TABLE 2.13 Incremental Operation and Maintenance Cost (15,000 m^3/day)

Item	Calculation	O&M Cost (Rs/yr)	Remarks
Personnel	3×16,000Rs/month·capita×12＝576,000 Sub-total 576,000	600,000	
Power	・Kadduwa Intake Basic charge：800+240kVA×400Rs/month×12＝96,800 Demand charge：4,950khW/day×365×7.1Rs/kwH＝12,827,925 ・Malimbada WTP Basic charge：800+350kVA×400Rs/month×12＝140,800 Demand charge：5,615khW/日×365×7.1Rs/kwH＝14,551,273 Sub-total 27,616,798	27,600,000	
Fuel	・Kadduwa Intake Diesel：18,500Rs/month×12＝222,000 ・Malimbada WTP Diesel：25,000Rs/month×12＝300,000 Sub-total 522,000	500,000	Power Generator
Chemicals	・Alum 15,000m^3/d×10mg/L×1/1000×22Rs/kg×365＝1,204,500 ・Lime 15,000m^3/d×5mg/L×1/1000×8Rs/kg×365＝219,000 ・Chlorine 15,000m^3/d×2mg/L×1/1000×67.5Rs/kg×365＝739,125 Sub-total 2,162,625	2,200,000	Actual Value 9.24 mg/L 4.57 mg/L 1.80 mg/L
Repair	・Mechanical Equip.：Equip. cost×0.5%/yr (65,700＋132,650) ×10^3×0.005×1.25Rs/円×1000＝1,239,688 ・Electical Equip.：Equip. cost×0.2%/yr (36,000＋50,400) ×10^3×0.002×1.25Rs/円×1000＝216,000 Sub-total 1,455,688	1,500,000	
Total		32,400,000	

2.5 Other Relevant Issues

(1) Design Target Year

In the Project the design target year is set in 2009 when water demand will balance water supply. However, there is a possibility that it will be prolonged by the actual increase in design fundamentals used in the water demand projection, how to consider the present treatment capacity, priority of the area for water supply and so on as described below.

The design target year of the Project is set in 2009, but water demand is estimated based on the assumption of a various kinds of parameters such as population coverage, share of individual connections, per capita daily consumption, non-revenue water ratio, population growth rate and the rate of non-domestic water demand to the total water demand, and if even one of those parameters will not be changed as assumed, it results in the change in target year. For example, one of population coverage, share of individual connections or per capita daily consumption will be below the assumption, water demand will become small resulting in the prolongation of the target year. On the contrary, those values exceed the assumption or the non-revenue water ratio will not be improved as expected, it leads to shorten the target year. It should be noted that the population coverage and share of individual connections in the inland new service area were estimated to increase rapidly by the year of 2011 after commissioning, assuming that the people will be fascinated with the convenience to hold the individual connection.

The present treatment capacity of existing two water treatment plants is assessed at 33,000 m^3/day in comparison with a nominal capacity of 39,000 m^3/day due to some malfunctions in existing facilities and drop in pumping efficiency at Kadduwa and Balukawara Intakes. By the implementation of the Project, for example by pump replacement and additional pipe-laying for raw water transmission, there is some expectation for improvement in pumping efficiency, but it is assumed conservatively side that there is no change, since such improvement cannot identify without actual operation.

The originally proposed new service area was reduced in the course of the discussion with NWS&DB, but water demand in such an area that is eliminated from the service area in this Project is included in future projection and for this purpose one branch will be provided on the transmission pipeline between Diyagaha and Gandara Service Reservoirs. Therefore, it is possible to supply water to this area if NWS&DB will lay transmission and distribution pipes together with the construction of a pump station and service reservoir. However, if NWS&DB will prolong to expand the service area to such an area, the target year for 24 hour water supply can be extended three more years by 2012 for the existing service area. It depends on whether the priority will be given to the expansion of service area or improvement in water supply condition.

(2) Increase in wastewater associated with the increase in water supply

The water supply augmentation in the Project will result in the increase in domestic wastewater to be discharged from the houses in the service area. The most people in Matara area use the sealed pit latrines, while the coverage by septic tanks is less than 10% in the total population. The domestic wastewater is basically categorized into excreta and sullage (miscellaneous wastewater other than excreta) and there is little change in excreta generation even though the increase in water supply. The sullage is discharged into drains that are connected to the road gutters and then finally to the watercourses. But most drains and gutters are still dug and incomplete and wastewater is infiltrated into the ground or evaporated in the hot climate, when wastewater is stagnant at a pile of soils in such a drainage system. Therefore, wastewater to be directly entered into watercourses is not so much, and causes less water pollution. (It is reported that in Kandy, the second largest city in the country with steep topography, only about 6% of BOD loading generated in the urban area is discharged into the river based on the actual measurement.) The existing urban area is built up narrowly and long along the coastal belt in Matara District is also contributed to the mitigation of water pollution due to dispersed discharge of pollutant loads.

(3) Salinity Intrusion at Water Intakes

NWS&DB entrusted the study on salinity intrusion in the Niluwala River to Lanka Hydraulic Institute Ltd. on December 1998 that prepared "Salinity Studies on Gin Ganga & Nilwala Ganga (February 2000)".

According to the report, the limit river flow when salinity intrusion will occur at Nadugala and Kadduwa Intakes is as shown in **TABLE 2.14** and **FIGURE 2.13.**

TABLE 2.14 Predicted Limits of Salinity Intrusion

Location	Spring Tide	Mid Tide	Neap Tide
Nadugala Inrake	11.00	7.75	5.00
Kadduwa Intake	2.20	2.50	2.80

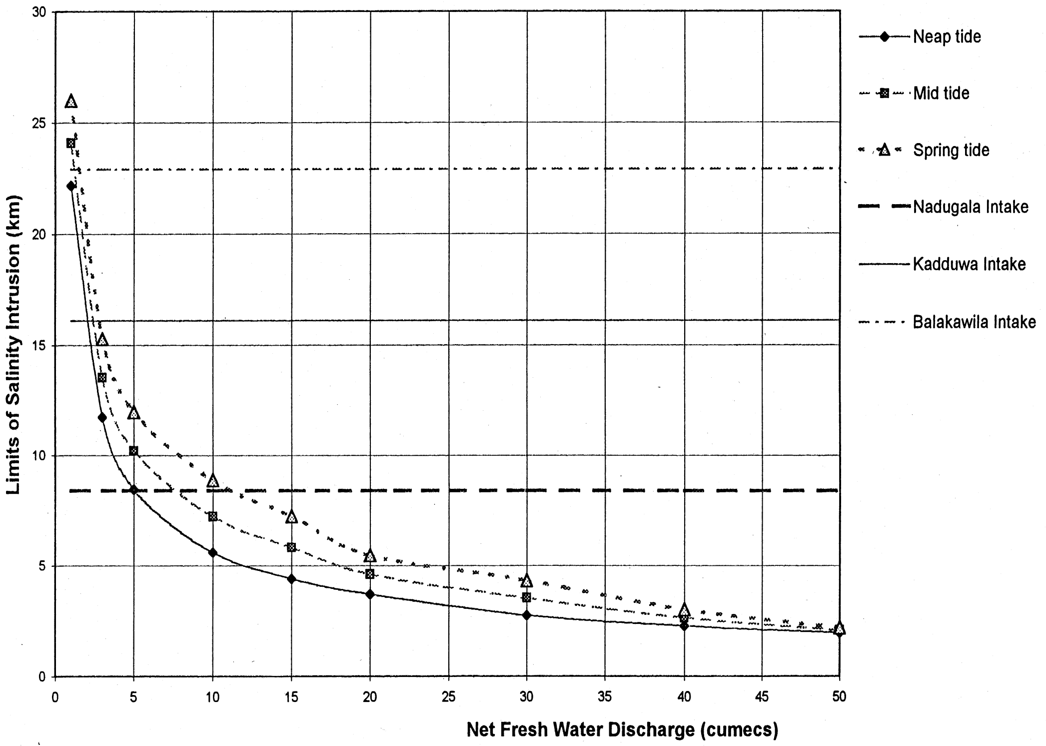

FIGURE 2.13 Predicted Limits of Salinity Intrusion

TABLE 2.14 show the predicted number of failure days for the Nilwala River when Nadugala and Kadduwa Intakes stop taking water for the past 31 year (1967-1998) data. The nominal water intake at Kadduwa Intake after the completion of the Project including that at upstream Balukawala Intake increase from 31,500 m^3/day (0.365 m^3/sec) to 47,250m^3/day (0.547 m^3/sec), however an increase in the number of failure days is only 0.17 days from 3.10 days to 3.27 days based on the results of regression analysis between the water intake and the number of failure days. Therfore, there is little affect of salinity intrusion on water intake at Kadduwa Intake.

Likewise, the nominal water intake at Nadugala Intake after the completion of the Project including that at upstream Balukawala and Kaduwa Intakes increase from 40,950 m^3/day (0.474 m^3/sec) to 56,700m^3/day (0.656 m^3/sec), however an increase in the number of failure days is only 1.33 days from 10.23 days to 11.56 days based on the results of regression analysis between the water intake and the number of failure days. Therfore, there is a little affect of salinity intrusion on water intake at Nadugala Intake.

It should be noted that these prediction is based on the assumption that the river flow assure at 3.10 m^3/sec at Kadduwa Intake and 8.60 m^3/sec at Nadugala Intake, respectively.

The above report says that the future abstractions at Nadugala, Kadduwa and Balukawala Intakes as shown in **TABLE 2.15** are a small fraction of the net flow required to ensure salinity control, and concludes that the problem of salinity intrusion will not rapidly worsen in the face of increased. The nominal water intake at Kaduwwa Intake after the completion of the Project is bigger than that predicted in the reports, but there will be no problem in salinity intrusion.

TABLE 2.15 Present and Future Water Intake in the Niluwala River

Intake	Present Abstraction	Future Abstraction
Nadugala	0.116 m^3/s (10,000 m^3/d)	0.579 m^3/s (50,000 m^3/d)
Kadduwa	0.174 m^3/s (15,000 m^3/d)	0.174 m^3/s (15,000 m^3/d)
Balukawala	0.174 m^3/s (15,000 m^3/d)	0.261 m^3/s (22,500 m^3/d)

NWS&DB considers from a shortterm view to pile sandbags in the Niluwala River at the downstream of the Nadugala Intake. This method has been used in the Kelani Ganga, the water source of Ambatale WTP for the Greater Colomb, with certain success for more than ten yearso, and from a longterm view to construct a permanent salinity control barrier with an assitance from ADB, which is specified in the Memorandum of Understanding between the Government of Sri Lanka and ADB in June 2002.

TABLE 2.16 Number of Failure Days for Water Intake by Salinity Intrusion

(1) Kadduwa Intake

Intake (m^3/s)	0.1	0.2	0.4	0.6	0.8	1.0
Min. River Flow (m^3/s)	2.60	2.70	2.90	3.10	3.30	3.50
Year	No. of Failure Days in Each Year					
1967	0	0	0	0	0	0
1968	0	0	0	0	0	0
1969	0	0	0	0	0	1
1970	0	0	0	0	0	0
1971	0	0	0	0	0	0
1972	0	0	0	0	0	0
1973	0	0	0	0	0	0
1974	0	0	0	0	0	0
1975	0	0	0	0	0	0
1976	4	4	8	9	13	15
1977	0	0	0	0	0	0
1978	1	1	1	2	2	2
1979	38	38	40	40	40	41
1981	0	0	0	0	0	0
1982	10	10	11	11	11	12
1983	35	35	35	35	36	36
1984	0	0	0	0	1	4
1985	2	3	3	3	3	4
1986	0	0	0	0	0	0
1987	0	0	0	0	1	1
1988	0	0	0	0	0	0
1989	0	0	0	0	4	4
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	0	0	0	0	0	0
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	1	1	1	1	1	1
Average	2.94	2.97	3.19	3.26	3.61	3.90

(2) Nadugala Intake

Intake (m^3/s)	0.1	0.2	0.4	0.6	0.8	1.0
Min. River Flow (m^3/s)	8.10	8.20	8.40	8.60	8.80	9.00
Year	No. of Failure Days in Each Year					
1967	0	0	0	0	0	0
1968	0	0	0	0	0	0
1969	8	8	8	9	9	11
1970	0	0	0	0	0	0
1971	0	0	0	0	0	0
1972	2	2	5	5	5	5
1973	10	10	12	14	14	19
1974	0	0	0	2	2	4
1975	11	11	12	17	17	22
1976	42	0	0	0	57	58
1977	7	7	8	10	11	11
1978	1	1	1	1	1	1
1979	45	47	48	48	49	50
1981	0	0	0	0	0	1
1982	19	19	20	21	23	23
1983	41	41	41	43	43	43
1984	19	19	19	21	22	25
1985	8	8	9	10	11	13
1986	12	13	14	15	15	16
1987	18	18	18	20	23	24
1988	11	11	11	11	12	12
1989	10	10	10	10	12	13
1990	5	6	6	8	9	15
1991	6	7	7	11	11	13
1992	0	0	0	0	5	10
1993	9	9	10	12	12	14
1994	17	18	19	27	27	36
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	19	19	20	24	25	30
Average	8.97	9.16	9.61	10.94	13.39	15.13