metropolitan investments aiming to reduce the physical and socio-economic impacts of flooding in the capital city area; and long-term capacity building for metropolitan management & local service delivery, and implementation support.

The proposed project interventions are expected to generate many positive environmental and public health impacts through improved flood/drainage management and local services in the Colombo metropolitan area. However, achieving the desired outcomes and sustaining them in the long-term would also critically depend upon how the project will address environmental risks and challenges when planning and implementing sub-projects. One of the key environmental concerns associated with the project is the disposal of dredged material, especially in lakes and low-lying areas where sediment toxicity is believed to be potentially high.

The project has proposed the deepening of canals and lakes through dredging to create and increase retention capacity in a number of locations throughout the basin. While there is very limited data on sediment quality, information from Beira Lake restoration project that was carried out in 1993 indicates the presence of heavy metals that exceed permissible levels in its bottom sediments. Given the drainage patterns, flow rates, land-use and industrial activity in the Colombo basin, especially the lower part, it is considered necessary to assess the presence of potentially toxic chemicals in canal/lake bottoms, where dredging is proposed to be carried out, which would require special disposal methods. Therefore, main objective of this assignment is depicted as follows.

2. Objectives

The main objective of this project is to design and develop a sediment sampling and analysis plan to assess the potential toxicity of canal/lake sediments in selected locations within the Colombo basin and to assess the possible environmental risks of dredging these areas.

3 Methodology

3.1 Sampling Strategy

Sampling will be carried out during wet and dry season at the selected locations.

3.2 Sampling Locations

Sampling locations will be selected depending on the degree of pollution at the preliminary visit and available primary data (site history, current site use, sources of contamination, industrial processes at or near the site, location of storm/wastewater drainage, results of any previous sampling and testing etc.). Then, exact locations will be re-selected using GPS coordination and marked on a map of the basin.

3.3 Sampling Criteria

Grab samples will be collected at the surface and bottom of water column for water quality analysis. Sediment samples will be collected at bottom using core samplers. Sampling will be done on 3 consecutive days at 8.00 a.m - 12.00 noon.

3.4 Sampling, Preservation and Analysis of Sediment

Sampling, preservation and analysis of sediments will be carried out in accordance with British Standard Methods of testing for Soil for Civil Engineering purposes. Table 1 gives the methodologies used for physical and chemical analysis of sediment. Leachability test for sediment samples will be carried out in accordance with EPA methods for sediments.

Table 1: Methodology of analysis of physical and chemical parameters for sediment

Parameter	Type of measurement	Method	Remarks
Particle size distribution	At the laboratory	ASTM D-422-63	It is useful to understand the physical and chemical properties of sediments.
pH	Chemical methods at the laboratory	BS 1377: 1990: Part 3 - Methods of Test for Soils for Civil Engineering Purposes: Chemical and Electro-Chemical Tests	An indication of alkalinity or acidity of the sediment.
Sulphate content	Chemical methods at the laboratory	BS 1377: 1990: Part 3 - Methods of Test for Soils for Civil Engineering Purposes: Chemical and Electro-Chemical Tests)	An indication of inorganic pollution of sediments.
Chloride content	Chemical methods at the laboratory	BS 1377: 1990: Part 3 - Methods of Test for Soils for Civil Engineering Purposes: Chemical and Electro-Chemical Tests	An indication of inorganic pollution of sediments.
Total organic carbon	Chemical methods at the laboratory	Walkley-Black Method	An indication of organic pollution of sediments.
Heavy metals	Chemical methods	ASTM Standard Practice for	An indication of heavy metal

	at the laboratory	Nitric Acid Digestion	pollution of sediments.
Leachability test	Chemical methods at the laboratory	Toxicity Characteristic Leaching Procedure (EPA TCLP)	An indication of leaching out of substances which adhere to the sediments.

3.5 Sampling, Preservation and Analysis of Water

Sampling, preservation and analysis of water will be carried out in accordance with the Standards Methods for Testing Water and Wastewater, 21st edition, published by American Public Health Association (2005).

Table 2: Methodology of analysis of physical, chemical and microbiological parameters water

Parameter	Type of measurement	Method	Remarks
Temperature	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	Physical condition of water may affect the properties of water and provides hints of possible contamination/pollution of water.
pH	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	
Color	At the laboratory	UV/Visible Spectrophotometric method	
Turbidity	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	
Salinity	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	
Electrical conductivity	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	
Total Dissolve Solids	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	
Total Suspended Solids	Chemical methods at the laboratory	APHA (2005) - 2540 D. Total Suspended Solids Dried at 103-105 °C	

Dissolve Oxygen	<i>In situ</i>	Portable Water Quality Meter (WQC 24, DKK-TOA)	
BOD ₅	Chemical methods at the laboratory	APHA (2005) - 5210 B. 5-Day BOD Test	An indication of organic pollution
COD	Preserved and sent to laboratory for chemical analysis	APHA (2005) - 5220 C. Closed Reflux, Titrimetric Method	An indication of inorganic pollution
Oil and Grease	Preserved and sent to laboratory for chemical analysis	APHA (2005) - 5520 B. Liquid-Liquid, Partition-Gravimetric Method	Chemical pollution of water
Total Coliforms	Preserved and sent to laboratory for chemical analysis	APHA (2005) – 9221B. Multiple-tube Fermentation Technique for Members of the Coliform Group	An indication of fecal contamination.
Faecal Coliforms	Preserved and sent to laboratory for chemical analysis	APHA (2005) – 9221B. Multiple-tube Fermentation Technique for Members of the Coliform Group	

3.6 Quality Assurance and Control

Major aspects of chain of custody (COC)

1. Labeling of Samples
(Sample No., Name of collector, Date, Time of collection, Place of collection, Sample preservations should be pointed out)
2. Sealing samples
3. Maintaining the field log book
4. Recording the chain of custody
(Sample No; signature of collector; date, time and address of collection; sample type; signatures of persons involved in chain of possession; inclusive dates of possession.)
5. Filling the sample analysis request sheet
6. Sample delivery to the laboratory
7. Receipt and logging of sample
8. Assignment of sample for analysis

Quality Assurance

Set of operating principles that, strictly followed during sample collection and analysis, will produce data of known and defensible quality. The accuracy of the analytical result can be stated with a high level of confidence.

Quality Control

Set of measures within a sample analysis methodology to assure that the process is in control. Quality control program consist of,

1. Certification of operator competence
2. Known additions are recovered as part of a regular analytical protocol and known additions are used to verify the absence of matrix effects.
3. Externally supplied standards are analyzed as part of a regular analytical protocol.
4. Reagent blanks are analyzed whenever new reagents are used and as often as required in specific methods.
5. Calibrations are done with minimum four different dilutions of the standards.
6. Duplicated analysis is done during sample analysis.

3.7 Testing Laboratory and Compliance of Accreditation

Environmental Engineering Laboratory, Department of Civil Engineering, University of Moratuwa is registered as a Laboratory for Environmental Monitoring and Analysis at the Central Environmental Authority of Sri Lanka: Registered No: 07/LM/LAB/18/2008.

3.8 Reference Standards

- For water sample analysis CEA standards will be used and for sediment samples
- ASTM D3976 - 92(2010) Standard Practice for Preparation of Sediment Samples for Chemical Analysis
- Central Environmental Authority. 2001. Proposed Ambient Water quality Standards for Inland Waters of Sri Lanka. Colombo, Sri Lanka.
- EPA guild lines will be used for sediment dredging.

4 Time outline

The first phase (sampling, analysis, data evaluation and reporting) of the assignment will be completed not more than 2 months. Please note that sampling can be done for wet season only.

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