

**JAPAN INTERNATIONAL COOPERATION AGENCY**

**MINISTRY OF HOUSING & PLANTATION INFRASTRUCTURE  
SRI LANKA LAND RECLAMATION & DEVELOPMENT CORPORATION**

**THE STUDY  
ON  
STORM WATER DRAINAGE PLAN  
FOR THE COLOMBO METROPOLITAN REGION  
IN  
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

**FINAL REPORT  
VOLUME I : EXECUTIVE SUMMARY**

**MARCH 2003**

**NIPPON KOEI CO., LTD.**

## **LIST OF VOLUMES**

- VOLUME I : EXECUTIVE SUMMARY**
- VOLUME II : MAIN REPORT**
- VOLUME III : SUPPORTING REPORT (1)**
- VOLUME IV : SUPPORTING REPORT (2)**
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**Exchange Rate Applied**

**US\$1.00 = Sri Lanka Rupee 96.26**

**= ¥ 118.94**

**(as of August 2002)**

## PREFACE

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a master plan and feasibility study on Storm Water Drainage Plan for the Colombo Metropolitan Region and entrusted the study to the Japan International Cooperation Agency (JICA).

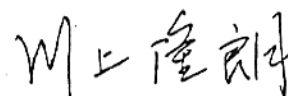
JICA selected and dispatched a study team headed by Mr. Hirofumi SADAMURA of NIPPON KOEI CO., LTD. to Sri Lanka three times between September 2001 and December 2002. In addition, JICA set up an advisory committee headed by Mr. Hideomi OI, Senior Advisor, Institute for International Cooperation, JICA between September 2001 and March 2003, which examined the study from specialist and technical point of view.

The team held discussions with the officials concerned of the Government of Sri Lanka and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Sri Lanka for their close cooperation extended to the team.

March 2003



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Takao KAWAKAMI

President

Japan International Cooperation Agency

March 2003

Mr. Takao Kawakami  
President  
Japan International Cooperation Agency  
Tokyo, Japan

### Letter of Transmittal

Dear Sir,

We are pleased to submit the final report entitled "The Study on Storm Water Drainage Plan in the Colombo Metropolitan Region in the Socialist Democratic Republic of Sri Lanka". This report compiles the results of the Study in accordance with the contracts signed on September 10, 2001 and June 14, 2002 between Japan International Cooperation Agency and Nippon Koei Co., Ltd.

In the Study we present the Master Plan and Feasibility Study based on analyses of the existing conditions and problems on storm water drainage in the Colombo Metropolitan Region. The report consists of Executive Summary, Main Report, Supporting Report (1) and (2), and Data Book.

We wish to express our sincere appreciation to the personnel concerned of your Agency, Advisory Committee, and Embassy of Japan in Sri Lanka, and also to the officials concerned of the Government of Sri Lanka, Western Provincial Council, and Local Authorities in the Western Province for their cooperation extended to our team. We sincerely hopes that the results of the Study will be helpful for realization of the proposed projects for improvement of storm water drainage and will contribute to the promotion of socio-economic development in the Colombo Metropolitan Region.

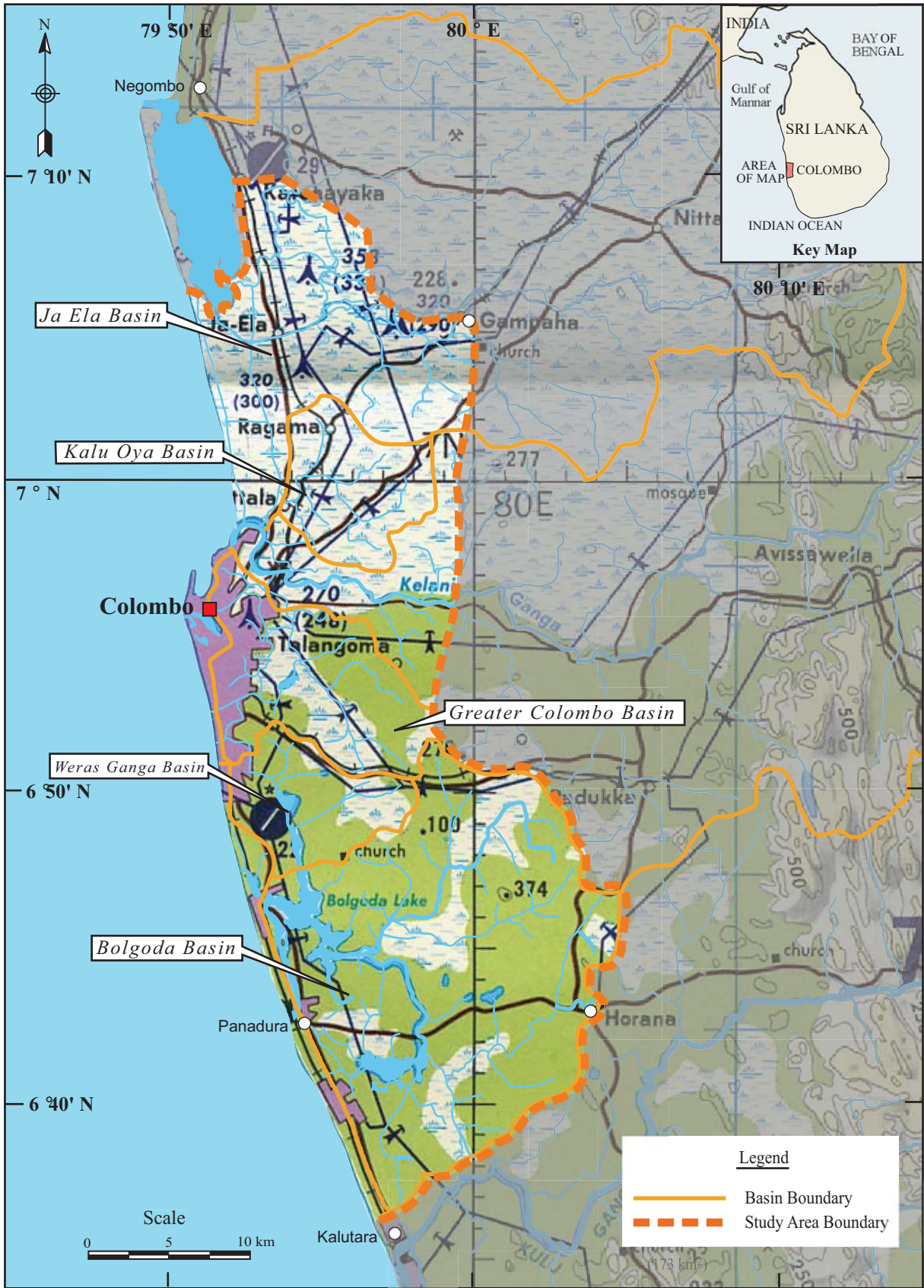
Yours Faithfully,

定村 寛文

Hirofumi Sadamura

Team Leader

The Study on Storm Water Drainage Plan  
for the Colombo Metropolitan Region  
in the Socialist Democratic Republic  
of Sri Lanka



The Study on Storm Water Drainage Plan  
for the Colombo Metropolitan Region  
in the Democratic Socialist Republic of Sri Lanka  
JAPAN INTERNATIONAL COOPERATION AGENCY

Location Map

**THE STUDY  
ON  
STORM WATER DRAINAGE PLAN  
FOR THE COLOMBO METROPOLITAN REGION  
IN  
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

**OUTLINE OF THE STUDY**

**1. Objectives of the Study and Study Area**

The objectives of the Study are:

- 1) To formulate a master plan for storm water drainage in the Colombo Metropolitan Region,
- 2) To conduct a feasibility study on priority projects identified in the master plan, and
- 3) To carry out technology transfer to counterpart personnel in the course of the Study.

The area for the master plan study, which is a part of the Colombo Metropolitan Region, is shown in Location Map. The study area is roughly divided into four drainage basins of Ja Ela basin, Kalu Oya basin, Greater Colombo basin and Bolgoda basin. The total catchment area comes to 830 km<sup>2</sup>.

**2. Master Plan**

The proposed storm water drainage master plan consists of the following components.

- 1) Structural measures for each basin,
- 2) Non-structural measures,
- 3) Institutional development plan,
- 4) Operation and maintenance plan, and
- 5) Human resources development plan.

Each component is outlined as follows:

**2.1 Structural Measures**

- (1) Ja Ela Basin Storm Water Drainage Plan
  - a) Ja Ela Channel Improvement (length 7 km, width 60 m)
  - b) Dandungam Oya Channel Improvement (length 9.9 km, width 70-80 m)
  - c) Storm Water Retention Area (lower area 500 ha, upper area 376 ha)
- (2) Kalu Oya Basin Storm Water Drainage Plan
  - a) Kalu Oya Channel Improvement (length 5 km, width 25-50 m,)

- b) Old Negombo Canal Improvement (length 4.5 km, width 40 m)
- d) Storm Water Retention Area (lower area 360 ha, upper area 89 ha)
- (3) Greater Colombo Basin Storm Water Drainage Plan
  - a) Madiwela South Diversion Canal (length 8.8 km, width 32 m)
  - b) Existing Mutwal Tunnel Restoration (length 554 m, diameter 1.8 m)
  - c) New Mutwal Tunnel (length 740 m, diameter 4 m)
  - d) Storm Water Retention Area (Kolonnawa Marsh, Kotte Marsh, Heen Marsh and Parliament Lake Area 380 ha in total)
- (4) Bolgoda Basin Storm Water Drainage Plan
  - a) Weras Ganga Scheme (length 5.5 km)
  - b) Nugegoda-Rattanapitiya Scheme (length 5.47 km)
  - c) Bolgoda Canal Scheme (length 2.4 km)
  - d) Boralesgamuwa North Scheme (length 3.09 km)
  - e) Boralesgamuwa South Scheme (length 0.98 km)
  - f) Maha Ela Scheme (length 4.46 km)
  - g) Ratmalana-Moratuwa Scheme (length 11.12 km)
  - h) Storm Water Retention Area (retention area in Weras Ganga basin 295 ha, lowlands surrounding North and South Bolgoda Lakes 4,739 ha)

## **2.2 Non-structural Measures**

- (1) Storm water retention area management
  - a) Legal designation of storm water retention areas
  - b) Regulation of land use in storm water retention areas
  - c) Strict legal action for illegal activities
- (2) Development control in urban development areas
- (3) Land use regulation in lowland areas
- (4) Dissemination of flood information to the public
- (5) Flood-proofing of buildings in flood-prone areas
- (6) Flood fighting

## **2.3 Institutional Development Plan**

- (1) Demarcation of responsibilities within the storm water drainage sector among related agencies (SLLRDC, Local Authorities, Irrigation Department and Road Development Authority)

- (2) Lowland management by SLLRDC
  - a) Empowerment of the SLLRDC as the sole agency for the management of lowland storm water drainage works
  - b) Formulation of authorized land use plans for land use regulation
  - c) Combined activities with local authorities for illegal activities
  - d) Achievement of social understanding on the lowland management

## **2.4 Operation and Maintenance Plan**

- (1) Demarcation of O&M works among SLLRDC and local authorities
  - a) SLLRDC: responsible for declared areas
  - b) Local authorities: responsible for their administrative areas
- (2) Organization strengthening of SLLRDC
  - a) Set-up of a new section for O&M of storm water drainage systems in built up areas
  - b) Set-up of a new section for provision of technical guidance and staff training to the local authorities except CMC.
- (3) Organization set-up of local authorities
  - a) CMC: Improvement of the quality of the O&M works
  - b) Other local authorities: Establishment of the organizations to exclusively undertake storm water drainage works

## **2.5 Human Resources Development Plan**

- (1) Short-term objectives
  - a) Enhancement of the capability of SLLRDC staff for the O&M activities
  - b) Execution of the on-the-job trainings and lectures for the staff of local authorities under the leadership of SLLRDC
- (2) Long-term objectives
  - a) Development of human resources specialized in the storm water drainage sector
  - b) Execution of overall training program consisting of four categories of managerial and administrative, technological and technical, social development and O&M



## 2.6 Project Evaluation

### (1) Project Costs and Economic Evaluation

Project	Project Cost (million Rs.)	Annual Benefit (million Rs.)	B/C	EIRR (%)
Ja Ela Basin Storm Water Drainage Project	3,679	388	1.34	12.9
Kalu Oya Basin Storm Water Drainage Project	2,463	422	1.94	19.5
Greater Colombo Basin Storm Water Drainage Project	4,389	886	2.23	19.8
Bolgoda Basin Storm Water Drainage Project	5,102	1,022	2.22	19.2

All the proposed storm water drainage projects are economically viable.

### (2) Technical evaluation

No technical constraints, which could hamper the implementation of the proposed storm water drainage projects, are expected.

### (3) Environmental evaluation

No environmental issues, which could hamper the implementation of the proposed storm water drainage projects, are expected, but wastewater treatment and control of solid waste dumping into drainage channels should be executed in parallel with storm water drainage projects from the environmental viewpoint.

### (4) Social evaluation

The proposed projects are inevitably accompanied with land acquisition and resettlement (about 3,500 households), however no critical location in the proposed project areas has been identified so far in ethnic, religious, cultural and historical aspects in connection with land acquisition and resettlement activities.

### (5) Overall evaluation

It is concluded that the storm water drainage plans proposed for the four objective basins of Ja Ela, Kalu Oya, Greater Colombo and Bolgoda basins are economically, technically, environmentally and socially viable for the planning scale of a 50-year return period. Also, it should be noted that implementation of the proposed storm water drainage projects will contribute to poverty reduction through reduction of flood damage, development of the study area, improvement of living conditions of the low-income group, etc.

## 3. Feasibility Study

### 3.1 Priority Project

Based on the master plan study, the storm water drainage project for the Weras Ganga basin, a sub-catchment of the Bolgoda basin, was selected as a priority project for the feasibility study.

### 3.2 Structure Measures

The structural measures for the proposed Weras Ganga Storm Water Drainage Project are summarized as follows:

- (1) Weras Ganga Scheme
  - a) Weras Ganga Dredging: length 5,500 m, width 19-40 m
  - b) Flood Protection Dike on Right Bank: length 2,300 m, height 1 m
  - c) Sluiceways: Kandawala 2.0 m × 1.9 m × 2 nos., Telewala North 2.5 m × 1.9 m × 2 nos., Telewala South 2.5 m × 1.9 m × 2 nos.
  - d) Weras Ganga Swamp Retention Area: 65 ha
  - e) Maha Ela Marsh and Lowland Retention Area: 106 ha
- (2) Nugegoda-Rattanapitiya Scheme
  - a) Channel Improvement of Nugegoda-Ela: length 1,580 m, width 5-13 m
  - b) Channel Improvement of Delkanda Ela: length 1,760 m, width 3-13.5 m
  - c) Channel Improvement of Rattanapitiya Ela: length 2,130 m, width 19 m
  - d) Nugegoda-Rattanapitiya Retention Areas: total extent 36 ha
- (3) Bolgoda Canal Scheme
  - a) Channel Improvement of Bolgoda Canal: length 2,400 m, width 15-19 m
  - b) Bellanwila-Attidiya Marsh Retention Area: 88 ha
- (4) Ratmalana-Moratuwa Scheme
  - a) Improvement of trunk drainage channels (open channels) connected to Weras Ganga: length 3,580 m, width 1-6 m
  - b) Improvement of secondary drainage channels (concrete channels) connected to the trunk drainage channels: length 6,390 m, width 0.8-2.0 m
  - c) Drainage channel along flood protection dike: length 1,150 m, width 1-1.5 m
  - d) Kandawala Retention Pond: area 3 ha, volume 48,000 m<sup>3</sup>
  - e) Telewala Retention Pond: area 10 ha, volume 160,000 m<sup>3</sup>

### 3.3 Non-structural Measures

- (1) Storm water retention area management
  - a) Legal designation of storm water retention areas
  - b) Regulation of land use in storm water retention areas
  - c) Strict legal action for illegal activities
- (2) Development control in urban development areas
- (3) Land use regulations in lowland areas
- (4) Dissemination of flood information to the public
- (5) Flood-proofing of buildings in flood-prone areas

### 3.4 Operation and Maintenance Plan

- (1) Demarcation of O&M works
  - a) SLLRDC: responsible for main drainage channels
  - b) Dehiwela - Mount Lavinia MC and Moratuwa MC: responsible for urban drainage channels in their administrative areas
  - c) Other local authorities: periodical inspection for drainage channels in their administrative areas (The O&M works are to be executed by SLLRDC.)
- (2) Operation and maintenance plan
  - a) Strengthening of staffing for the Attidiya Regional Office and Kirimandara Mawatha Regional Office for the O&M works and training
  - b) Establishment of a separate section in Dehiwela - Mount. Lavinia MC and Moratuwa MC to undertake the O&M related activities, while the existing organizational structures in Kotte MC and Kesbewa PS may be kept for periodical inspection of the drainage facilities
  - c) Procurement of the equipment required for the O&M works and stock control of the spare parts and tools to meet the demand at any time.
  - d) Execution of training programs for the staff of SLLRDC and local authorities in charge of O&M works

### 3.5 Project Evaluation

#### (1) Project cost

Cost Item	Amount (million Rs.)
1) Construction cost	1,907
2) Land acquisition and compensation cost	841
3) Procurement of O&M equipment	113
3) Engineering services cost	381
4) Administration cost	63
5) Price escalation	88
6) Physical contingency	303
7) Tax	693
Total	4,389

#### (2) Economic evaluation

Project Cost	Annual Flood Reduction Benefit	Annual Land Enhancement Benefit	B-C (million Rs.)	B/C	EIRR (%)
4,389	147	875	3,043	2.09	18.8

The proposed project is economically feasible.

#### (3) Technical evaluation

No technical constraints, which could hamper the implementation of the proposed storm water drainage projects, are expected.

(4) Environmental evaluation

No environmental issues, which could hamper the implementation of the proposed storm water drainage projects, are expected. The policy to conserve the Bellanwila-Attidiya wildlife sanctuary should be discussed among the relevant government agencies and stakeholders and made clear as early as possible.

(5) Social evaluation

The number of households to be resettled for the Project is 158 in total. No critical factor, which hampers the resettlement, has been identified as long as the compensation and necessary assistance on the resettlement are properly made under the National Involuntary Resettlement Policy.

(6) Overall evaluation

It is concluded that there is sufficient need for the proposed Weras Ganga Basin Storm Water Drainage Project to justify its implementation and that it is economically, technically, environmentally and socially viable. The proposed project primarily aims at reducing the flood damages in the Weras Ganga basin, but it will produce various tangible and intangible benefits. Also, the proposed project will improve the people's living conditions and consequently contribute to poverty reduction.

### 3.6 Project Implementation Plan

(1) Executing Agency

SLLRDC (Sri Lanka Land Reclamation & Development Corporation)

(2) Implementation Period

- a) Overall implementation period: 6 years
- b) Detailed design stage: 22 months
- c) Pre-construction stage: 12 months
- d) Construction stage: 38 months

(3) Financial Arrangements

- a) Loan from international funding agency: Rs. 2,792 million
- b) Sri Lanka Government's own funds: Rs. 1,597 million

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**FINAL REPORT**

**VOLUME I : EXECUTIVE SUMMARY**

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## ABBREVIATIONS

ADB	Asian Development Bank
ADD	Agrarian Development Department
BOD	Biochemical Oxygen Demand
CAP	Community Action Plan
CBO	Community Based Organization
CCD	Coastal Conservation Department
CDC	Community Development Council
CD&M	Canal Development and Maintenance Division
CEA	Central Environment Authority
CEB	Ceylon Electricity Board
CEPOM	Committee on Environmental Policy and Management
CHPB	Center for Housing Planning and Building
CKE	Colombo-Katunayake Expressway
CMC	Colombo Municipal Council
CMR	Colombo Metropolitan Region
CMRSP	Colombo Metropolitan Regional Structure Plan
COD	Chemical Oxygen Demand
CSP	Clean Settlements Project
DAC	Development Assistance Committee
DEM	Digital Elevation Model
DHI	Danish Hydraulic Institute
DMMC	Dehiwala/Mt. Lavinia Municipal Council
DO	Dissolved Oxygen
DS	Divisional Secretariats
DWLC	Department of Wildlife Conservation
EIA	Environmental Impact Assessment
EMS	Environmental Management Strategy
FC	Foreign Currency
FEPO	Fauna and Flora and Protection Ordinance
GCFC&EIP	Greater Colombo Flood Control and Environment Improvement Project
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GN	Grama Niladhari
GOJ	Government of Japan
GOSL	Government of Sri Lanka
HAT	Highest Astronomical Tide
HCC	HCDC Coordination Committee
HCDC	Housing and Community Development Committee
IASC	Inter-Agency Steering Committee
ICB	International Competitive Bidding
ICTAD	Institute for Construction Training and Development
IDA	International Development Agency
IEE	Initial Environmental Examination
IRD	Irrigation Department
ITCZ	Inter Tropical Convergence Zone
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JOCV	Japan Overseas Cooperation Volunteers
KMC	Kotte Municipal Council
KPS	Keabewa Pradeshiya Sabha
KUC	Kolonnawa Urban Council

LA	Local Authority
LAA	Land Acquisition Act
LAT	Lowest Astronomical Tide
LC	Local Currency
LRD	Land Registration Department
LUPPD	Land Use Policy Planning Division
MC	Municipal Council
MFP	Ministry of Finance and Planning
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MMC	Moratuwa Municipal Council
MOL	Ministry of Land
MHAPCLG	Ministry of Home Affairs, Provincial Councils and Local Government
MHPI	Ministry of Housing and Plantation Infrastructure
MSL	Mean Sea Level
MUC	Maharagama Urban Council
NEA	National Environmental Act
NERD	National Engineering Research Development Center
NGO	Non-governmental Organization
NHDA	National Housing Development Authority
NIBM	National Institute of Business Management
NIRP	National Involuntary Resettlement Policy
NWSDB	National Water Supply and Drainage Board
ODA	Overseas Development Assistance
O&M	Operation and Maintenance
PAA	Project-approving Agency
P&E	Plant and Equipment Division
PIRD	Provincial Irrigation Department
PRS	Poverty Reduction Strategy
PS	Pradeshiya Sabha
PTU/WP	Provincial Training Unit in Western Provincial Council
RAP	Resettlement Action Plan
RDA	Road Development Authority
RDD	Research and Design Division
REEL	Real Estate Exchange Ltd.
SAPROF	Special Assistance for Project Formation
SLIDA	Sri Lanka Institute of Development and Administration
SLILG	Sri Lanka Institute of Local Government
SLLRDC	Sri Lanka Land Reclamation and Development Corporation
SLR	Sri Lanka Railway
SLTL	Sri Lanka Telecom
STP	Sustainable Township Program
TA	Technical Assistance
UC	Urban Council
UHD	Urban Housing Division
UDA	Urban Development Authority
UDC	Utility Diversion Committee
UNDP	United Nations Development Program
USIP	Urban Settlement Improvement Project Unit
USS	Under-served Settlements
WPC	Western Provincial Council

## MEASUREMENT UNITS

### Area

cm <sup>2</sup>	=	Square Centimeters
m <sup>2</sup>	=	Square Meters
km <sup>2</sup>	=	Square Kilometers
ha	=	Hectares (10,000 m <sup>2</sup> )

### Length

mm	=	Millimeters
cm	=	Centimeters
m	=	Meters
km	=	Kilometers

### Currency

US\$	=	United State Dollars
¥	=	Japanese Yen
Rs.	=	Sri Lanka Rupee

### Energy

kVA	=	Kilovolt Ampere
kW	=	Kilowatt

### Economy

EIRR	=	Economic Internal Rate of Return
NPV	=	Net Present Value
B/C	=	Benefit Cost Ratio

### Volume

cm <sup>3</sup>	=	Cubic Centimeters
m <sup>3</sup>	=	Cubic Meters
m <sup>3</sup> /day	=	Cubic Meters per Day
m <sup>3</sup> /sec	=	Cubic Meters per Second
l or lit	=	Liter (1,000 cm <sup>3</sup> )
lpcd	=	Liter per capita per day
MCM	=	Million Cubic Meter

### Weight

g	=	Grams
mg	=	Milligrams (1/1,000 g)
mg/l	=	Milligrams per liter
kg	=	Kilograms (1,000 g)
kg/cm <sup>2</sup>	=	Kilograms per square centimeter
t	=	Metric ton (1,000 kg)

### Time

sec	=	Seconds
min.	=	Minutes
hr	=	Hours

### Others

per/km <sup>2</sup>	=	Persons per Square Kilometer
MSL	=	Mean Sea Level