

SUPPORTING REPORT (2)

ANNEX 9 : CONSTRUCTION PLAN AND COST ESTIMATE

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

FINAL REPORT

VOLUME IV : SUPPORTING REPORT (2)

ANNEX 9 : CONSTRUCTION PLAN AND COST ESTIMATE

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CHAPTER 1 CONSTRUCTION PLAN

1.1 Basic Conditions

1.1.1 Project Components

The proposed Weras Ganga Basin Storm Water Drainage Project (the Project) consists of the following four schemes and measures:

(1) Weras Ganga Scheme

- 1) Dredging of Weras Ganga
- 2) Flood protection dike and sluiceway
- 3) Periphery canal around retention area

(2) Nugegoda-Rattanaipitiya Scheme

- 1) Channel improvement of Rattanaipitiya Ela, Delkanda Ela, and Nugegoda Ela
- 2) Maintenance road
- 3) Reconstruction of bridges and culverts
- 4) Periphery canal around retention area

(3) Bolgoda Canal Scheme

- 1) Channel improvement of Bolgoda Canal
- 2) Maintenance road
- 3) Reconstruction of bridge
- 4) Periphery canal around retention area

(4) Ratmalana-Moratuwa Scheme

- 1) Improvement of Open Channel
- 2) Improvement of drains (Concrete flume with cover slab)

The detailed features of the above measures are described in Annex 8: Preliminary Design.

1.1.2 Working Conditions

(1) Location of the Project Area

The project area is located south-east of Colombo MC and is administered by five local authorities: Dehiwala - Mount Lavinia MC, Moratuwa MC, Kotte MC, Maharagama UC and Kesbewa PS. Distance from the center of Colombo MC is about 15 km.

(2) Ground Condition

The project area is roughly categorized into two ground types: lowlands and surrounding uplands. In the lowlands, the surface horizon consists of weak alluvial deposits which contain organic clays at some of the locations with thickness of 2 to 3 m. The alluvial deposits lie above the residual formation; i.e. the formation due to the in-situ weathering of the parent rock lying beneath. Consequently, the residual formation consists of successive layers of residual soils, highly weathered rock, and hard basement rock. Traffic ability of ground of the lowland is not sufficient for carrying heavy vehicles.

(3) Weather Condition

The project area is located in the southwestern quarter of the country, which is classified as a Wet Zone. The last 30 years records of average monthly rainfall and number of rainy days (more than 10 mm/day) of Ratmalana Meteorological Station which is located in the project area are summarized below. The average annual rainfall and annual rainy days are around 2,400 mm and 70 days, respectively. There are two rainy seasons of April-May and October-November.

Average Monthly Rainfall

Bolgoda Basin (Station Name: Ratmalana)												(Unit: mm)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
62	70	117	264	336	203	129	110	253	348	335	169	2,397

Number of Rainy Days (more than 10mm/day)

Bolgoda Basin (Station Name: Ratmalana)												(Unit: day)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
4	3	2	8	8	6	5	5	8	8	7	7	71

(4) Workable Days

The annual net workable days for construction work are determined based on the above-mentioned rainfall record, number of national holidays in Sri Lanka, and the following criteria.

- 1) Work is suspended on Sunday and national holiday.
- 2) Work is suspended by rainfall as follows:

10 -20 mm/day	: 0.5 days
More than 20 mm/day	: 1 day

The average monthly workable days are calculated to be 21 days as shown below and applied to the construction planning.

Workable Days

												(Unit: days)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
23	21	23	17	18	21	23	23	22	20	18	22	21

(5) Access to the Sites

Imported equipment and materials can be transported from the Colombo port to the project area through Baseline Road, Horana Road and High Level Road. The distance from the Colombo Port to the project area is about 18 km.

There are three major roads in and around the project area: Galle road, Horana road and High Level Road from east to west. The municipal roads derive from the above main roads and lead to the construction site.

The standard widths of the above roads are as follows:

- 1) Baseline road : 22 m
- 2) Galle road : 15-20 m
- 3) Horana/High-Level road : 10-15 m
- 4) Municipal roads : 6-10 m

The bridges of the above roads can sustain a load of 30 ton class trailer.

The municipal roads that lead to some of the bridge/culvert construction sites do not have enough width (less than 6 m) and will not accommodate heavy vehicles. There is no access road to the proposed disposal site which is situated in the lowland.

The access routes are shown in Figure 1.1.1.

1.1.3 Availability of Construction Resources

(1) Labor

The project area is located near Colombo MC and there is no particular difficulty envisaged to procure all fields of skilled and common laborers. Those laborers can be procured through local contractors.

(2) Construction Materials

1) Earth material for embankment and back filling

The earth material for embankment and back filling will be transported from borrow areas in the hilly areas located in the eastern part of the project area. The excavated soils in the rivers and lowlands are generally not suitable for embankment and back filling because they contain organic materials and silt. About 70,000 m³ of earth material including material for construction of access roads will be required for the Project. The expected locations of borrow areas are shown in Figure 1.1.1. The distances from the construction sites in the project area to those borrow areas are about 10 km.

2) Rubble stone and crushed stone for aggregate

These materials are usually purchased from local stone suppliers. About 30,000 m³ of rubble stone will be required for the gabion works and wet masonry works. The quarry sites for rock material are also located in the eastern part of the project area and their locations are shown in Figure 1.1.1.

3) Sand

River sand from the Kelani River, the Kalu Ganga and their tributaries can be used for construction. It is usually purchased from local sand suppliers.

4) Cement

Cement is produced in the local factories at Puttalam, Galle and Trincomalee and readily available through private traders in the Colombo District. Imported cement is also available in the local market of Colombo District.

5) Ready Mixed Concrete

About 16,000 m³ of ready mixed concrete will be required for the Project. There are several major suppliers of ready mixed concrete such as International Construction Consortium Ltd., etc. in Colombo District. Ready mixed concrete can be delivered within one hour from those suppliers to the construction sites. Each supplier has a concrete plant with production capacity of 30 to 70 m³/hour, 15 to 30 numbers of agitator trucks of 5 ton class and 2 to 4 numbers of concrete pump cars.

6) Concrete Products

Reinforced concrete products are available in ready-made or made-to-order basis. Pre-cast concrete pipes of less than 1,500 mm in diameter are available from domestic manufacturers. Hemicycle concrete pipe, kerb stone and pre-cast concrete beam for bridge (maximum span length of 15 m) are also available. Reinforced concrete trough, manholes, and gully boxes can be purchased on a made-to-order basis.

7) Steel Materials

Steel sheet pile, reinforcing bar and other steel materials are usually imported from foreign countries. Only reinforcing bar is available in the local market, although for large scale civil construction works, it will also be imported. About 1,600 tons of reinforcing bar will be required for the Project.

(3) Construction Equipment

Major construction equipment such as excavator, bulldozer, loader, truck, mobile cranes, pile driver, grader, roller, and generator can be rented from the private companies. These rental companies are operating in the Colombo District.

For dredging of Weras Ganga (total dredging volume 140,000 m³), the use of a cutter suction dredger of shallow draft (smaller than 1 m) will be recommendable from an economical viewpoint, and it may be necessary to import it at the time of implementation of the Project.

1.1.4 Material Disposal

The following volume of material will be generated in the construction process:

- 1) Dredged material: 140,000 m³
- 2) Excavated material (not suitable for embankment/back filling)
: 280,000 m³

(1) Disposal of Dredged Material

Conceivable sites for the dredged material disposal are the north-east area of the Ratmalana Airport and the area near the confluence of Maha Ela and Weras Ganga.

The extent of the former site is about 36 ha and will receive about 80,000 m³ of the dredged soil. The disposal site will be located a certain distance from the residential zone to avoid the public nuisance.

The latter site is located in the proposed storm water retention area. Therefore, the top level of the soil filling will be higher than the design high water level. The extent of the site is about 6 ha and 60,000 m³ of the dredged soil will be disposed at this site.

(2) Disposal of Excavated Material

Disposal site for the excavated material is also assumed to be in the north-east area of the Ratmalana Airport. It will be necessary to select small disposal sites for each excavation work near the excavation sites.

Location of those disposal sites is shown in Figure 1.1.1.

1.1.5 Land Acquisition

Land acquisition is necessary for the widening of river channels, construction of maintenance roads and conservation of retention area. Ministry of Land is responsible for the land acquisition and SLLRDC will cooperate with the Ministry.

1.2 Construction Schedule

1.2.1 Construction Period of Each Scheme

Prior to the main construction works, preparatory works are to be carried out. The preparatory works include:

- 1) Construction of contractor's facilities (site office, workshop, motor pool, etc.)
- 2) Mobilization of construction equipment
- 3) Relocation of existing facilities
- 4) Construction of material disposal sites and access roads

The preparatory works will be completed in 3 months except for relocation of existing facilities and construction of access road. The main construction works will be commenced from the 4th month. The construction period of each scheme is estimated based on each work volume and the assumed progress rate.

(1) Weras Ganga Scheme

1) Dredging of Weras Ganga

Dredging of the Weras Ganga is to be commenced after provision of disposal site. Dredging will be executed by cutter suction dredger considering the dredging volume. Total dredging volume is 140,000 m³ and the progress rate is assumed to be 4,200 m³/month/party x 2 parties. Consequently, the work period is estimated at 17 months.

2) Flood protection wall and sluiceway

Construction of the flood protection dike of 2,300 m long will be executed mainly by manpower. Prior to the construction, it is necessary to construct a temporary access road for transportation of the material such as rubble stone, cement, sand, etc. The progress rate is assumed to be 130 m/month, resulting in a construction period estimated at 18 months.

3) Periphery canal

The work progress rate of periphery canal construction for retention areas is assumed to be 400 m/month/party x 2 parties and the construction period of the canals of 10,400 m long is estimated at 13 month.

(2) Bolgoda Canal Scheme

1) Channel improvement

Prior to the channel improvement work, construction of temporary access road along the canal and removal of aquatic plant which is entirely covering the site

will be completed. After such works the earth work will be carried out. The work volumes, assumed progress rates and estimated construction periods are as follows:

Estimation of Construction Period for Channel Improvement Work

Work Item	Work Volume	Assumed Progress Rate	Construction Period
Excavation	67,800 m ³	3,150 m ³ /month/party x 2	11 months
Embankment	7,700 m ³	6,300 m ³ /month/party	2 months

The construction period of the channel improvement work is estimated at 11 months.

2) Maintenance road

Construction period of the maintenance road of 2,410 m long is estimated at 11 months based on the work quantity and the assumed work progress rate of 210 m/month.

3) Bridge

The bridge construction will be carried out by conventional method as follows:

- Temporary detour preparation 4 weeks
 - Demolition of existing bridge 3 weeks
 - Piling works (Cast-in-place concrete piles) 15 weeks
 - Sub-structure works 16 weeks
 - Launching the pre-stressed concrete units 6 weeks
 - Concrete deck slab works 8 weeks
 - Miscellaneous bridge works 4 weeks
 - Connection road works 5 weeks
 - Removal of temporary structures and site cleaning 4 weeks
- Total 65 weeks (455 days)

As shown above, the construction period is estimated to be 15 months (30 days/month).

4) Periphery canal

The work progress rate of periphery canal construction for retention areas is assumed to be 400 m/month and the construction period of the canals of 4,400 m long is estimated at 11 month.

(3) Nugegoda-Rattanapitiya Scheme

1) Channel improvement

Construction schedule of the channel improvement works of the tributaries are worked out taking into account the work quantity and assumed work progress rates of the earthwork and the bank protection work.

The work volumes, assumed progress rates and estimated construction periods of the respective tributaries are as follows:

Estimation of Construction Period for Channel Improvement Work

Work Item	Work Volume	Assumed Progress Rate	Construction Period
Rattanapitiya Ela			
Excavation	109,000 m ³	3,150 m ³ /month/party x 2	17 months
Bank protection	2,480 m	100 m/month/party x 2	12 months
Embankment	13,000 m ³	6,300 m ³ /month/party x 1	2 months
Delkanda Ela			
Excavation	37,500 m ³	3,150 m ³ /month/party x 2	6 months
Bank protection	1,840 m	130 m/month/party x 2	7 months
Embankment	5,950 m ³	6,300 m ³ /month/party x 1	1 month
Rattanapitiya Ela			
Excavation	31,000 m ³	3,150 m ³ /month/party x 2	5 months
Bank protection	1,240 m	130 m/month/party x 2	5 months
Embankment	30,800 m ³	6,300 m ³ /month/party x 1	5 months

The construction period of each tributary is estimated as follows based on the above and considering minimization of the number of work parties operating simultaneously.

- Rattanpitiya Ela: 19 months
- Delkanda Ela: 13 months
- Nugegoda Ela: 10 months

2) Maintenance road

Construction periods of the maintenance roads of the tributaries are estimated as follows taking account of the work quantity and the assumed work progress rate of 210 m/month/party.

- Rattanpitiya Ela (2,150 m): 10 months
- Delkanda Ela (300 m): 2 months
- Nugegoda Ela (1,600 m): 8 months

3) Bridge/Culvert

Temporary works for traffic control and care of water are required for reconstruction of the bridge and culvert. The construction period is estimated to be 9 to 16 months for one bridge and 6 to 9 months for one culvert.

In each tributary, construction of two bridges will be executed simultaneously. Total construction period for bridge/culvert of the tributaries are estimated as follows:

- Rattanpitiya Ela (5 bridges) : 19 months
- Delkanda Ela (6 bridges, 1 culvert) : 16 months
- Nugegoda Ela (3 bridges) : 13 months

4) Periphery canal

Construction periods of the periphery canals of the tributaries are estimated as follows taking into account the work volumes and the assumed work progress rate of 400 m/month.

- Delkanda Ela (1,600 m) 4 months
- Nugegoda Ela (3,600 m) 9 months

(4) Ratmalana-Moratuwa Scheme

The work volumes, assumed progress rates and estimated construction periods of the respective work items are as follows:

Estimation of Construction Period for Channel Improvement Work

Work Item	Work Volume	Assumed Progress Rate	Construction Period
Open Channel			
Wet Masonry Channel	6,600 m ²	330 m ² /month/party x 2	10 months
Earth Open Channel and Gabion Channel	1,900 m	80 m/month/party x 2	12 months
Culvert			
Concrete Flume with Cover Slab	6,400 m	25 m/month/party x 10	25 months

Based on the above, the construction periods of the open channel and culvert are estimated to be 12 months and 25 months, respectively.

1.2.2 Overall Construction Schedule

Based on the above-mentioned calculations, construction periods of the respective schemes are determined to be:

- 1) Weras Ganga Scheme: 21 months
- 2) Bolgoda Canal Scheme: 19 months
- 3) Nugegoda-Rattanapitiya Scheme: 32 months
- 4) Ratmalana-Moratuwa Scheme: 31 months

Overall construction schedule is shown in Figure 1.2.1. The overall construction period is planned to be 36 months.

1.3 Mode of Construction Execution

(1) Selection of Construction Contractor

In order to execute the main civil works of the Project, the contractor should have the following capabilities:

- 1) Management of the large scale dredging works including proper preparatory works
- 2) Management of the large scale bridge construction works of more than 20m span length
- 3) Management of the environmental aspect caused by the construction work

In order to procure a well experienced and internationally recognized contractor to satisfy the above requirements, an international competitive bidding should be applied.

The selection will be executed complying with the regulations of the Government of Sri Lanka and the guidelines of the international financing agencies. Pre-qualification of the bidders should be executed prior to the bidding.

(2) Contract Packaging

It is proposed that the project works should be divided into two contract packages of main civil works and procurement of O&M equipment. The reason why the civil works are executed by one package is explained as follows:

- 1) The scale of contract should be enough large for international competitive bidding.
- 2) The proposed civil works are related each other and a comprehensive management will be necessary for smooth implementation. It is therefore preferable to manage the works by one contractor.
- 3) Efficiency and safety of the work execution will be secured more easily by contracting with one contractor.

CHAPTER 2 COST ESTIMATE

2.1 Basic Conditions

(1) Composition of Project Cost

The financial project cost comprises the following cost items.

- 1) Construction cost
- 2) Land acquisition and compensation cost
- 3) Cost for procurement of O/M equipment
- 4) Engineering service cost
- 5) Administration cost
- 6) Price escalation
- 7) Physical contingency
- 8) Tax

(2) Price Level and Foreign Exchange Rate

All costs are estimated at the price level on August 30, 2002.

The exchange rate is set as follows:

$$\text{US\$1.0} = \text{Rs. } 96.26 = \text{¥118.94}$$

(3) Foreign and Local Currency Portion

All costs are estimated by separating the foreign currency portion (FC) and local currency portion (LC) based on the ratio of the imported and local materials and equipment and also by referring to similar projects such as GCFC&EIP Phase III.

(4) Construction Cost

The construction cost comprises direct construction cost and preparatory work cost. The direct construction cost is estimated on the unit cost basis. The unit costs are estimated based on the current prices of construction resources and the construction plan. The unit construction cost for the urban drainage is based on the data of current similar projects such as GCFC&EIP Phase III.

The preparatory work cost is estimated at 10 % of the direct construction cost.

(5) Land Acquisition and Compensation Cost

1) Land Acquisition

Land acquisition cost is estimated by the required land area and its unit cost. The unit cost of land is estimated based on the data from the Chief Valuer's Department of Ministry of Finance.

The applied unit costs of lands are as follows:

DS Division	Residential		Rural (Paddy, etc.)
	Ordinary area	Low grade area	
Kesbewa	1,190	540	200
Moratuwa	2,620	940	200
Dehiwela-Mount Lavinia	3,110	1,380	200

2) Compensation

The compensation cost for relocation is estimated by the number of houses/facilities to be relocated and their values. The number of the houses to be relocated is determined based on the river channel design and the community inventory survey. The unit values of the houses or buildings are determined as follows, based on the data from the local authorities:

Floor Area (m ²)	Value (Rs./house)
< 70	675,000
70 - 100	840,000
100<	1,500,000
Factory, etc.	3,000,000

(6) Cost for Procurement of O/M Equipment

The cost for procurement of O/M equipment is estimated according to the amount of equipment to be procured and the current prices of the equipment. The equipment to be procured is based on the proposed operation and maintenance plan described in Annex 10.

(7) Engineering Service Cost

The engineering service cost includes cost for field investigation, basic and detailed design including preparation of pre-qualification documents and tender documents, assistance for pre-qualification and tendering, and construction supervision.

(8) Administration Cost

The Government's administration cost for the project implementation is assumed to be 2% of the total of the construction cost, engineering service cost, and land acquisition and compensation cost. The rate is referred to the "JBIC SAPROF for Lunawa Lake Environment Improvement and Community Development Project, February 2001 (the Lunawa Project)".

(9) Price Escalation

The following price escalation rates were applied to the SAPROF study for the Lunawa Project.

- 1) 0.8% per annum for foreign currency (FC)
- 2) 2.8% per annum for local currency (LC)

The above price escalation rate for local currency was determined based on the following price index data up to the year 1999.

Colombo Consumer's Price Index (1997-1999)

Year	1997	1998	1999
Colombo Consumer's Price Index (CCPI) (% change)	9.6	9.4	4.7

Source: Central Bank of Sri Lanka Annual Report - 2001

The future price index is projected by Central Bank of Sri Lanka as follows:

Projected Colombo Consumer's Price Index (2002-2006)

Year	2002	2003	2004	2005	2006
CCPI (% change)	9.0	6.0	5.5	4.5	3.8

Source: Central Bank of Sri Lanka Annual Report - 2001

According to the above projections, the long-term escalation rate may be presumed to decline to below 3.0%.

Consequently, the price escalation rates to be applied to the present Study are set at the same rates as those of the SAPROF study for the Lunawa Project.

(10) Physical Contingency

Physical contingency is set as follows referring to the SAPROF study for Lunawa Project:

- 1) 10% of the construction cost, land acquisition and compensation cost
- 2) 5% of the equipment procurement cost, engineering service cost, and administration cost

(11) Tax

Tax is estimated as follows based on the current tax system of Sri Lanka:

- 1) 30% for the construction cost
- 2) 40% for the equipment procurement cost
- 3) 20% for the engineering service cost

2.2 Project Cost

(1) Construction Cost

The current basic prices of construction resources such as labor, equipment, and material cost are shown in Tables 2.2.1, 2.2.2, and 2.2.3. The basic price is divided into foreign currency portion (FC) and local currency portion (LC) referring to the current applied data such as that of GCFC&EIP Phase III. Estimated unit construction costs are shown in Table 2.2.4.

The direct construction cost is estimated by the unit construction cost and scheduled work quantities. The estimated direct construction costs of the proposed schemes are shown in Table 2.2.5 and summarized below:

Direct Construction Cost

Scheme	Cost (million Rs.)
1. Weras Ganga Scheme	307
2. Nugegoda-Rattanapitiya Scheme	675
3. Bolgoda Canal Scheme	113
4. Ratmalana-Moratuwa Scheme	639
Total Project	1,734

(2) Land Acquisition and Compensation Cost

1) Land Acquisition Cost

The land acquisition cost is estimated from the required land areas and its unit costs. The total land area to be acquired is 326 ha, including 31 ha for the channel improvement works and 295 ha for the storm water retention areas. The land acquisition costs amounts to Rs. 658 million. The required land areas for the Project and the estimated costs are shown in Table 2.2.6.

2) Compensation Cost

The number of the houses to be relocated is 158 houses. The compensation cost is estimated based on the different unit values by the floor areas of the houses. The compensation cost amounts to Rs. 182 million. The number of houses/buildings to be relocated and compensation costs are shown in Table 2.2.7.

(3) Cost for Procurement of O&M equipment

The cost for procurement of O&M equipment proposed in Annex 10 is estimated by the current prices (CIF values) of such equipment. The procurement cost is estimated to be Rs. 113 million and the breakdown is shown in Table 2.2.8.

(4) Engineering Service Cost

It is assumed that engineering services will be provided throughout the period of project implementation. Estimated total inputs comprise foreign experts (95 M/M) and Sri Lanka experts (200 M/M). Based on the assumed input of foreign experts and Sri Lanka experts and the required direct costs, the engineering service cost is estimated to be Rs. 382 million.

(5) Project Cost

The estimated project cost is shown in Table 2.2.9 and summarized below:

Project Cost Estimated

Item	Project Cost (million Rs.)
1. Construction Cost	1,908
2. Land Acquisition and Compensation Cost	840
3. Cost for Procurement of O/M Equipment	113
4. Engineering Service Cost	382
5. Administration Cost	62
Total of (1+2+3+4+5)	3,305
6. Price Escalation	88
7. Physical Contingency	302
8. Tax	694
Total Project Cost	4,389

2.3 Operation and Maintenance Cost

Operation and Maintenance (O&M) cost of the Project is estimated based on the proposed O&M plan described in Annex 10 and the unit rates of the O&M works.

(1) Unit Rates of O&M works

The unit rates of O&M works are estimated based on the data from SLLRDC. The applied unit rates are shown in Table 2.3.1.

(2) Operation and Maintenance Cost

The annual O&M costs estimated for the proposed schemes are shown in Table 2.3.2 and summarized below. The total annual O&M cost is Rs. 40 million.

Annual O&M Cost

Scheme	Annual O&M Cost (million Rs.)
1. Weras Ganga	16
2. Nugegoda-Rattapitiya	10
3. Bolgoda Canal	8
4. Ratmalana-Moratuwa	6
Total	40

Tables

Table 2.2.1 Daily Labor Wages

(Unit: Rs./day)

Description	FC	LC	Total
Foreman	0	585	585
Foreman (Bridge)	0	850	850
Bridge Builder	0	800	800
Equipment Operator	0	520	520
Assistant Equipment Operator	0	390	390
Driver	0	390	390
Rigger/Welder	0	390	390
Carpenter	0	390	390
Mason	0	390	390
Re-bar Worker	0	390	390
Concrete Worker	0	390	390
Common Labourer	0	270	270

Source: SLLRDC

Table 2.2.2 Hourly Cost of Construction Equipment

(Unit: Rs./hr)

Plant & Equipment	Capacity	FC	LC	Total
Bulldozer	6 t	730	180	910
Bulldozer	15 t	1,660	420	2,080
Bulldozer	21 t	3,090	770	3,860
Wheel loader	1.4 m ³	1,030	260	1,290
Backhoe	1.2 m ³	1,890	470	2,360
Backhoe	0.6 m ³	1,530	380	1,910
Backhoe	0.4 m ³	980	240	1,220
Backhoe wheel type	0.3 m ³	1,030	260	1,290
Crawler Cramshell	0.4 m ³	3,270	820	4,090
Grab dredger	0.6 m ³	4,160	1,040	5,200
Cutter Suction Dredger	50 m ³ /hr	20,960	5,240	26,200
Dump Truck	11 t	1,620	410	2,030
Cargo Truck	11 t	2,020	500	2,520
Cargo Truck	6 t	1,440	360	1,800
Ordinary Truck	4 t	900	230	1,130
Crawler Crane	50 t	6,750	1,690	8,440
Crawler Crane	80 t	9,600	2,400	12,000
Truck Crane	5 t	1,180	300	1,480
Truck Crane	25 t	3,330	830	4,160
Vibro Hammer	47-49 t	250	60	310
Pile excavator	dia 900	7,220	1,810	9,030
Pile Hammer	2.5 t	10,750	2,690	13,440
Concrete breaker	30 kg	630	160	790
Motor Grader	4 m	1,260	320	1,580
Asphalt finisher	2.5-6 m	5,570	1,390	6,960
Sprayer		620	160	780
Macadam Roller	10-12 t	1,260	320	1,580
Tire Roller	8-20 t	510	130	640
Rammer	60 kg	60	20	80
Vibrating Roller	3 t	310	80	390
Concrete Pump Car	60 m ³ /hr	5,490	1,370	6,860
Concrete Vibrator	45 mm dia	110	30	140
Air Compressor	7 m ³ /min	410	100	510
Generator	100 kVA	1,260	320	1,580
Generator (Welder)	20 kVA	590	150	740
Generator	10 kVA	390	100	490
Barge	7 m ³	6,120	1,530	7,650
Tug boat	40 HP	730	180	910
Pump dia 150		470	120	590
Pump dia 100		350	90	440
Pump dia 50		110	30	140

Source: SLLRDC, JICA Study Team

Table 2.2.3 Basic Prices of Construction Materials

(Unit: Rs.)

Material	Unit	FC	LC	Total
Light Oil	liter	19	8	27
Heavy Oil	liter	23	10	33
Petrol	liter	35	15	50
Sandy Clay	m ³	276	118	394
Rubble Stone 6"-9"	m ³	433	186	619
Gravel	m ³	433	186	619
Crushed Stone	m ³	867	371	1,238
Brick	no.	1	1	2
Turfing	m ²	59	25	84
Gabion 2 x 1 x 1	No.	3,961	1,698	5,659
Gabion 1.5 x 1 x 1	No.	3,056	1,309	4,365
Gabion 1 x 1 x 1	No.	2,363	1,012	3,375
Geotextile Filter	m ²	142	61	203
Cement	kg	6	2	8
Sand	m ³	417	179	596
Aggregate 20 mm	m ³	867	371	1,238
Reinforcement bar	kg	30	13	43
Binding wire	kg	43	19	62
Plywood t = 12 mm	m ²	374	160	534
Square wood	m ³	11,813	5,062	16,875
Ready Mix Concrete 15	m ³	3,347	1,434	4,781
Ready Mix Concrete 20	m ³	3,623	1,552	5,175
Ready Mix Concrete 30	m ³	3,938	1,687	5,625
Ready Mix Concrete 40	m ³	4,410	1,890	6,300
Precast RC pipe 300 mm L = 2.5 m	No.	1,465	628	2,093
Precast RC pipe 350 mm L = 2.5 m	No.	1,713	734	2,447
Precast RC pipe 450 mm L = 2.5 m	No.	2,323	996	3,319
Precast RC pipe 750 mm L = 2.5 m	No.	4,311	1,848	6,159
Precast RC pipe 900 mm L = 2.5 m	No.	5,418	2,322	7,740
Precast RC pipe 1200 mm L = 2.5 m	No.	8,269	3,544	11,813
Precast RC pipe 1500 mm L = 2.5 m	No.	11,025	4,725	15,750
Kerb Stone 150 x 300	m	284	121	405
Paving Slab 450 x 450 x 50 mm (without R/F)	No.	79	34	113
Cover Slab 800 x 1000 x 100 mm (with R/F)	pc	945	405	1,350
Cover Slab 700 x 1000 x 70 mm (with R/F)	pc	630	270	900
PVC Pipe 25 mm dia	m	39	17	56
PVC Pipe 50 mm dia	m	134	57	191
PVC Pipe 100 mm dia	m	807	346	1,153
PVC water stop 250 mm	m	1,142	489	1,631
PVC water stop 200 mm	m	945	405	1,350
Upvc pipe 25 mm dia	m	39	17	56
Steel Plate	kg	32	13	45
Angle	kg	32	13	45
Sheet pile	kg	36	16	52
H-Shape Steel	kg	36	16	52
Channel Steel	kg	36	16	52
Covering Plate	kg	158	68	226
Timber planks t = 18 mm	m ²	1,024	439	1,463
Timber planks t = 12 mm	m ²	678	290	968
Asphalt	kg	4	2	6
Asphalt Concrete	ton	4,102	1,758	5,860
Propan Gas	kg	24	10	34
Bamboo l=4m	Pc	140	60	200
Pre-tention PC Beam 16 m	Piece	34,590	14,830	49,420
Pre-tention PC Beam 15 m	Piece	31,080	13,320	44,400
Pre-tention PC Beam 14 m	Piece	27,750	11,890	39,640
Pre-tention PC Beam 13 m	Piece	24,970	10,700	35,670
Pre-tention PC Beam 12 m	Piece	22,620	9,690	32,310
Pre-tention PC Beam 11 m	Piece	19,560	8,380	27,940
Pre-tention PC Beam 10 m	Piece	17,130	7,340	24,470
Pre-tention PC Beam 9 m	Piece	16,040	6,880	22,920

Source: SLLRDC, JICA Study Team

Table 2.2.4 Unit Construction Cost (1/2)

Item	Unit	Unit Cost (Rs.)		
		FC	LC	Total
1 River improvement and Storm Water Regulating Pond				
1.1 Temporary Works				
1) Coffering	m	1,080	810	1,890
2) Temporary Sheet Pile (L = 5 m)	m	12,660	4,370	17,030
3) Dewatering for Bank protection work	m	2,950	1,000	3,950
4) Access Road	m	4,570	1,500	6,070
5) Removal of existing structure	m ³	2,930	1,250	4,180
6) Clearing and Grubbing	m ²	40	30	70
7) Preparation of Dredged Material Disposal Area	LS			
8) Other (equipment mobilization/demobilization)	LS			
1.2 River Channel Excavation				
1) Excavation (normal)	m ³	180	70	250
2) Excavation (underwater)	m ³	450	140	590
3) Disposal of excavated material	m ³	300	100	400
4) Dredging by Cutter Suction Dredger	m ³	810	210	1,020
1.3 Bank Protection (Gabion)				
1) Gabion Work (H = 3 m)	m	23,450	10,600	34,050
2) Gabion Work (H = 2 m)	m	15,630	7,070	22,700
3) Backfill with borrowed material	m ³	760	280	1,040
1.4 Bank Protection (Wetmasonry)				
1) Foundation	m	1,950	910	2,860
2) Wetmasonry	m ²	3,210	1,640	4,850
1.5 Miscellaneous				
1) Relocation/Reinforcement of existing facilities	LS			
2 Inspection Road				
2.1 Dike Construction				
1) Embankment for Dike with borrowed material	m ³	590	190	780
2) Turfing	m ²	80	40	120
3) Other (equipment mobilization/demobilization)	LS			
2.2 Road Work				
1) Laterite pavement with base course	m ²	300	110	410
2) Side Drain	m	600	560	1,160
3) Drain sluiceway (1 nos per 100 m)	nos	63,030	37,030	100,060
3 Bridge				
3.1 Temporary Works				
1) Temporary road bridge	m	183,810	45,950	229,760
2) Temporary work stage	m ²	26,880	9,500	36,380
3) Removal of existing structure	m ³	2,930	1,250	4,180
4) Site preparatory works	LS			
5) Other (equipment mobilization/demobilization)	LS			
3.2 Substructure				
1) Temporary Sheet Piling (L = 9 m)	m	16,560	6,160	22,720
2) Dewatering	day	3,730	1,170	4,900
3) Excavation for Bridge substructures	m ³	230	130	360
4) Backfilling with borrowed material	m ³	760	280	1,040
5) Backfilling with excavated material	m ³	210	90	300
6) Disposal of excavated material	m ³	300	100	400
7) Insitu pile foundation (dia 600 mm)	m	16,850	5,850	22,700
8) Gravel bedding	m ²	260	130	390
9) Leveling concrete	m ³	5,090	2,400	7,490
10) Concrete (structure)	m ³	6,070	2,590	8,660
11) Form (structure)	m ²	670	380	1,050
12) Reinforcing bar	kg	60	30	90
13) Miscellaneous	LS			
3.3 Superstructure				
1) Procurement of PC beam (L = 4-16 m)	LS			
2) Fabrication of PC beam (L = 17-28 m)	LS			
3) Installation of PC Beam (L = 4-16 m) Crane	LS			
4) Installation of PC Beam (L = 17-28 m) Girder	LS			
5) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+3)		
6) Miscellaneous bridge work (L = 17-28 m)	LS	30% of (2) + 4)		
3.4 Others				
1) Gabion for riverbank protection beside bridge	m ³	3,490	1,590	5,080

Table 2.2.4 Unit Construction Cost (2/2)

Item	Unit	Unit Cost (Rs.)		
		FC	LC	Total
4 Culvert and Sluiceway				
4.1 Temporary Works				
1) Temporary diversion	m	18,720	7,350	26,070
2) Temporary road bridge	m	183,810	45,950	229,760
3) Dewatering	day	3,730	1,170	4,900
4) Removal of existing structure	m ³	2,930	1,250	4,180
5) Other (equipment mobilization/demobilization)	LS			
4.2 Earth Work				
1) Excavation for Structures	m ³	180	70	250
2) Backfilling with borrowed material	m ³	760	280	1,040
3) Disposal of excavated material	m ³	300	100	400
4) Embankment with borrowed material	m ³	590	190	780
4.3 Foundation				
1) Piling (PC Pile, 350 x 350)	m	10,800	4,250	15,050
2) Gravel bedding (t = 20 cm)	m ²	260	130	390
3) Leveling concrete	m ³	5,090	2,400	7,490
4.4 Structure				
1) Concrete (structure)	m ³	6,070	2,590	8,660
2) Form (structure)	m ²	670	380	1,050
3) Reinforcing bar	kg	60	30	90
4.5 Pavement				
1) Sub base course (t = 400 mm)	m ³	780	340	1,120
2) Base course (t = 200 mm)	m ³	830	350	1,180
3) Asphalt pavement (t = 50 mm)	m ²	820	350	1,170
4.6 Gate				
1) Flap gate	m ²	133,940	31,890	165,830
4.7 Other				
1) Gabion for riverbank protection	m ³	3,490	1,590	5,080
2) Miscellaneous for culvert	LS	3% of 4.1-4.5		
3) Miscellaneous for sluiceway	LS	10% of 4.1-4.6		
5 Urban drainage				
5.1 Concrete Flume with Cover Slab				
1) B = 0.8, H = 0.8	m	39,560	16,950	56,510
2) B = 0.9, H = 0.9	m	43,320	18,570	61,890
3) B = 1.0, H = 1.0	m	47,090	20,180	67,270
4) B = 1.1, H = 1.1	m	50,860	21,790	72,650
5) B = 1.2, H = 1.2	m	54,620	23,410	78,030
6) B = 1.3, H = 1.3	m	58,390	25,020	83,410
7) B = 1.3, H = 1.4	m	62,160	26,640	88,800
8) B = 1.5, H = 1.5	m	67,110	28,760	95,870
9) B = 2.0, H = 1.5	m	76,220	32,670	108,890
5.2 Masonry Channel				
1) B = 1.0, H = 1.0	m	21,840	5,460	27,300
2) B = 1.5, H = 1.0	m	22,240	5,560	27,800
3) B = 1.5, H = 1.5	m	26,480	6,620	33,100
4) B = 2.0, H = 1.5	m	26,880	6,720	33,600
5) B = 3.0, H = 1.5	m	27,680	6,920	34,600
5.3 Earth Open Channel with Gabion				
1) B = 3.0, H = 1.5	m	48,000	12,000	60,000
2) B = 5.0, H = 1.5	m	49,360	12,340	61,700
3) B = 6.0, H = 1.5	m	50,320	12,580	62,900
5.4 Earth Open Channel				
1) B = 2.0, H = 1.5	m	8,480	2,120	10,600
2) B = 5.0, H = 1.5	m	10,800	2,700	13,500
3) B = 6.0, H = 1.5	m	11,760	2,940	14,700
6 Retention Area				
6.1 Periohery Canal				
1) Periohery Canal and Path way	m	560	1,480	2,040

Table 2.2.5 Breakdown of the Direct Construction Cost (1/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
1. Weras Ganga Scheme							
WG1							
1 Temporary Works							
1) Access Road	m	1,000	4,570	1,500	4,570,000	1,500,000	6,070,000
2) Clearing and Grubling	m ²	136,000	40	30	5,440,000	4,080,000	9,520,000
3) Preparation of disposal area	LS	1			15,877,600	3,969,400	19,847,000
4) Other (equipment mobilization/demobilization)	LS	1			7,332,000	1,833,000	9,165,000
	sub-total				33,219,600	11,382,400	44,602,000
2 Dredging							
1) Dredging by Cutter Suction Dredger	m ³	70,500	810	210	57,105,000	14,805,000	71,910,000
	sub-total				57,105,000	14,805,000	71,910,000
3 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	5% of 1-2			4,516,230	1,309,370	5,825,600
	sub-total				4,516,230	1,309,370	5,825,600
	Total				94,840,830	27,496,770	122,337,600
WG2							
1 Temporary Works							
1) Access Road	m	1,000	4,570	1,500	4,570,000	1,500,000	6,070,000
2) Clearing and Grubling	m ²	84,000	40	30	3,360,000	2,520,000	5,880,000
3) Preparation of disposal area	LS	1			15,877,600	3,969,400	19,847,000
4) Other (equipment mobilization/demobilization)	LS	1			7,446,400	1,861,600	9,308,000
	sub-total				31,254,000	9,851,000	41,105,000
2 Dredging							
1) Dredging by Cutter Suction Dredger	m ³	71,600	810	210	57,996,000	15,036,000	73,032,000
	sub-total				57,996,000	15,036,000	73,032,000
3 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	5% of 1-2			4,462,500	1,244,350	5,706,850
	sub-total				4,462,500	1,244,350	5,706,850
	Total				93,712,500	26,131,350	119,843,850
Flood Protection Wall							
1 Temporary Works							
1) Dewatering for Bank protection work	m	2,300	2,950	1,000	6,785,000	2,300,000	9,085,000
2) Access Road	m	2,300	4,570	1,500	10,511,000	3,450,000	13,961,000
3) Removal of existing structure	m ³	100	2,930	1,250	293,000	125,000	418,000
4) Clearing and Grubling	m ²	6,900	40	30	276,000	207,000	483,000
5) Other (equipment mobilization/demobilization)	LS	1	31,800	13,650	31,800	13,650	45,450
	sub-total				17,896,800	6,095,650	23,992,450
2 Wet Masonry Wall							
1) Excavation for Structures	m ³	1,570	180	70	282,600	109,900	392,500
2) Backfilling with borrowed material	m ³	520	760	280	395,200	145,600	540,800
3) Disposal of excavated material	m ³	1,050	300	100	315,000	105,000	420,000
4) Leveling concrete	m ³	130	5,090	2,400	661,700	312,000	973,700
5) Wet Masonry	m ³	1,810	1640	1,370	2,968,400	2,479,700	5,448,100
	sub-total				4,622,900	3,152,200	7,775,100
	Total				22,519,700	9,247,850	31,767,550
Kandawala Gate1							
1 Temporary Works							
1) Temporary diversion	m	30	18,720	7,350	561,600	220,500	782,100
3) Dewatering	day	30	3,730	1,170	111,900	35,100	147,000
4) Removal of existing structure	m ³	10	2,930	1,250	29,300	12,500	41,800
5) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
	sub-total				743,700	285,640	1,029,340
2 Earth Work							
1) Excavation for Structures	m ³	154	180	70	27,720	10,780	38,500
2) Backfilling with borrowed material	m ³	76	760	280	57,760	21,280	79,040
3) Disposal of excavated material	m ³	154	300	100	46,200	15,400	61,600
	sub-total				131,680	47,460	179,140
3 Foundation							
1) Piling (PC Pile .350 x 350)	m	60	10,800	4,250	648,000	255,000	903,000
2) Gravel bedding (t = 20 cm)	m ²	0	260	130	0	0	0
3) Leveling concrete	m ³	3	5,090	2,400	16,288	7,680	23,968
	sub-total				664,288	262,680	926,968
4 Structure							
1) Concrete (structure)	m ³	28	6,070	2,590	169,353	72,261	241,614
2) Form (structure)	m ²	94	670	380	63,047	35,758	98,805
3) Reinforcing bar	kg	2,790	60	30	167,400	83,700	251,100
	sub-total				399,800	191,719	591,519
5 Gate							
1) Flap gate	m ²	7.6	133,940	31,890	1,017,944	242,364	1,260,308
	sub-total				1,017,944	242,364	1,260,308
6 Other							
1) Gabion for riverbank protection	m ³	42	3,490	1,590	146,231	66,621	212,852

Table 2.2.5 Breakdown of the Direct Construction Cost (2/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
2) Miscellaneous for sluiceway	LS	10% of 4.1-4.6			295,741	102,986	398,728
sub-total					441,972	169,607	611,580
Total					3,399,384	1,199,470	4,598,855
Telawala Gate1							
1 Temporary Works							
1) Temporary diversion	m	30	18,720	7,350	561,600	220,500	782,100
2) Dewatering	day	30	3,730	1,170	111,900	35,100	147,000
3) Removal of existing structure	m ³	30	2,930	1,250	87,900	37,500	125,400
4) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					802,300	310,640	1,112,940
2 Earth Work							
1) Excavation for Structures	m ³	154	180	70	27,720	10,780	38,500
2) Backfilling with borrowed material	m ³	76	760	280	57,760	21,280	79,040
3) Disposal of excavated material	m ³	154	300	100	46,200	15,400	61,600
sub-total					131,680	47,460	179,140
3 Foundation							
1) Piling (PC Pile ,350 x 350)	m	60	10,800	4,250	648,000	255,000	903,000
2) Gravel bedding (t = 20 cm)	m ²	0	260	130	0	0	0
3) Leveling concrete	m ³	3	5,090	2,400	16,288	7,680	23,968
sub-total					664,288	262,680	926,968
4 Structure							
1) Concrete (structure)	m ³	29	6,070	2,590	177,851	75,887	253,738
2) Form (structure)	m ²	104	670	380	69,948	39,672	109,620
3) Reinforcing bar	kg	2,930	60	30	175,800	87,900	263,700
sub-total					423,599	203,459	627,058
5 Gate							
1) Flap gate	m ²	9.5	133,940	31,890	1,272,430	302,955	1,575,385
sub-total					1,272,430	302,955	1,575,385
6 Other							
1) Gabion for riverbank protection	m ³	42	3,490	1,590	146,231	66,621	212,852
2) Miscellaneous for sluiceway	LS	10% of 4.1-4.6			329,430	112,719	442,149
sub-total					475,661	179,340	655,001
Total					3,769,958	1,306,534	5,076,492
Telawala Gate2							
1 Temporary Works							
1) Temporary diversion	m	15	18,720	7,350	280,800	110,250	391,050
2) Dewatering	day	30	3,730	1,170	111,900	35,100	147,000
3) Removal of existing structure	m ³	10	2,930	1,250	29,300	12,500	41,800
4) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					462,900	175,390	638,290
2 Earth Work							
1) Excavation for Structures	m ³	82	180	70	14,742	5,733	20,475
2) Backfilling with borrowed material	m ³	63	760	280	47,880	17,640	65,520
3) Disposal of excavated material	m ³	82	300	100	24,570	8,190	32,760
sub-total					87,192	31,563	118,755
3 Foundation							
1) Piling (PC Pile, 350 x 350)	m	30	10,800	4,250	324,000	127,500	451,500
2) Gravel bedding (t = 20 cm)	m ²	0	260	130	0	0	0
3) Leveling concrete	m ³	1	5,090	2,400	5,599	2,640	8,239
sub-total					329,599	130,140	459,739
4 Structure							
1) Concrete (structure)	m ³	11	6,070	2,590	66,770	28,490	95,260
2) Form (structure)	m ²	44	670	380	29,279	16,606	45,885
3) Reinforcing bar	kg	1,100	60	30	66,000	33,000	99,000
sub-total					162,049	78,096	240,145
5 Gate							
1) Flap gate	m ²	3.5	133,940	31,890	468,790	111,615	580,405
sub-total					468,790	111,615	580,405
6 Other							
1) Gabion for riverbank protection	m ³	27	3,490	1,590	92,834	42,294	135,128
2) Miscellaneous for sluiceway	LS	10 % of 4.1-4.6			151,053	52,680	203,733
sub-total					243,887	94,974	338,861
Total					1,754,417	621,778	2,376,195
Weras Ganga Swamp Retention Area							
1 Periphery Canal							
1) Periphery Canal and Path way	m	4,400	560	1,480	2,464,000	6,512,000	8,976,000
sub-total					2,464,000	6,512,000	8,976,000
Total					2,464,000	6,512,000	8,976,000
Maha Ela Retention Area							
2 Periphery Canal							

Table 2.2.5 Breakdown of the Direct Construction Cost (3/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
1) Periphery Canal and Path way	m	6,000	560	1,480	3,360,000	8,880,000	12,240,000
sub-total					3,360,000	8,880,000	12,240,000
Total					3,360,000	8,880,000	12,240,000
Total of I. Weras Ganga Scheme					225,820,789	81,395,753	307,216,542
2. Nugegoda-Rattanaipitiya Scheme							
2.1 Rattanaipitiya							
River Improvement							
1 Temporary Works							
1) Coffering	m	2,150	1,080	810	2,322,000	1,741,500	4,063,500
2) Temporary Sheet Pile (L = 5 m)	m	0	12,660	4,370	0	0	0
3) Dewatering for Bank protection work	m	3,400	2,950	1,000	10,030,000	3,400,000	13,430,000
4) Removal of existing structure	m ³	30	2,930	1,250	87,900	37,500	125,400
5) Clearing and Grubbing	m ²	17,200	40	30	688,000	516,000	1,204,000
6) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					13,168,800	5,712,540	18,881,340
2 River Channel Excavation							
1) Excavation (normal) (within 6m from the river bar)	m ³	103,550	180	70	18,639,000	7,248,500	25,887,500
2) Excavation (underwater)	m ³	5,450	450	140	2,452,500	763,000	3,215,500
3) Disposal of excavated material	m ³	109,000	300	100	32,700,000	10,900,000	43,600,000
sub-total					53,791,500	18,911,500	72,703,000
3 Bank Protection (Gabion)							
1) Gabion Work (H = 3 m)	m	2,480	23,450	10,600	58,156,000	26,288,000	84,444,000
3) Backfill with borrowed material	m ³	5,000	760	280	3,800,000	1,400,000	5,200,000
sub-total					61,956,000	27,688,000	89,644,000
4 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	5% of 1.1-1.4			6,445,815	2,615,602	9,061,417
sub-total					6,445,815	2,615,602	9,061,417
Total					135,362,115	54,927,642	190,289,757
Inspection Road							
1 Dike Construction							
1) Embankment for Dike with borrowed material	m ³	8,000	590	190	4,720,000	1,520,000	6,240,000
2) Turfing	m ²	5,300	80	40	424,000	212,000	636,000
3) Other (equipment mobilization/demobilization)	LS	1	21,200	9,100	21,200	9,100	30,300
sub-total					5,165,200	1,741,100	6,906,300
2 Road Work							
1) Laterite pavement with base course	m ²	6,100	300	110	1,830,000	671,000	2,501,000
2) Side Drain	m	2,000	600	560	1,200,000	1,120,000	2,320,000
3) Drain sluiceway (1 nos per 100 m)	nos	43	63,030	37,030	2,710,290	1,592,290	4,302,580
sub-total					5,740,290	3,383,290	9,123,580
Total					10,905,490	5,124,390	16,029,880
Bridge RE1							
1 Temporary Works							
1) Temporary road bridge	m	12	183,810	45,950	2,205,720	551,400	2,757,120
3) Removal of existing structure	m ³	260	2,930	1,250	761,800	325,000	1,086,800
4) Site preparatory works	LS	5% of 2.+3.			757,903	271,377	1,029,280
5) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					3,786,023	1,173,757	4,959,780
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	60	16,560	6,160	993,600	369,600	1,363,200
2) Dewatering	day	150	3,730	1,170	559,500	175,500	735,000
3) Excavation for Bridge substructures	m ³	1,200	230	130	276,000	156,000	432,000
4) Backfilling with borrowed material	m ³	150	760	280	114,000	42,000	156,000
5) Backfilling with excavated material	m ³	1,050	210	90	220,500	94,500	315,000
6) Disposal of excavated material	m ³	150	300	100	45,000	15,000	60,000
7) Insitu pile foundation (dia 600 mm)	m	405	16,850	5,850	6,824,250	2,369,250	9,193,500
8) Gravel bedding	m ²	143	260	130	37,180	18,590	55,770
9) Leveling concrete	m ³	45	5,090	2,400	229,050	108,000	337,050
10) Concrete (structure)	m ³	195	6,070	2,590	1,183,650	505,050	1,688,700
11) Form (structure)	m ²	345	670	380	231,150	131,100	362,250
12) Reinforcing bar	kg	19,500	60	30	1,170,000	585,000	1,755,000
13) Miscellaneous	LS	3% of 1) - 12)			321,416	119,538	440,954
sub-total					12,205,296	4,689,128	16,894,424
3 Superstructure							
1) Procurement of PC Beam (L = 14 m, 30 nos)	LS	1			1,670,990	417,750	2,088,740
2) Installation of PC Beam (L = 14 m), Crane	nos	30	12,180	3,050	365,400	91,500	456,900
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1) + 2))			916,376	229,163	1,145,538
sub-total					2,952,766	738,413	3,691,178
3.4 Others							
1) Gabion for riverbank protection beside bridge	m ³	280	3,490	1,590	977,200	445,200	1,422,400
sub-total					977,200	445,200	1,422,400
Total					19,921,285	7,046,497	26,967,782

Table 2.2.5 Breakdown of the Direct Construction Cost (4/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
Bridge RE2							
1 Temporary Works							
1) Temporary road bridge	m	10	183,810	45,950	1,838,100	459,500	2,297,600
3) Removal of existing structure	m ³	700	2,930	1,250	2,051,000	875,000	2,926,000
4) Site preparatory works	LS	5% of 3.2 + 3.3			1,503,900	488,204	1,992,103
5) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				5,453,600	1,848,684	7,302,283
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	60	16,560	6,160	993,600	369,600	1,363,200
2) Dewatering	day	100	3,730	1,170	373,000	117,000	490,000
3) Excavation for Bridge substructures	m ³	1,640	230	130	377,200	213,200	590,400
4) Backfilling with borrowed material	m ³	230	760	280	174,800	64,400	239,200
5) Backfilling with excavated material	m ³	1,000	210	90	210,000	90,000	300,000
6) Disposal of excavated material	m ³	640	300	100	192,000	64,000	256,000
7) Insitu pile foundation (dia 600 mm)	m	450	16,850	5,850	7,582,500	2,632,500	10,215,000
8) Gravel bedding	m ²	200	260	130	52,000	26,000	78,000
9) Leveling concrete	m ³	60	5,090	2,400	305,400	144,000	449,400
10) Concrete (structure)	m ³	350	6,070	2,590	2,124,500	906,500	3,031,000
11) Form (structure)	m ²	580	670	380	388,600	220,400	609,000
12) Reinforcing bar	kg	35,000	60	30	2,100,000	1,050,000	3,150,000
13) Miscellaneous	LS	3% of 1) - 12)			446,208	176,928	623,136
	sub-total				15,319,808	6,074,528	21,394,336
3 Superstructure							
1) Fabrication of PC Beam (L = 19 m, 36 nos)	LS	1			6,254,130	1,563,530	7,817,660
2) Installation of PC Beam (L = 19 m, 36 nos) Girder	LS	1			5,098,320	1,274,580	6,372,900
3) Miscellaneous bridge work (L = 17-28 m)	LS	30% of (1)+2))			3,405,735	851,433	4,257,168
	sub-total				14,758,185	3,689,543	18,447,728
	Total				35,531,593	11,612,755	47,144,347
Bridge RE3							
1 Temporary Works							
1) Removal of existing structure	m ³	100	2,930	1,250	293,000	125,000	418,000
2) Site preparatory works	LS	5% of 3.2 + 3.3			374,681	126,146	500,827
3) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				728,281	277,126	1,005,407
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	20	16,560	6,160	331,200	123,200	454,400
2) Dewatering	day	90	3,730	1,170	335,700	105,300	441,000
3) Excavation for Bridge substructures	m ³	550	230	130	126,500	71,500	198,000
4) Backfilling with borrowed material	m ³	50	760	280	38,000	14,000	52,000
5) Backfilling with excavated material	m ³	400	210	90	84,000	36,000	120,000
6) Disposal of excavated material	m ³	150	300	100	45,000	15,000	60,000
7) Insitu pile foundation (dia 600 mm)	m	150	16,850	5,850	2,527,500	877,500	3,405,000
8) Gravel bedding	m ²	50	260	130	13,000	6,500	19,500
9) Leveling concrete	m ³	15	5,090	2,400	76,350	36,000	112,350
10) Concrete (structure)	m ³	85	6,070	2,590	515,950	220,150	736,100
11) Form (structure)	m ²	100	670	380	67,000	38,000	105,000
12) Reinforcing bar	kg	8,500	60	30	510,000	255,000	765,000
13) Miscellaneous	LS	3% of 1) - 12)			140,106	53,945	194,051
	sub-total				4,810,306	1,852,095	6,662,401
3 Superstructure							
1) Fabrication of PC Beam (L = 19 m, 10 nos)	LS	1			1,137,120	284,280	1,421,400
2) Installation of PC Beam (L = 19 m, 10 nos) Girder	LS	1			926,960	231,740	1,158,700
3) Miscellaneous bridge work (L = 17-28 m)	LS	30% of (1)+2))			619,224	154,806	774,030
	sub-total				2,683,304	670,826	3,354,130
	Total				8,221,891	2,800,047	11,021,937
Bridge RE4							
1 Temporary Works							
1) Removal of existing structure	m ³	100	2,930	1,250	293,000	125,000	418,000
2) Site preparatory works	LS	5% of 3.2 + 3.3			460,551	154,011	614,562
3) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				814,151	304,991	1,119,142
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	20	16,560	6,160	331,200	123,200	454,400
2) Dewatering	day	90	3,730	1,170	335,700	105,300	441,000
3) Excavation for Bridge substructures	m ³	630	230	130	144,900	81,900	226,800
4) Backfilling with borrowed material	m ³	90	760	280	68,400	25,200	93,600
5) Backfilling with excavated material	m ³	400	210	90	84,000	36,000	120,000
6) Disposal of excavated material	m ³	230	300	100	69,000	23,000	92,000
7) Insitu pile foundation (dia 600 mm)	m	180	16,850	5,850	3,033,000	1,053,000	4,086,000
8) Gravel bedding	m ²	70	260	130	18,200	9,100	27,300
9) Leveling concrete	m ³	20	5,090	2,400	101,800	48,000	149,800
10) Concrete (structure)	m ³	105	6,070	2,590	637,350	271,950	909,300

Table 2.2.5 Breakdown of the Direct Construction Cost (5/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
11 Form (structure)	m ²	125	670	380	83,750	47,500	131,250
12 Reinforcing bar	kg	10,500	60	30	630,000	315,000	945,000
13 Miscellaneous	LS	3% of (1) - 12)			166,119	64,175	230,294
	sub-total				5,703,419	2,203,325	7,906,744
3 Superstructure							
1) Fabrication of PC Beam (L = 19 m, 12 nos)	LS	1			1,486,420	371,610	1,858,030
2) Installation of PC Beam (L = 19 m, 12 nos) Girder	LS	1			1,211,730	302,931	1,514,661
3) Miscellaneous bridge work (L = 17-28 m)	LS	30% of (1)+2)			809,445	202,362	1,011,807
	sub-total				3,507,595	876,903	4,384,498
	Total				10,025,165	3,385,219	13,410,384
Bridge RE5							
1 Temporary Works							
1) Temporary road bridge	m	0	183,810	45,950	0	0	0
2) Temporary work stage	m ²	0	26,880	9,500	0	0	0
3) Removal of existing structure	m ³	100	2,930	1,250	293,000	125,000	418,000
4) Site preparatory works	LS	5% of 3.2 + 3.3			460,551	154,011	614,562
5) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				814,151	304,991	1,119,142
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	20	16,560	6,160	331,200	123,200	454,400
2) Dewatering	day	90	3,730	1,170	335,700	105,300	441,000
3) Excavation for Bridge substructures	m ³	630	230	130	144,900	81,900	226,800
4) Backfilling with borrowed material	m ³	90	760	280	68,400	25,200	93,600
5) Backfilling with excavated material	m ³	400	210	90	84,000	36,000	120,000
6) Disposal of excavated material	m ³	230	300	100	69,000	23,000	92,000
7) Insitu pile foundation (dia 600 mm)	m	180	16,850	5,850	3,033,000	1,053,000	4,086,000
8) Gravel bedding	m ²	70	260	130	18,200	9,100	27,300
9) Leveling concrete	m ³	20	5,090	2,400	101,800	48,000	149,800
10) Concrete (structure)	m ³	105	6,070	2,590	637,350	271,950	909,300
11) Form (structure)	m ²	125	670	380	83,750	47,500	131,250
12) Reinforcing bar	kg	10,500	60	30	630,000	315,000	945,000
13) Miscellaneous	LS	3% of (1) - 12)			166,119	64,175	230,294
	sub-total				5,703,419	2,203,325	7,906,744
3 Superstructure							
1) Fabrication of PC Beam (L = 19 m, 12 nos)	LS	1			1,486,420	371,610	1,858,030
2) Installation of PC Beam (L = 19 m, 12 nos) Girder	LS	1			1,211,730	302,931	1,514,661
3) Miscellaneous bridge work (L = 17-28 m)	LS	30% of (1)+2)			809,445	202,362	1,011,807
	sub-total				3,507,595	876,903	4,384,498
	Total				10,025,165	3,385,219	13,410,384
	Grand Total 2.1				229,992,703	88,281,769	318,274,471
2.2 Delkanda							
River Improvement							
1 Temporary Works							
1) Coffering	m	1,150	1,080	810	1,242,000	931,500	2,173,500
2) Temporary Sheet Pile (L = 5 m)	m	800	12,660	4,370	10,128,000	3,496,000	13,624,000
3) Dewatering for Bank protection work	m	3,600	2,950	1,000	10,620,000	3,600,000	14,220,000
4) Removal of existing structure	m ³	50	2,930	1,250	146,500	62,500	209,000
5) Clearing and Grubbing	m ²	15,600	40	30	624,000	468,000	1,092,000
6) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
	sub-total				22,801,400	8,575,540	31,376,940
2 River Channel Excavation							
1) Excavation (normal)	m ³	37,500	180	70	6,750,000	2,625,000	9,375,000
3) Disposal of excavated material	m ³	37,500	300	100	11,250,000	3,750,000	15,000,000
	sub-total				18,000,000	6,375,000	24,375,000
3 Bank Protection (Gabion)							
2) Gabion Work (H = 2 m)	m	1,840	15,630	7,070	28,759,200	13,008,800	41,768,000
3) Backfill with borrowed material	m ³	4,700	760	280	3,572,000	1,316,000	4,888,000
	sub-total				32,331,200	14,324,800	46,656,000
4 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	10% of 1.1-1.4			7,313,260	2,927,534	10,240,794
	sub-total				7,313,260	2,927,534	10,240,794
	Total				80,445,860	32,202,874	112,648,734
Inspection Road							
1 Dike Construction							
1) Embankment for Dike with borrowed material	m ³	1,250	590	190	737,500	237,500	975,000
2) Turfing	m ²	2,400	80	40	192,000	96,000	288,000
3) Other (equipment mobilization/demobilization)	LS	1	21,200	9,100	21,200	9,100	30,300
	sub-total				950,700	342,600	1,293,300
2 Road Work							
1) Laterite pavement with base course	m ²	750	300	110	225,000	82,500	307,500
2) Side Drain	m	1,170	600	560	702,000	655,200	1,357,200

Table 2.2.5 Breakdown of the Direct Construction Cost (6/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
3) Drain sluiceway (1 nos per 100 m)	nos	39	63,030	37,030	2,458,170	1,444,170	3,902,340
	sub-total				3,385,170	2,181,870	5,567,040
	Total				4,335,870	2,524,470	6,860,340
Bridge D1							
1 Temporary Works							
1) Temporary road bridge	m	8	183,810	45,950	1,470,480	367,600	1,838,080
3) Removal of existing structure	m ³	50	2,930	1,250	146,500	62,500	209,000
4) Site preparatory works	LS	5% of 2. + 3.			455,079	165,738	620,817
5) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				2,132,659	621,818	2,754,477
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	38	16,560	6,160	629,280	234,080	863,360
2) Dewatering	day	95	3,730	1,170	354,350	111,150	465,500
3) Excavation for Bridge substructures	m ³	760	230	130	174,800	98,800	273,600
4) Backfilling with borrowed material	m ³	95	760	280	72,200	26,600	98,800
5) Backfilling with excavated material	m ³	665	210	90	139,650	59,850	199,500
6) Disposal of excavated material	m ³	95	300	100	28,500	9,500	38,000
7) Insitu pile foundation (dia 600 mm)	m	257	16,850	5,850	4,330,450	1,503,450	5,833,900
8) Gravel bedding	m ²	90	260	130	23,400	11,700	35,100
9) Leveling concrete	m ³	29	5,090	2,400	147,610	69,600	217,210
10) Concrete (structure)	m ³	124	6,070	2,590	752,680	321,160	1,073,840
11) Form (structure)	m ²	219	670	380	146,730	83,220	229,950
12) Reinforcing bar	kg	12,350	60	30	741,000	370,500	1,111,500
13) Miscellaneous	LS	3% of 1) - 12)			203,990	75,873	279,863
	sub-total				7,744,640	2,975,483	10,720,123
3 Superstructure							
1) Procurement of PC beam (L= 13 m, 15 nos)	LS	1			757,770	189,440	947,210
2) Installation of PC Beam (L = 13 m) Crane	nos	15	11,870	2,970	178,050	44,550	222,600
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2)			421,119	105,296	526,415
	sub-total				1,356,939	339,286	1,696,225
	Total				11,234,237	3,936,587	15,170,825
Bridge D2							
1 Temporary Works							
1) Temporary road bridge	m	8	183,810	45,950	1,470,480	367,600	1,838,080
2) Removal of existing structure	m ³	45	2,930	1,250	131,850	56,250	188,100
3) Site preparatory works	LS	5% of 2. + 3.			280,458	102,401	382,860
4) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				1,943,388	552,231	2,495,620
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	20	16,560	6,160	331,200	123,200	454,400
2) Dewatering	day	90	3,730	1,170	335,700	105,300	441,000
3) Excavation for Bridge substructures	m ³	550	230	130	126,500	71,500	198,000
4) Backfilling with borrowed material	m ³	50	760	280	38,000	14,000	52,000
5) Backfilling with excavated material	m ³	400	210	90	84,000	36,000	120,000
6) Disposal of excavated material	m ³	150	300	100	45,000	15,000	60,000
7) Insitu pile foundation (dia 600 mm)	m	150	16,850	5,850	2,527,500	877,500	3,405,000
8) Gravel bedding	m ²	50	260	130	13,000	6,500	19,500
9) Leveling concrete	m ³	15	5,090	2,400	76,350	36,000	112,350
10) Concrete (structure)	m ³	85	6,070	2,590	515,950	220,150	736,100
11) Form (structure)	m ²	100	670	380	67,000	38,000	105,000
12) Reinforcing bar	kg	8,500	60	30	510,000	255,000	765,000
13) Miscellaneous	LS	3% of 1) - 12)			124,806	46,295	171,101
	sub-total				4,795,006	1,844,445	6,639,451
3 Superstructure							
1) Procurement of PC beam (L= 13 m, 9 nos)	LS	1			454,660	113,670	568,330
2) Installation of PC Beam (L = 13 m) Crane	nos	9	11,870	2,970	106,830	26,730	133,560
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2)			252,671	63,180	315,851
	sub-total				814,161	203,580	1,017,741
	Total				7,552,555	2,600,256	10,152,811
Bridge D3							
1 Temporary Works							
1) Removal of existing structure	m ³	35	2,930	1,250	102,550	43,750	146,300
2) Site preparatory works	LS	5% of 2. + 3.			207,534	76,152	283,686
3) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
	sub-total				370,684	145,882	516,566
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	15	16,560	6,160	248,400	92,400	340,800
2) Dewatering	day	68	3,730	1,170	253,640	79,560	333,200
3) Excavation for Bridge substructures	m ³	413	230	130	94,990	53,690	148,680
4) Backfilling with borrowed material	m ³	38	760	280	28,880	10,640	39,520
5) Backfilling with excavated material	m ³	300	210	90	63,000	27,000	90,000
6) Disposal of excavated material	m ³	113	300	100	33,900	11,300	45,200

Table 2.2.5 Breakdown of the Direct Construction Cost (7/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
7) Insitu pile foundation (dia 600 mm)	m	113	16,850	5,850	1,904,050	661,050	2,565,100
8) Gravel bedding	m ²	38	260	130	9,880	4,940	14,820
9) Leveling concrete	m ³	11	5,090	2,400	55,990	26,400	82,390
10) Concrete (structure)	m ³	64	6,070	2,590	388,480	165,760	554,240
11) Form (structure)	m ²	75	670	380	50,250	28,500	78,750
12) Reinforcing bar	kg	6,375	60	30	382,500	191,250	573,750
13) Miscellaneous	LS	3% of 1) - 12)			93,944	34,837	128,781
sub-total					3,607,904	1,387,327	4,995,231
3 Superstructure							
1) Procurement of PC beam (L = 13 m, 6 nos)	LS	1			303,110	75,780	378,890
2) Installation of PC Beam (L = 13 m) Crane	nos	6	11,870	2,970	71,220	17,820	89,040
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2)			168,449	42,120	210,569
sub-total					542,779	135,720	678,499
Total					4,521,366	1,668,930	6,190,296
Bridge D4							
1 Temporary Works							
1) Temporary road bridge	m	30	183,810	45,950	5,514,300	1,378,500	6,892,800
2) Removal of existing structure	m ³	400	2,930	1,250	1,172,000	500,000	1,672,000
3) Site preparatory works	LS	5% of 2. + 3.			869,314	317,633	1,186,947
4) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					7,616,214	2,222,113	9,838,327
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	54	16,560	6,160	894,240	332,640	1,226,880
2) Dewatering	day	90	3,730	1,170	335,700	105,300	441,000
3) Excavation for Bridge substructures	m ³	1,476	230	130	339,480	191,880	531,360
4) Backfilling with borrowed material	m ³	207	760	280	157,320	57,960	215,280
5) Backfilling with excavated material	m ³	900	210	90	189,000	81,000	270,000
6) Disposal of excavated material	m ³	576	300	100	172,800	57,600	230,400
7) Insitu pile foundation (dia 600 mm)	m	405	16,850	5,850	6,824,250	2,369,250	9,193,500
8) Gravel bedding	m ²	180	260	130	46,800	23,400	70,200
9) Leveling concrete	m ³	54	5,090	2,400	274,860	129,600	404,460
10) Concrete (structure)	m ³	315	6,070	2,590	1,912,050	815,850	2,727,900
11) Form (structure)	m ²	522	670	380	349,740	198,360	548,100
12) Reinforcing bar	kg	31,500	60	30	1,890,000	945,000	2,835,000
13) Miscellaneous	LS	3% of 1) - 12)			344,887	130,885	475,772
sub-total					13,731,127	5,438,725	19,169,852
3 Superstructure							
1) Procurement of PC beam (L = 13 m, 40 nos)	LS	1			2,045,990	511,500	2,557,490
2) Installation of PC Beam (L = 13 m) Crane	nos	40	11,870	2,970	474,800	118,800	593,600
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2)			1,134,356	283,635	1,417,991
sub-total					3,655,146	913,935	4,569,081
Total					25,002,486	8,574,773	33,577,260
Bridge D5							
1 Temporary Works							
1) Removal of existing structure	m ³	60	2,930	1,250	175,800	75,000	250,800
2) Site preparatory works	LS	5% of 2. + 3.			399,872	146,335	546,207
3) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					636,272	247,315	883,587
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	24	16,560	6,160	397,440	147,840	545,280
2) Dewatering	day	108	3,730	1,170	402,840	126,360	529,200
3) Excavation for Bridge substructures	m ³	756	230	130	173,880	98,280	272,160
4) Backfilling with borrowed material	m ³	108	760	280	82,080	30,240	112,320
5) Backfilling with excavated material	m ³	480	210	90	100,800	43,200	144,000
6) Disposal of excavated material	m ³	276	300	100	82,800	27,600	110,400
7) Insitu pile foundation (dia 600 mm)	m	216	16,850	5,850	3,639,600	1,263,600	4,903,200
8) Gravel bedding	m ²	84	260	130	21,840	10,920	32,760
9) Leveling concrete	m ³	24	5,090	2,400	122,160	57,600	179,760
10) Concrete (structure)	m ³	126	6,070	2,590	764,820	326,340	1,091,160
11) Form (structure)	m ²	150	670	380	100,500	57,000	157,500
12) Reinforcing bar	kg	12,600	60	30	756,000	378,000	1,134,000
13) Miscellaneous	LS	3% of 1) - 12)			176,663	65,669	242,332
sub-total					6,821,423	2,632,649	9,454,072
3 Superstructure							
1) Procurement of PC beam (L = 13 m, 13 nos)	LS	1			656,740	164,180	820,920
2) Installation of PC Beam (L = 13 m) Crane	nos	13	11,870	2,970	154,310	38,610	192,920
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2)			364,973	91,256	456,228
sub-total					1,176,023	294,046	1,470,068
Total					8,633,718	3,174,010	11,807,727
Bridge D6							
1 Temporary Works							
1) Temporary road bridge	m	6	183,810	45,950	1,102,860	275,700	1,378,560

Table 2.2.5 Breakdown of the Direct Construction Cost (8/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
2) Removal of existing structure	m ³	20	2,930	1,250	58,600	25,000	83,600
3) Site preparatory works	LS	5% of 2. + 3.			244,840	91,634	336,474
4) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					1,466,900	418,314	1,885,214
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	36	16,560	6,160	596,160	221,760	817,920
2) Dewatering	day	60	3,730	1,170	223,800	70,200	294,000
3) Excavation for Bridge substructures	m ³	425	230	130	97,750	55,250	153,000
4) Backfilling with borrowed material	m ³	35	760	280	26,600	9,800	36,400
5) Backfilling with excavated material	m ³	300	210	90	63,000	27,000	90,000
6) Disposal of excavated material	m ³	125	300	100	37,500	12,500	50,000
7) Insitu pile foundation (dia 600 mm)	m	120	16,850	5,850	2,022,000	702,000	2,724,000
8) Gravel bedding	m ²	55	260	130	14,300	7,150	21,450
9) Leveling concrete	m ³	16	5,090	2,400	81,440	38,400	119,840
10) Concrete (structure)	m ³	80	6,070	2,590	485,600	207,200	692,800
11) Form (structure)	m ²	165	670	380	110,550	62,700	173,250
12) Reinforcing bar	kg	8,000	60	30	480,000	240,000	720,000
13) Miscellaneous	LS	3% of 1) - 12)			112,761	42,419	155,180
sub-total					4,351,461	1,696,379	6,047,840
3 Superstructure							
1) Procurement of PC beam (L= 9 m, 10 nos)	LS	1			321,590	80,403	401,993
2) Installation of PC Beam (L = 13 m) Crane	nos	10	5,450	1,360	54,500	13,600	68,100
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2))			169,241	42,301	211,542
sub-total					545,331	136,304	681,635
Total					6,363,691	2,250,997	8,614,688
Culvert D7							
4 Culvert and Sluiceway							
4.1 Temporary Works							
1) Temporary diversion	m	20	18,720	7,350	374,400	147,000	521,400
2) Temporary road bridge	m	4	183,810	45,950	735,240	183,800	919,040
3) Dewatering	day	30	3,730	1,170	111,900	35,100	147,000
4) Removal of existing structure	m ³	25	2,930	1,250	73,250	31,250	104,500
5) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					1,335,690	414,690	1,750,380
4.2 Earth Work							
1) Excavation for Structures	m ³	55	180	70	9,900	3,850	13,750
2) Backfilling with borrowed material	m ³	60	760	280	45,600	16,800	62,400
3) Disposal of excavated material	m ³	55	300	100	16,500	5,500	22,000
sub-total					72,000	26,150	98,150
4.3 Foundation							
1) Piling (PC Pile, 350 x 350)	m	59	10,800	4,250	637,200	250,750	887,950
2) Gravel bedding (t = 20 cm)	m ²	0	260	130	0	0	0
3) Leveling concrete	m ³	2	5,090	2,400	10,180	4,800	14,980
sub-total					647,380	255,550	902,930
4.4 Structure							
1) Concrete (structure)	m ³	25	6,070	2,590	151,750	64,750	216,500
2) Form (structure)	m ²	125	670	380	83,750	47,500	131,250
3) Reinforcing bar	kg	2,000	60	30	120,000	60,000	180,000
sub-total					355,500	172,250	527,750
4.5 Pavement							
1) Sub base course (t = 400 mm)	m ³	18	780	340	14,040	6,120	20,160
2) Base course (t = 200 mm)	m ³	9	830	350	7,470	3,150	10,620
3) Asphalt pavement (t = 50 mm)	m ²	45	820	350	36,900	15,750	52,650
sub-total					58,410	25,020	83,430
4.7 Other							
1) Gabion for riverbank protection	m ³	0	3,490	1,590	0	0	0
2) Miscellaneous for culvert	LS	5% of 4.1-4.5			123,449	44,683	168,132
sub-total					123,449	44,683	168,132
Total					2,592,429	938,343	3,530,772
Grand Total 2.2					150,682,213	57,871,240	208,553,452
2.3 Nugegoda Ela							
River Improvement							
1 Temporary Works							
1) Coffering	m	1,150	1,080	810	1,242,000	931,500	2,173,500
2) Temporary Sheet Pile (L = 5 m)	m	450	12,660	4,370	5,697,000	1,966,500	7,663,500
3) Dewatering for Bank protection work	m	2,250	2,950	1,000	6,637,500	2,250,000	8,887,500
4) Removal of existing structure	m ³	50	2,930	1,250	146,500	62,500	209,000
5) Clearing and Grubbing	m ²	12,800	40	30	512,000	384,000	896,000
6) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					14,275,900	5,612,040	19,887,940
2 River Channel Excavation							

Table 2.2.5 Breakdown of the Direct Construction Cost (9/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
1) Excavation (normal)	m ³	31,000	180	70	5,580,000	2,170,000	7,750,000
2) Disposal of excavated material	m ³	31,000	300	100	9,300,000	3,100,000	12,400,000
sub-total					14,880,000	5,270,000	20,150,000
3 Bank Protection (Gabion)							
1) Gabion Work (H = 2 m)	m	1,240	15,630	7,070	19,381,200	8,766,800	28,148,000
2) Backfill with borrowed material	m ³	26,000	760	280	19,760,000	7,280,000	27,040,000
sub-total					39,141,200	16,046,800	55,188,000
4 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	5% of 1.1-1.4			3,414,855	1,346,442	4,761,297
sub-total					3,414,855	1,346,442	4,761,297
Total					71,711,955	28,275,282	99,987,237
Inspection Road							
1 Dike Construction							
1) Embankment for Dike with borrowed material	m ³	4,800	590	190	2,832,000	912,000	3,744,000
2) Turfing	m ²	3,200	80	40	256,000	128,000	384,000
3) Other (equipment mobilization/demobilization)	LS	1	21,200	9,100	21,200	9,100	30,300
sub-total					3,109,200	1,049,100	4,158,300
2 Road Work							
1) Laterite pavement with base course	m ²	4,700	300	110	1,410,000	517,000	1,927,000
2) Side Drain	m	1,870	600	560	1,122,000	1,047,200	2,169,200
3) Drain sluiceway (1 nos per 100 m)	nos	32	63,030	37,030	2,016,960	1,184,960	3,201,920
sub-total					4,548,960	2,749,160	7,298,120
Total					7,658,160	3,798,260	11,456,420
Bridge NE1							
1 Temporary Works							
1) Temporary road bridge	m	6	183,810	45,950	1,102,860	275,700	1,378,560
2) Temporary work stage	m ²	0	26,880	9,500	0	0	0
3) Removal of existing structure	m ³	80	2,930	1,250	234,400	100,000	334,400
4) Site preparatory works	LS	5% of 2. + 3.			372,335	123,689	496,025
5) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					1,770,195	525,369	2,295,565
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	36	16,560	6,160	596,160	221,760	817,920
2) Dewatering	day	60	3,730	1,170	223,800	70,200	294,000
3) Excavation for Bridge substructures	m ³	425	230	130	97,750	55,250	153,000
4) Backfilling with borrowed material	m ³	35	760	280	26,600	9,800	36,400
5) Backfilling with excavated material	m ³	300	210	90	63,000	27,000	90,000
6) Disposal of excavated material	m ³	125	300	100	37,500	12,500	50,000
7) Insitu pile foundation (dia 600 mm)	m	120	16,850	5,850	2,022,000	702,000	2,724,000
8) Gravel bedding	m ²	55	260	130	14,300	7,150	21,450
9) Leveling concrete	m ³	16	5,090	2,400	81,440	38,400	119,840
10) Concrete (structure)	m ³	80	6,070	2,590	485,600	207,200	692,800
11) Form (structure)	m ²	165	670	380	110,550	62,700	173,250
12) Reinforcing bar	kg	8,000	60	30	480,000	240,000	720,000
13) Miscellaneous	LS	3% of 1) - 12)			127,161	49,619	176,780
sub-total					4,365,861	1,703,579	6,069,440
3 Superstructure							
1) Fabrication of PC Beam (L = 19 m, 11 nos)	LS	1			1,305,580	326,390	1,631,970
2) Installation of PC Beam (L = 19 m, 11 nos) Girder	LS	1			1,064,300	266,080	1,330,380
3) Miscellaneous bridge work (L = 17-28 m)	LS	30% of (1)+2)			710,964	177,741	888,705
sub-total					3,080,844	770,211	3,851,055
3.4 Others							
1) Gabion for riverbank protection beside bridge	m ³	120	3,490	1,590	418,800	190,800	609,600
sub-total					418,800	190,800	609,600
Total					9,635,700	3,189,959	12,825,660
Bridge NE2							
1 Temporary Works							
1) Removal of existing structure	m ³	70	2,930	1,250	205,100	87,500	292,600
2) Site preparatory works	LS	5% of 2. + 3.			121,852	47,729	169,582
3) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					387,552	161,209	548,762
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	30	16,560	6,160	496,800	184,800	681,600
2) Dewatering	day	60	3,730	1,170	223,800	70,200	294,000
3) Excavation for Bridge substructures	m ³	530	230	130	121,900	68,900	190,800
4) Backfilling with borrowed material	m ³	75	760	280	57,000	21,000	78,000
5) Backfilling with excavated material	m ³	400	210	90	84,000	36,000	120,000
6) Disposal of excavated material	m ³	130	300	100	39,000	13,000	52,000
7) Insitu pile foundation (dia 600 mm)	m	0	16,850	5,850	0	0	0
8) Gravel bedding	m ²	46	260	130	11,960	5,980	17,940
9) Leveling concrete	m ³	14	5,090	2,400	71,260	33,600	104,860
10) Concrete (structure)	m ³	70	6,070	2,590	424,900	181,300	606,200

Table 2.2.5 Breakdown of the Direct Construction Cost (10/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
11) Form (structure)	m ²	90	670	380	60,300	34,200	94,500
12) Reinforcing bar	kg	5,600	60	30	336,000	168,000	504,000
13) Miscellaneous	LS	3% of 1) - 12)			57,808	24,509	82,317
sub-total					1,984,728	841,489	2,826,217
3 Superstructure							
1) Procurement of PC beam (L = 13 m, 5 nos)	LS	1			252,590	63,150	315,740
3) Installation of PC Beam (L = 12 m) Crane	nos	5	11,870	2,970	59,350	14,850	74,200
5) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+3)			140,373	35,100	175,473
sub-total					452,313	113,100	565,413
Total					2,824,593	1,115,799	3,940,392
Bridge NE3							
1 Temporary Works							
1) Removal of existing structure	m ³	50	2,930	1,250	146,500	62,500	209,000
2) Site preparatory works	LS	5% of 2. + 3.			320,563	119,186	439,749
3) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					527,663	207,666	735,329
2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	30	16,560	6,160	496,800	184,800	681,600
2) Dewatering	day	30	3,730	1,170	111,900	35,100	147,000
4) Excavation for Bridge substructures	m ³	670	230	130	154,100	87,100	241,200
4) Backfilling with borrowed material	m ³	90	760	280	68,400	25,200	93,600
5) Backfilling with excavated material	m ³	500	210	90	105,000	45,000	150,000
6) Disposal of excavated material	m ³	170	300	100	51,000	17,000	68,000
7) Insitu pile foundation (dia 600 mm)	m	180	16,850	5,850	3,033,000	1,053,000	4,086,000
8) Gravel bedding	m ²	68	260	130	17,680	8,840	26,520
9) Leveling concrete	m ²	20	5,090	2,400	101,800	48,000	149,800
10) Concrete (structure)	m ³	100	6,070	2,590	607,000	259,000	866,000
11) Form (structure)	m ²	220	670	380	147,400	83,600	231,000
12) Reinforcing bar	kg	9,000	60	30	540,000	270,000	810,000
13) Miscellaneous	LS	3% of 1) - 12)			163,022	63,499	226,522
sub-total					5,597,102	2,180,139	7,777,242
3 Superstructure							
1) Procurement of PC beam (L = 13 m, 9 nos)	LS	1			454,660	113,670	568,330
3) Installation of PC Beam (L = 13 m) Crane	nos	9	11,870	2,970	106,830	26,730	133,560
5) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+3)			252,671	63,180	315,851
sub-total					814,161	203,580	1,017,741
Total					6,938,926	2,591,385	9,530,311
Nugegoda Ela Retention Area							
1 Periphery Canal							
1) Periphery Canal and Path way	m	5,200	560	1,480	2,912,000	7,696,000	10,608,000
sub-total					2,912,000	7,696,000	10,608,000
Total					2,912,000	7,696,000	10,608,000
Grand Total 2.3					101,681,334	46,666,685	148,348,019
Total of 2. Nugegoda-Rattanapitiya Scheme					482,356,249	192,819,694	675,175,943
3. Bolgoda Canal Scheme							
BC1							
1 Temporary Works							
1) Removal of existing structure	m ³	50	2,930	1,250	146,500	62,500	209,000
2) Clearing and Grubbing	m ²	27,720	40	30	1,108,800	831,600	1,940,400
3) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					1,296,200	911,640	2,207,840
2 River Channel Excavation							
1) Excavation (normal) (within 6 m from the river ba	m ³	17,440	180	70	3,139,200	1,220,800	4,360,000
2) Excavation (underwater)	m ³	4,360	450	140	1,962,000	610,400	2,572,400
3) Disposal of excavated material	m ³	21,800	300	100	6,540,000	2,180,000	8,720,000
sub-total					11,641,200	4,011,200	15,652,400
3 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	1	5% of 1.1-1.4		646,870	246,142	893,012
sub-total					646,870	246,142	893,012
Total					13,584,270	5,168,982	18,753,252
Inspection Road							
2.1 Dike Construction							
1) Embankment for Dike with borrowed material	m ³	3,150	590	190	1,858,500	598,500	2,457,000
2) Turfing	m ²	2,200	80	40	176,000	88,000	264,000
3) Other (equipment mobilization/demobilization)	LS	1	21,200	9,100	21,200	9,100	30,300
sub-total					2,055,700	695,600	2,751,300
2.2 Road Work							
1) Laterite pavement with base course	m ²	3,000	300	110	900,000	330,000	1,230,000
2) Side Drain	m	990	600	560	594,000	554,400	1,148,400

Table 2.2.5 Breakdown of the Direct Construction Cost (11/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
3) Drain sluiceway (1 nos per 100 m)	nos	20	63,030	37,030	1,260,600	740,600	2,001,200
sub-total					2,754,600	1,625,000	4,379,600
Total					4,810,300	2,320,600	7,130,900
BC2							
1 Temporary Works							
1) Removal of existing structure	m ³	50	2,930	1,250	146,500	62,500	209,000
2) Clearing and Grubbing	m ²	26,320	40	30	1,052,800	789,600	1,842,400
3) Other (equipment mobilization/demobilization)	LS	1			0	0	0
sub-total					1,199,300	852,100	2,051,400
2 River Channel Excavation							
1) Excavation (normal)	m ³	9,840	180	70	1,771,200	688,800	2,460,000
2) Excavation (underwater)	m ³	2,460	450	140	1,107,000	344,400	1,451,400
3) Disposal of excavated material	m ³	12,300	300	100	3,690,000	1,230,000	4,920,000
sub-total			40,900	17,540	6,568,200	2,263,200	8,831,400
3 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	1	5% of 1.1-1.4		388,375	155,765	544,140
sub-total					388,375	155,765	544,140
Total					8,155,875	3,271,065	11,426,940
Inspection Road							
1 Dike Construction							
1) Embankment for Dike with borrowed material	m ³	1,650	590	190	973,500	313,500	1,287,000
2) Turfing	m ²	1,000	80	40	80,000	40,000	120,000
3) Other (equipment mobilization/demobilization)	LS	1	21,200	9,100	21,200	9,100	30,300
sub-total					1,074,700	362,600	1,437,300
2 Road Work							
1) Laterite pavement with base course	m ²	800	300	110	240,000	88,000	328,000
2) Side Drain	m	470	600	560	282,000	263,200	545,200
3) Drain sluiceway (1 nos per 100 m)	nos	10	63,030	37,030	630,300	370,300	1,000,600
sub-total					1,152,300	721,500	1,873,800
Total					2,227,000	1,084,100	3,311,100
BC3							
1 Temporary Works							
1) Coffering	m	950	1,080	810	1,026,000	769,500	1,795,500
2) Dewatering for Bank protection work	m	950	2,950	1,000	2,802,500	950,000	3,752,500
3) Removal of existing structure	m ³	100	2,930	1,250	293,000	125,000	418,000
4) Clearing and Grubbing	m ²	15,200	40	30	608,000	456,000	1,064,000
5) Other (equipment mobilization/demobilization)	LS	1	40,900	17,540	40,900	17,540	58,440
sub-total					4,770,400	2,318,040	7,088,440
2 River Channel Excavation							
1) Excavation (normal)	m ³	33,700	180	70	6,066,000	2,359,000	8,425,000
2) Disposal of excavated material	m ³	33,700	300	100	10,110,000	3,370,000	13,480,000
sub-total					16,176,000	5,729,000	21,905,000
3 Miscellaneous							
1) Relocation/Reinforcement of existing facilities	LS	1	5% of 1.1-1.4		1,047,320	402,352	1,449,672
sub-total					1,047,320	402,352	1,449,672
Total					21,993,720	8,449,392	30,443,112
Inspection Road							
1 Dike Construction							
1) Embankment for Dike with borrowed material	m ³	2,900	590	190	1,711,000	551,000	2,262,000
2) Turfing	m ²	2,700	80	40	216,000	108,000	324,000
3) Other (equipment mobilization/demobilization)	LS	1	21,200	9,100	21,200	9,100	30,300
sub-total					1,948,200	668,100	2,616,300
2 Road Work							
1) Laterite pavement with base course	m ²	3,700	300	110	1,110,000	407,000	1,517,000
2) Side Drain	m	1,200	600	560	720,000	672,000	1,392,000
3) Drain sluiceway (1 nos per 100 m)	nos	19	63,030	37,030	1,197,570	703,570	1,901,140
sub-total					3,027,570	1,782,570	4,810,140
Total					4,975,770	2,450,670	7,426,440
Bridge BC1							
1 Temporary Works							
1) Temporary road bridge	m	34	183,810	45,950	6,249,540	1,562,300	7,811,840
2) Removal of existing structure	m ³	300	2,930	1,250	879,000	375,000	1,254,000
3) Site preparatory works	LS	5% of 2. + 3.			1,095,280	387,123	1,482,402
4) Other (equipment mobilization/demobilization)	LS	1	60,600	25,980	60,600	25,980	86,580
sub-total					8,284,420	2,350,403	10,634,822
3.2 Substructure							
1) Temporary Sheet Piling (L = 9 m)	m	57	16,560	6,160	943,920	351,120	1,295,040
2) Dewatering	day	150	3,730	1,170	559,500	175,500	735,000
3) Excavation for Bridge substructures	m ³	585	230	130	134,550	76,050	210,600
4) Backfilling with borrowed material	m ³	150	760	280	114,000	42,000	156,000
5) Backfilling with excavated material	m ³	300	210	90	63,000	27,000	90,000
6) Disposal of excavated material	m ³	285	300	100	85,500	28,500	114,000

Table 2.2.5 Breakdown of the Direct Construction Cost (12/12)

Item	Unit	Quantity	Unit Cost (Rs.)		Cost (Rs.)		
			FC	LC	FC	LC	Total
7) Insitu pile foundation (dia 600 mm)	m	315	16,850	5,850	5,307,750	1,842,750	7,150,500
8) Gravel bedding	m ²	90	260	130	23,400	11,700	35,100
9) Leveling concrete	m ³	27	5,090	2,400	137,430	64,800	202,230
10) Concrete (structure)	m ³	105	6,070	2,590	637,350	271,950	909,300
11) Form (structure)	m ²	248	670	380	166,160	94,240	260,400
12) Reinforcing bar	kg	10,500	60	30	630,000	315,000	945,000
13) Miscellaneous	LS	3% of 1) - 12)			264,077	99,018	363,095
sub-total					9,066,637	3,399,628	12,466,265
3.3 Superstructure							
1) Procurement of PC beam (L = 16 m, 16 nos)	LS	1			1,086,560	271,640	1,358,200
2) Installation of PC Beam (L = 13 m) Crane	nos	16	13,390	3,350	214,240	53,600	267,840
3) Miscellaneous bridge work (L = 4-16 m)	LS	45% of (1)+2))			585,360	146,358	731,718
sub-total					1,886,160	471,598	2,357,758
3.4 Others							
1) Gabion for riverbank protection beside bridge	m ³	60	3,490	1,590	209,400	95,400	304,800
sub-total					209,400	95,400	304,800
Total					19,446,616	6,317,029	25,763,645
Bellawila-Attidiya Marsh Retention Area							
1 Periphery Canal							
1) Periphery Canal and Path way	m	4,400	560	1,480	2,464,000	6,512,000	8,976,000
sub-total					2,464,000	6,512,000	8,976,000
Total					2,464,000	6,512,000	8,976,000
Total of 3. Bolgoda Canal Scheme					77,657,551	35,573,838	113,231,389
4. Ratmalana-Moratuwa Scheme							
Urban Drainage							
1 Concrete Flume with Cover Slab							
B = 0.8, H = 0.8	m	490	39,560	16,950	19,384,400	8,305,500	27,689,900
B = 0.9, H = 0.9	m	662	43,320	18,570	28,677,840	12,293,340	40,971,180
B = 1.0, H = 1.0	m	556	47,090	20,180	26,182,040	11,220,080	37,402,120
B = 1.1, H = 1.1	m	836	50,860	21,790	42,518,960	18,216,440	60,735,400
B = 1.2, H = 1.2	m	1,790	54,620	23,410	97,769,800	41,903,900	139,673,700
B = 1.3, H = 1.3	m	854	58,390	25,020	49,865,060	21,367,080	71,232,140
B = 1.3, H = 1.4	m	464	62,160	26,640	28,842,240	12,360,960	41,203,200
B = 1.5, H = 1.5	m	592	67,110	28,760	39,729,120	17,025,920	56,755,040
B = 2.0, H = 1.5	m	148	76,220	32,670	11,280,560	4,835,160	16,115,720
sub-total					344,250,020	147,528,380	491,778,400
2 Masonry Channel							
B = 1.0, H = 1.0	m	1,076	21,840	5,460	23,499,840	5,874,960	29,374,800
B = 1.5, H = 1.0	m	724	22,240	5,560	16,101,760	4,025,440	20,127,200
B = 1.5, H = 1.5	m	656	26,480	6,620	17,370,880	4,342,720	21,713,600
B = 2.0, H = 1.5	m	216	26,880	6,720	5,806,080	1,451,520	7,257,600
B = 3.0, H = 1.5	m	128	27,680	6,920	3,543,040	885,760	4,428,800
sub-total					66,321,600	16,580,400	82,902,000
3 Earth Open Channel with Gabion							
B = 3.0, H = 1.5	m	46	48,000	12,000	2,208,000	552,000	2,760,000
B = 5.0, H = 1.5	m	642	49,360	12,340	31,689,120	7,922,280	39,611,400
B = 6.0, H = 1.5	m	100	50,320	12,580	5,032,000	1,258,000	6,290,000
sub-total					38,929,120	9,732,280	48,661,400
4 Earth Open Channel							
B = 2.0, H = 1.5	m	320	8,480	2,120	2,713,600	678,400	3,392,000
B = 5.0, H = 1.5	m	104	10,800	2,700	1,123,200	280,800	1,404,000
B = 6.0, H = 1.5	m	712	11,760	2,940	8,373,120	2,093,280	10,466,400
sub-total					12,209,920	3,052,480	15,262,400
Total					461,710,660	176,893,540	638,604,200
Total of 4. Ratmalana-Moratuwa Scheme					461,710,660	176,893,540	638,604,200
Total Direct Construction Cost of the Project					1,247,545,249	486,682,825	1,734,228,074

Table 2.2.6 Land Acquisition Cost

No.	DS Division	Land Type	Unit Price (Rs./m ²)	Req. Area (m ²)	Land Cost (Rs.)
1. Weras Ganaga Scheme					
Flood Protection Wall	Moratuwa	L	940	9,500	8,930,000
Retention Area (Weras Ganga)	Kesbewa, Dehiwala - Mt. Lavinia	R	200	650,000	130,000,000
Retention Area (Maha Ela)	Kesbewa, Dehiwala - Mt. Lavinia	R	200	1,060,000	212,000,000
Total 1.					350,930,000
2. Nugegoda-Rattanaipitiya Scheme					
2.1 Rattanaipitiya Ela Improvement					
RE1	Kesbewa	R	200	9,000	1,800,000
RE2	Kesbewa	R	200	9,000	1,800,000
RE3	Kesbewa	L	540	15,000	8,100,000
Total 2.1					11,700,000
2.2 Delkanda Ela Improvement					
D1	Kesbewa	R	200	5,700	1,140,000
D2	Kesbewa	L	540	4,250	2,295,000
D3	Kesbewa	O	1,190	1,600	1,904,000
Retention Area	Kesbewa	R	200	90,000	18,000,000
Total 2.2					23,339,000
2.3 Nugegoda Ela Improvement					
N1	Kesbewa	R	200	18,050	3,610,000
N2	Kesbewa	O	1,190	1,100	1,309,000
N3	Kesbewa	R	200	4,275	855,000
Retention Area	Kesbewa	R	200	270,000	54,000,000
Total 2.3					59,774,000
Total 2.					94,813,000
3. Bolgoda Canal Scheme					
BC1	Dehiwala-Mt.Lavinia	R	200	24,000	4,800,000
BC2	Dehiwala-Mt.Lavinia	R	200	4,400	880,000
BC3	Dehiwala-Mt.Lavinia	R	200	3,200	640,000
Retention Area	Kesbewa, Dehiwala - Mt. Lavinia	R	200	880,000	176,000,000
Total 3.					182,320,000
4. Ratmalama-Moratuwa Scheme					
Urban Drainage Area	Moratuwa	O	2,620	1,600	4,192,000
Kandawala Pond	Moratuwa	R	200	30,000	6,000,000
Telewala Pond	Moratuwa	R	200	100,000	20,000,000
Total 4.					30,192,000
Total 1.+2.+3.+4.					658,255,000

Note: O: Ordinary Residential Area, L: Low Level Residential Area, R: Rural Area
Unit cost is derived from the data of the Valuation Department

Table 2.2.7 Compensation Cost for House Relocation(Unit: x 10³ Rs.)

	Floor Area (m ²)				Total Cost
	< 70	70-100	100<	Factory, etc.	
Unit value (x 10 ³ Rs. / house)	675	840	1,500	3,000	
1. Weras Ganga Scheme	19	10	7	1	
	12,825	8,400	10,500	3,000	34,725
2. Nugegoda-Rattanapitiya Scheme	30	28	40	4	
	20,250	23,520	60,000	12,000	115,770
3. Bolgoda Canal Scheme	1	1	1	0	
	675	840	1,500	0	3,015
4. Ratmalana-Moratuwa Scheme	6	8	2	5	
	4,050	6,720	3,000	15,000	28,770
Total	37,800	39,480	75,000	30,000	182,280

Table 2.2.8 Cost for Procurement of O&M Equipment

(Unit: Rs.)

Item	Qty	Unit Price (CIF Value)		Amount (CIF Value)		
		FC	LC	FC	LC	Total
Grab dredger and pontoon (0.5m ³)	1	11,896,710	237,930	11,896,710	237,930	12,134,640
Excavator (0.4m ²)	4	7,308,790	146,180	29,235,160	584,720	29,819,880
Dump truck (8m ³)	2	8,323,650	166,470	16,647,300	332,940	16,980,240
Skip barge (7 ton) with push boat	2	10,415,690	208,310	20,831,380	416,620	21,248,000
Tractor and trailer (45 HP, 3.5ton)	5	2,317,190	439,200	11,585,950	2,196,000	13,781,950
Diesel pump (100mm dia)	3	1,456,740	29,130	4,370,220	87,390	4,457,610
Pick-up truck (4WD double cab)	7	1,604,030	32,080	11,228,210	224,560	11,452,770
Inspection boat (25HP)	1	0	372,000	0	372,000	372,000
Diesel generator (18 KVA)	2	1,213,950	24,280	2,427,900	48,560	2,476,460
Total				108,222,830	4,500,720	112,723,550

Table 2.2.9 Total Project Cost(Unit: x 10³ Rs.)

Cost Item	FC	LC	Total
1. Construction Cost	1,372,300	535,351	1,907,651
Preparatory Works	124,755	48,668	173,423
Construction Cost	1,247,545	486,683	1,734,228
2. Land Acquisition & Compensation Cost	0	840,535	840,535
Land Acquisition	0	658,255	658,255
Compensation	0	182,280	182,280
3. Cost for Procurement of O/M Equipment	108,223	4,501	112,724
4. Engineering Service	267,071	114,459	381,530
5. Administration Cost	0	62,594	62,594
Total of (1+2+3+4+5)	1,747,594	1,557,440	3,305,034
6. Price Escalation	20,971	66,970	87,941
7. Physical Contingency	155,995	146,666	302,661
8. Tax	0	693,691	693,691
Project Cost	1,924,560	2,464,767	4,389,327

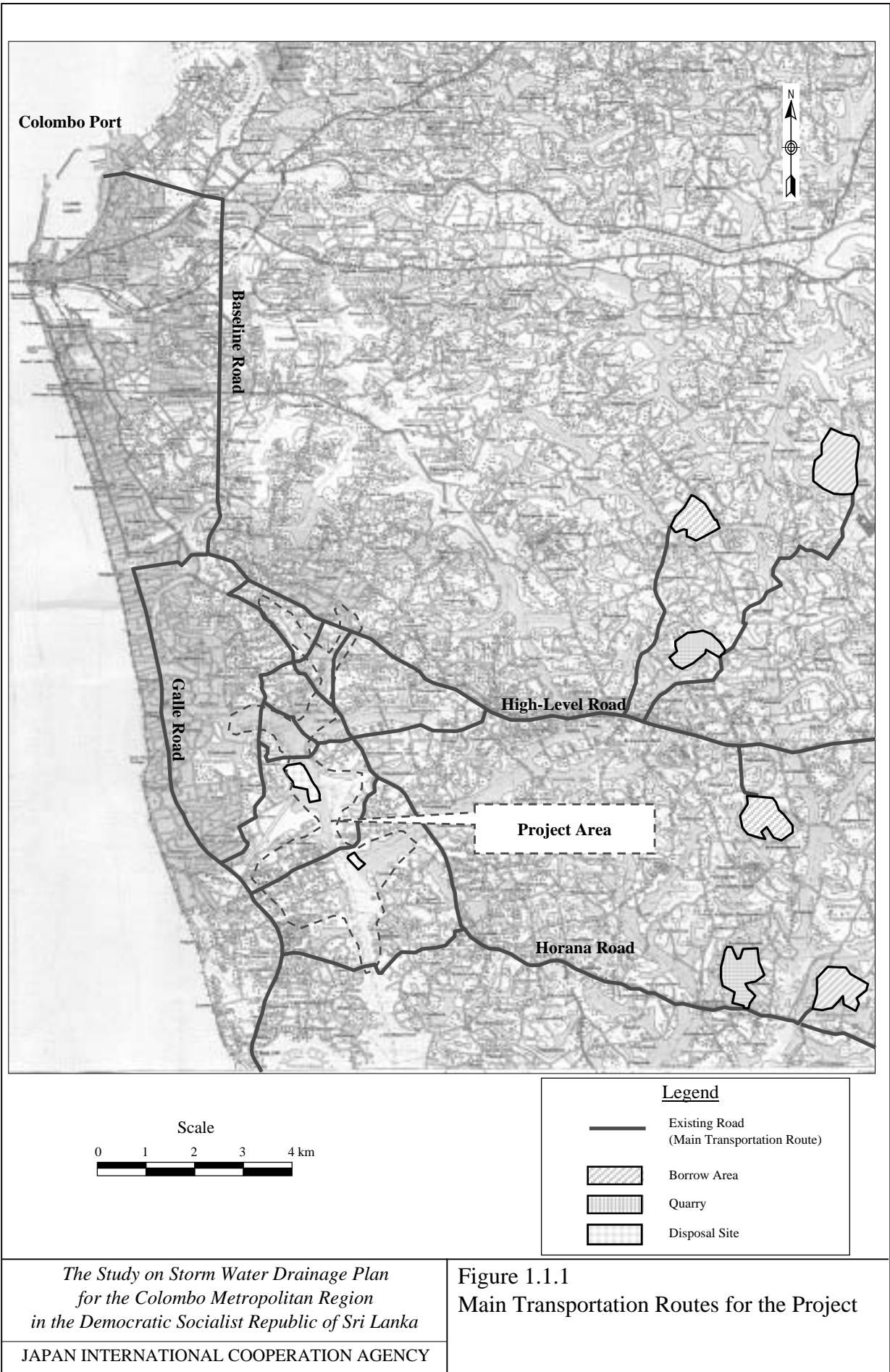
Table 2.3.1 Unit Rates of O&M Works

Type of Work	Work Item/Personnel/Equipment	Unit Rate
Dredging of main canals/ivers and channel clearing	Width of 5 to 10 m for channel clearing	200 (x10 ³ Rs./km/year)
	Width of 10 to 30 m for dredging	600 (x10 ³ Rs./km/year)
Grass cutting/clearing of canal bank and removal of surface	Surface clearing	600 (x10 ³ Rs./km/year)
	Bank maintenance	200 (x10 ³ Rs./km/year)
Maintenance of urban drains, retention ponds, and the related facilities	Maintenance of urban drainage	Rs.200,000/km/year
	Pond surface clearing	Rs.600,000/km
	O/M road maintenance	Rs.200,000/km
	Clearing of boundary	Rs.200,000/km
Inspection of drainage facilities and retention areas/ponds	Engineer	1,000 (Rs./day)
	Eng. Assistant	700 (Rs./day)
	Field Supervisor	600 (Rs./day)
	Operator/Driver	500 (Rs./day)
	Labor	300 (Rs./day)
	Secretary/Typist	300 (Rs./day)
	Pick-up track	200 (Rs./hr)
	Boat	200 (Rs./hr)

Table 2.3.2 Annual O&M Cost of the Project

O&M Works	Cost (x10 ³ Rs./year)
1. Weras Ganga Scheme	
a) Periodical dredging	1,100
b) Repair/reconstruction of bank protection	1,257
c) Grass cutting and removal of water surface weeds	7,280
d) Periodical inspection of canal and canal reservation (quarterly)	64
e) Reactive maintenance to deal with incidents and emergencies	970
f) Periodical inspection of boundary structure or marker	152
g) Periodical clearance of vegetation	4,160
h) Minor repair of the boundary structures of retention area	624
Total	15,608
2. Nugegoda - Rattanapitiya Scheme	
a) Periodical channel cleaning	2,928
b) Repair/reconstruction of bank protection	751
c) Grass cutting and removal of water surface weeds	1,952
d) Periodical cleaning of cross drains, gullies and catch pits	124
e) Periodical inspection of drainage channels	57
f) Reactive maintenance to deal with incidents and emergencies	581
g) Periodical inspection of boundary structure	114
h) Periodical clearance of vegetation in the area	2,280
i) Minor repair of the boundary structures of retention area	342
Total	9,129
3. Bolgoda Canal Scheme	
a) Periodical dredging	482
b) Repair/reconstruction of bank protection	648
c) Periodical grass cutting and removal of water surface weeds	3,840
d) Periodical inspection of drainage channels	39
e) Reactive maintenance to deal with incidents and emergencies	501
f) Periodical inspection of boundary structure	75
g) Periodical clearance of vegetation in the area	1,760
h) Minor repair of the boundary structures of retention area	264
Total	7,610
4. Ratmalana - Moratuwa Scheme	
a) Periodical Cleaning of tertiary/urban drains - DMMC area	1,320
b) Periodical Cleaning of tertiary/urban drains - Moratuwa MC area	1,500
c) Periodical cleaning of retention ponds - DMMC area	400
d) Periodical cleaning of retention ponds - Moratuwa MC area	1,120
e) Minor repair of the drainage channels and other related structures	651
f) Periodical Inspection of the drainage channels and retention pond	114
g) Reactive maintenance to deal with incidents and emergencies	511
Total	5,616

Figures



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Figure 1.1.1
Main Transportation Routes for the Project

Work Item	Work Q'ty	Month																																				Assumed Progress Rate
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
1. Preparatory Works																																						
2. Weras Ganga Scheme																																						
Dredging	142,100 m ³																																					4,200 m ³ /month x 2
Flood Protection Wall and Sluiceway	L = 2,300 m 3 nos.																																					130 m/month x 1
Periphery Canal	10,400 m																																					400 m/month x 2
3. Bolgoda Canal Scheme																																						
Channel Improvement	Excavation 67,800 m ³ Embankment 7,700 m ³																																					3,150 m ³ /month x 2 6,300 m ³ /month x 1
Maintenance Road	2,410 m																																					210m/month x 1
Bridge	1 nos																																					15 month
Periphery Canal	4,400 m																																					400 m/month x 1
4. Nugegoda-Rattanapitiya Scheme																																						
4.1 Rattanapitiya Ela																																						
Channel Improvement	Excavation 109,000 m ³ Bank protection 2,480 m Embankment 13,000 m ³																																					3,150 m ³ /month x 2 100 m/month x 2 6,300 m ³ /month x 1
Maintenance Road	2,150 m																																					210 m/month x 1
Bridge	5 nos																																					8-15 month /bridge
4.2 Delkanda Ela																																						
Channel Improvement	Excavation 37,500 m ³ Bank protection 1,840 m Embankment 5,950 m ³																																					3,150 m ³ /month x 2 130 m/month x 2 6,300 m ³ /month x 1
Maintenance Road	300 m																																					210 m/month x 1
Bridge / Culvert	7 nos																																					8-15 month /bridge 6 month/culvert
Periphery Canal	1,600 m																																					400 m/month x 1
4.3 Nugegoda Ela																																						
Channel Improvement	Excavation 31,000 m ³ Bank protection 1,240 m Embankment 30,800 m ³																																					3,150 m ³ /month x 2 130 m/month x 2 6,300 m ³ /month x 1
Maintenance Road	1,600 m																																					210 m/month x 1
Bridge	3 nos																																					8-15 month /bridge
Periphery Canal	3,600 m																																					400 m/month x 1
5. Ratmalana-Moratuwa Scheme																																						
Open Channel	Wet Masonry 6,600 m ² Open Channel 1,900 m																																					330 m ² /month x 2 80 m/month x 2
Concrete flume with Cover Slab	6,400 m																																					25 m/month x 10
6. Land Acquisition (to be commenced before construction)																																						

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Figure 1.2.1
 Proposed Construction Schedule