2.3.2 Dam Design

(1) Geological and Topographical Condition

The geological formation of dam site is river terrace developed at the both sides of the river over the bedrock of phyllite. The bedrock is considered to have sufficient strength for the dam construction. Vaza Barris River was formed as valley or ravine which river flow has been eroded the platform. The depth from the top of river terrace to the shoulder of platform is approximately 40 m to 50 m. Width of river at the shoulder of platform is about 300 m to 400 m.

(2) Dam Type

Dam was designed as rock-fill dam in this Master Plan because no sufficient geological information available at the dam site. Borrow pit for rock material will be the spillway construction site. Excavated rock of spillway will be used for construction of dam filling.

(3) Spillway

< Design Discharge of Spillway >

Probability of spillway design discharge is set at 1,000-year frequency according to the standard in Brazil. Using daily flow data at Fazenda Belem probable discharge with 1,000-year return period is estimated to be 1,600 m^3/s.

< Type of Spillway >

The type of spillway was designed as free overflow type in concrete open channel.

< Location of Spillway >

The following two locations of spillway were planned as alternatives and were compared:

1) Location-I : Spillway at the left side of dam
2) Location-II : Spillway apart from the dam site taking the river alignment into account.

As the result of cost estimation of spillway in both locations using quantity of materials as shown in Table-2.13, it was found that Location-II was more economical than Location-I.

(4) Low Flow Diversion Channel and Check Dam

< Low Flow Diversion Channel >

The low flow diversion channel is designed to have the inverted-trapezoidal section with 10 cm thick plain concrete lining. It is planned to construct on the river terrace of Vaza Barris River from the check dam, located at approximately 30 km upstream of the Vaza Barris dam, to the Vaza Barris Dam. The invert elevation of the channel is planned to be EL.59.0m at intake point and EL.50.0m at the Vaza Barris Dam Axis, resulting in the average gradient of channel as 0.000263 (1/3800) with total length of channel of 34.2 km. Hydraulic calculation shows that the average flow velocity is 0.7 m/s with flow volume more than 1.2 m^3/s specified in 5.5.3 (2) (c) with the cross section shown in Figure-2.19. Where the channel has to pass deep inside of gully, gorge or ravine, siphon pipe of prefabricated concrete pipe is provided to make short cut and to reduce channel length and friction head loss. Diameter of the siphon pipe is designed to be 2.0 m to pass the flow volume more than 1.2 m^3/s within total head loss of 9 m (59.0 m - 50.0 m).

< Check Dam >

Because of the low gradient of the natural river bed of Vaza Barris River as I = 0.000917 (1/1,090), when the water level of the reservoir rises up to about EL.50m as the result of construction of Vaza Barris Dam, it is very difficult to keep required gradient of the channel to enable the high salinity water discharge of 1.2 m^3/s without providing countermeasures. Check dam is planned to cope with this difficulty by raising intake water level of the channel to acceptable limit. The check dam is concrete dam with dam height of 14 m, which is almost upper limit of sabo dam and its crest elevation is EL.59.0m. Over flow section is designed to have the width of 50 m by overflow depth of 7 m, thus allowing flood discharge of 1,600 m^3/s. The check dam is also expected to provide the reduction in sedimentation of the Vaza Barris Reservoir. General profile of the check dam is shown in Figure-2.20.

(5) Specification of Proposed Dam

Specifications of the proposed dams with two types of spillways are summarized in Table-2.13.

Table-2.13 Specification of Proposed Vaza Barris Dam

Items		Unit	Specification		Remarks
			Location-I	Location-II	
Development Discharge	Municipal and Industrial Water	m^3/s	1.064		
	Irrigation Water	m^3/s	2.912		Vaza Barris Irr. Project
	Total	m^3/s	3.976		
Reservoir	Catchment Area	km^2	15,560		
	Reservoir Area	km^2	16.0		
	Total Storage Capacity	$M.m^3$	92.50		
	Effective Storage Capacity	$M.m^3$	72.81		
	Water Utilization Capacity	$M.m^3$	72.81		
	Municipal / Industrial	$M.m^3$	32.07		
	Irrigation	$M.m^3$	34.83		
	Maintenance Discharge	$M.m^3$	5.91		
	Sediment Capacity	$M.m^3$	19.69		12.7 m^3/km^2/year
	Design High Water Level (H.W.L.)	EL.m	53.40		4 m Flood Capacity
	Normal Water Level (N.W.L.)	EL.m	49.40		
	Low Water Level (L.W.L.)	EL.m	39.10		
Dam	Dam Type	-	Rock Fill		
	Dam Top Level	EL.m	56.00		2.6 m Freeboard
	Dam Foundation Level	EL.m	20.00		
	Dam Height	m	36.00		
	Dam Crest Width	m	260	265	
Spillway	Type	-	Free Overflow		
	Design Discharge	m^3/s	1,600		1,000-yr return period
	Structure : Width	m	105		
	: Height	m	4		
Check Dam	Dam Type	-	Concrete Sabo Dam		
	Dam Top Level	EL.m	59.00		
	Dam Foundation Level	EL.m	45.00		
	Dam Height	m	14.00		
	Dam Crest Width (Over flow sec.)	m	50.00		
	Design High Water Level	EL.m	66.00		
Low Flow Diversion Channel	Type Channel Portion	-	Open channel		
	Siphon Portion	-	Concrete pipe		
	Section Channel Portion	-	Inverted-Trapezoidal		
	Siphon Portion	-	Diameter 2.0 m		
	Total Length	km	34.23		
	Channel Portion	km	31.73		
	Siphon Portion	km	2.5 km		25 places
	Average Gradient	m/m	0.000263 (1/3,800)		
	Nominal discharge volume	m^3/s	1.23		
Construction Quantity	Dam Embankment Volume	m^3	617,000	633,000	
	Dam Excavation	m^3	72,000	72,000	
	Spillway Excavation	m^3	153,000	690,000	
	Spillway Concrete	m^3	52,000	5,000	
	Stripping of Spillway Course	m^2	-	90,000	

Note: Maintenance discharge : 0.46 m^3/s

The capacity of the Dam is schematically shown in Figure-2.16.

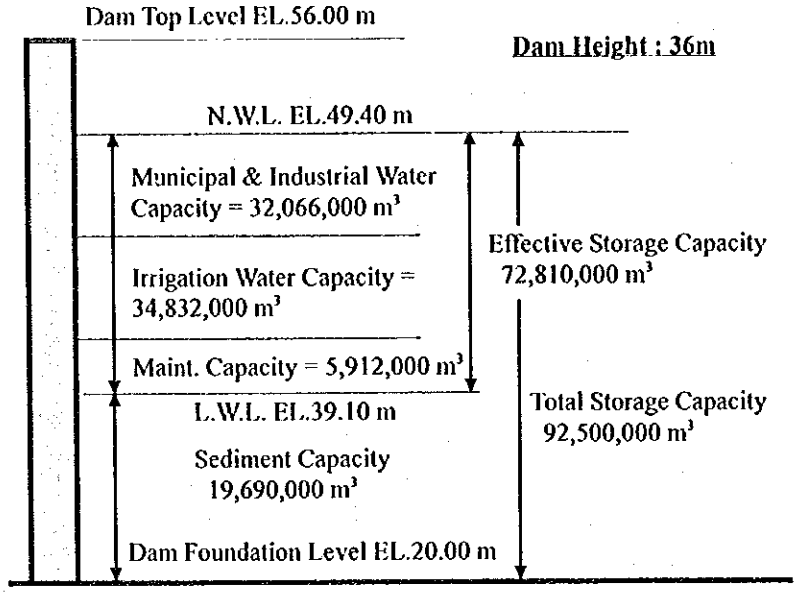


Figure-2.16 Schematic Description of Capacity of Vaza Barris Dam

(6) Profiles of Dam

The general profiles of the Vaza Barris Dam is attached in Figure-2.17 to Figure-2.20.

2.3.3 Design of Integrated Pipeline Projects

(1) Design Concept

The Design concept of this water supply system is exactly the same as for Independent Water Supply System, except that most of the system do not require construction of new dams or weirs.

(2) Overall Location Map of Water Supply System

The route map of the Independent Water Supply System and the Integrated Water Supply System is shown in Figure-2.21.

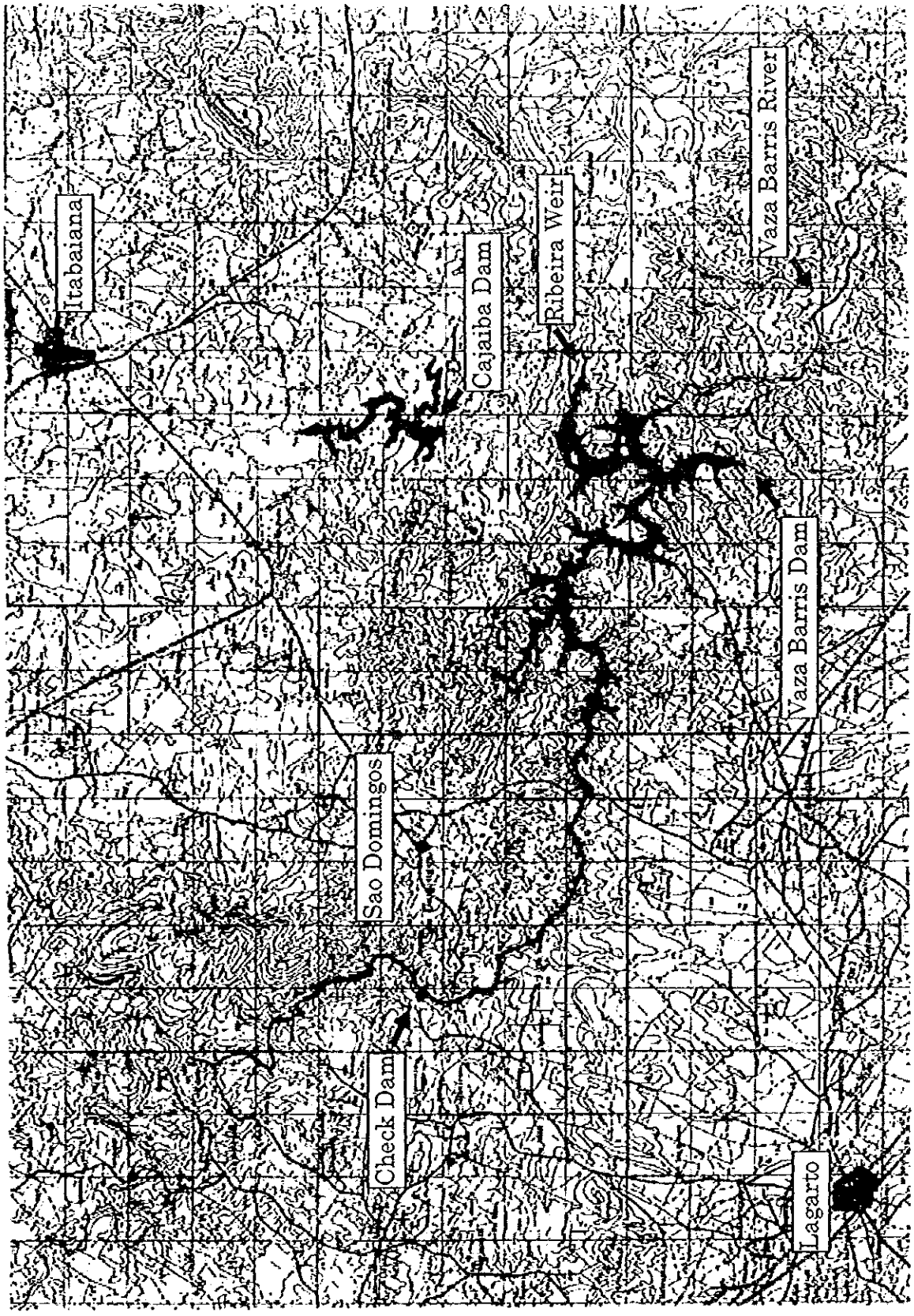
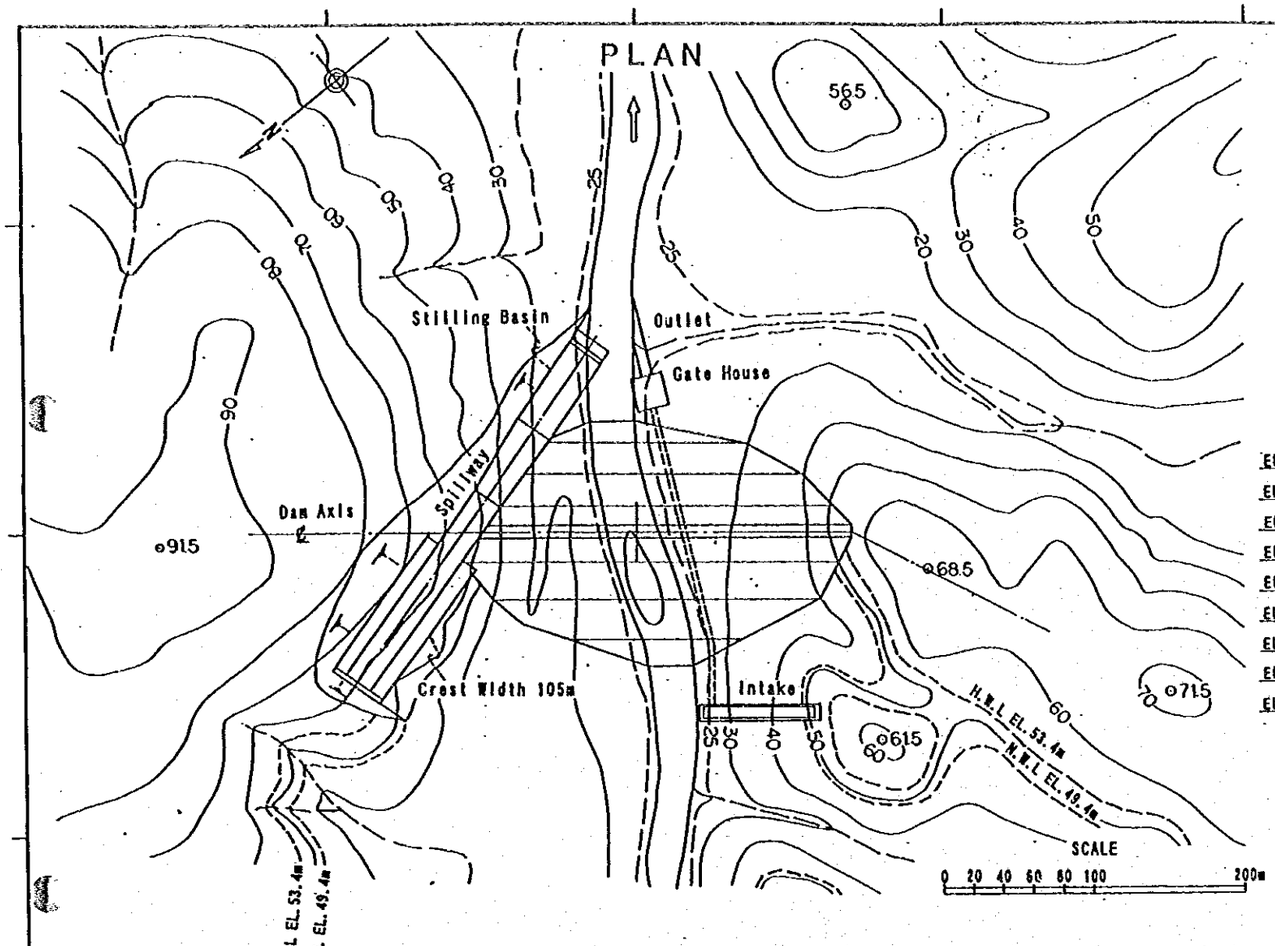
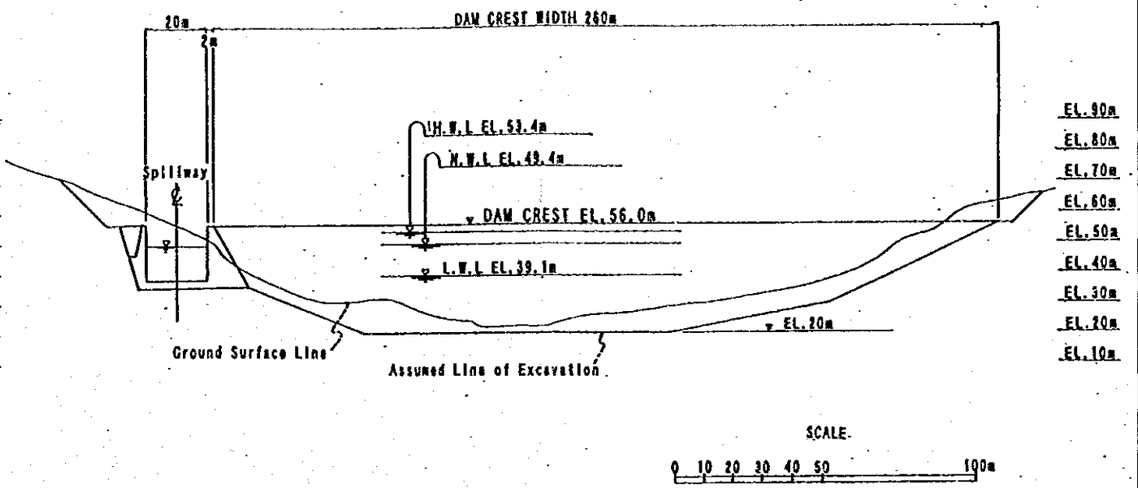


Figure-2.17 Location Map of Vaza Barris Dam





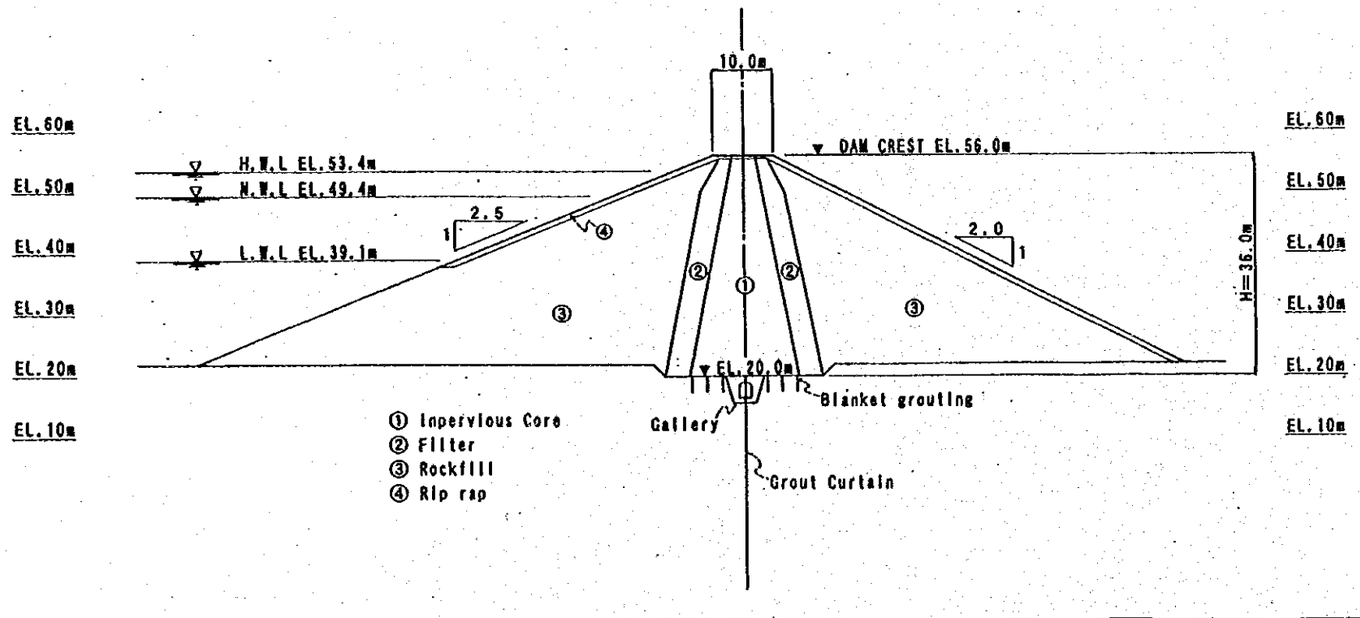
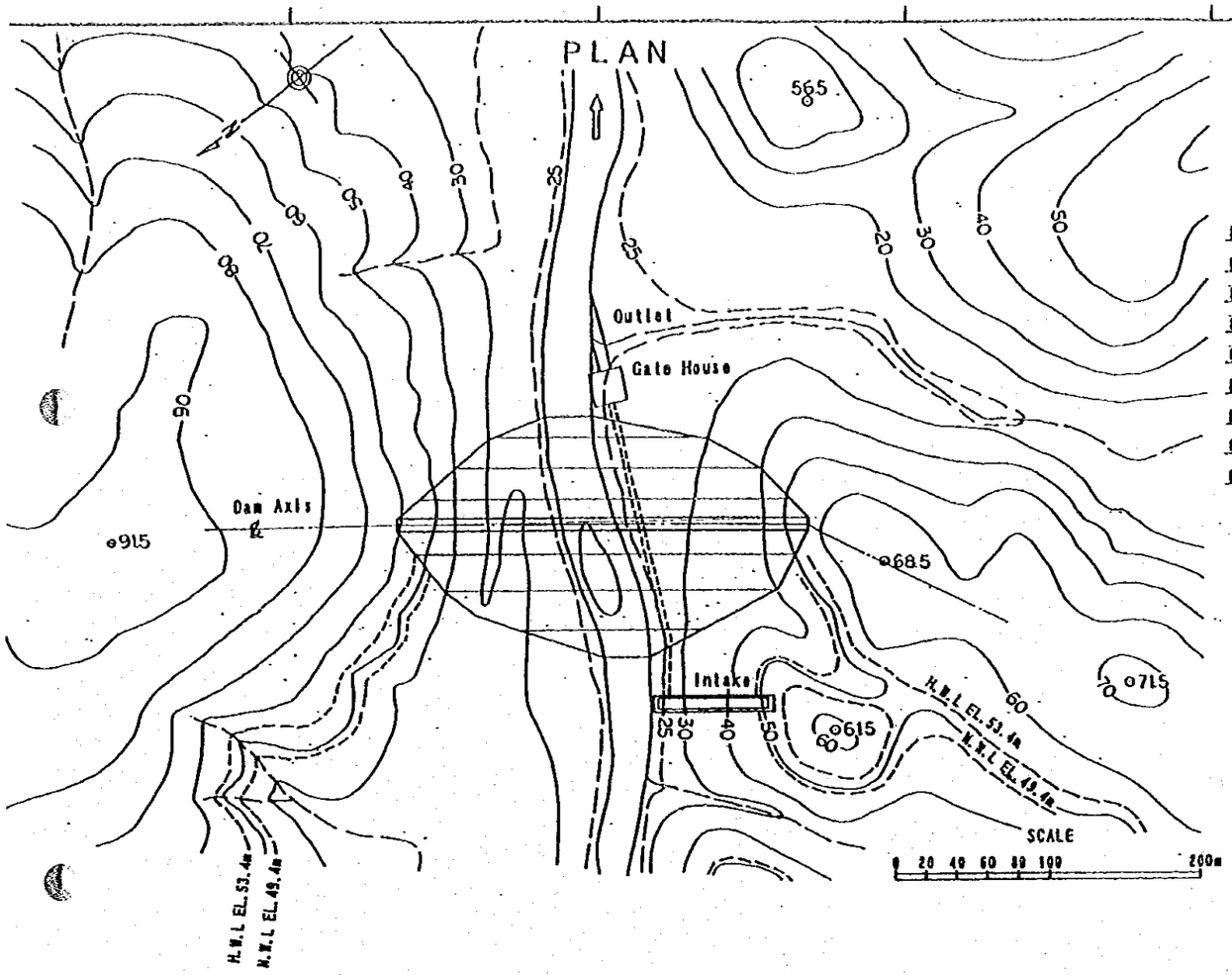
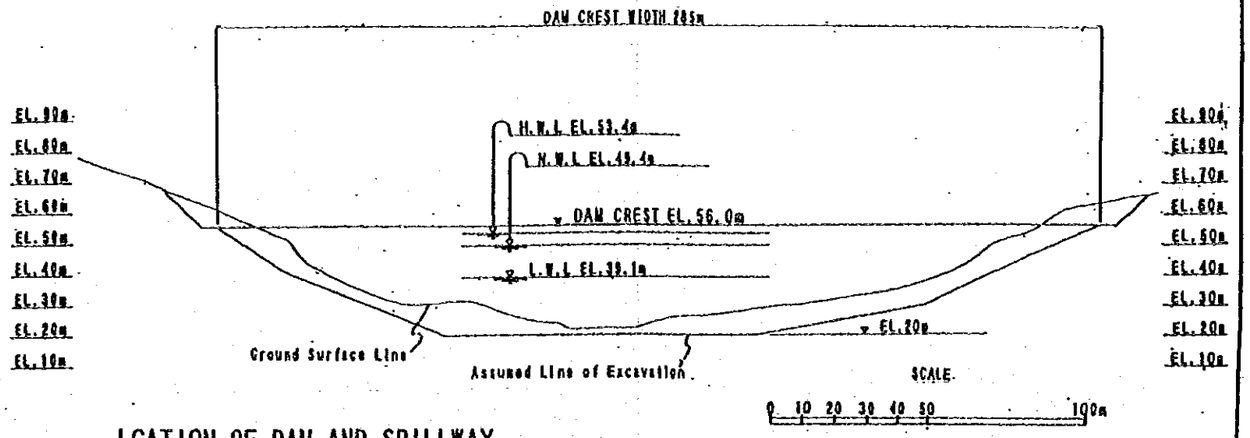
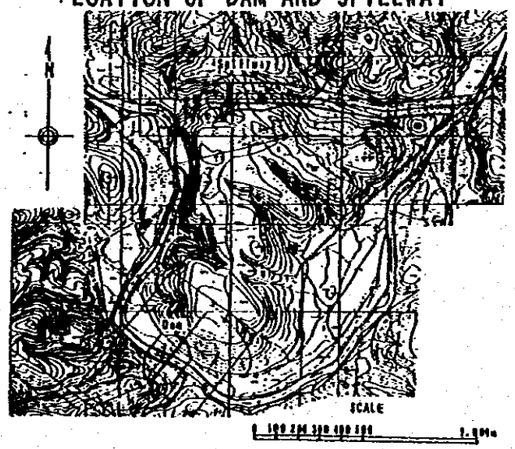
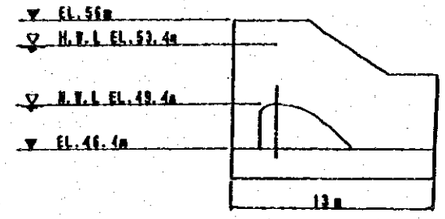


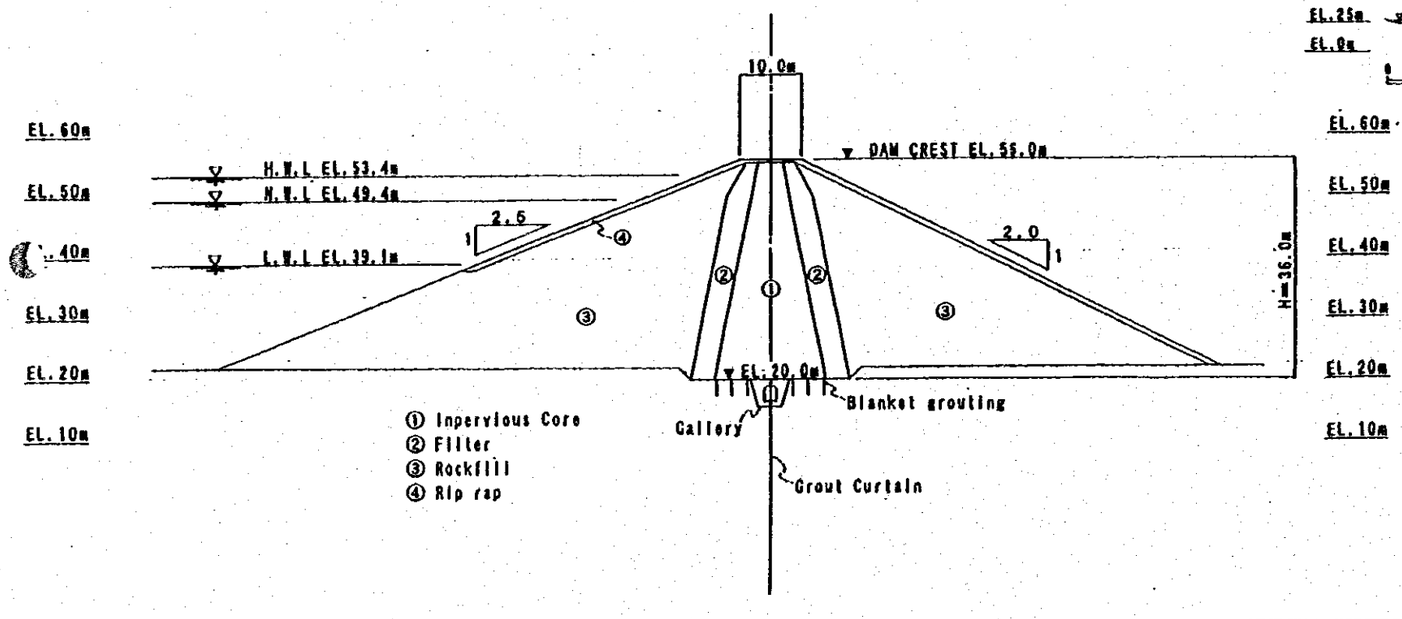
Figure-2.18 (1/2) General Profile of Vaza Barris Dam (Spillway next to the Dam)

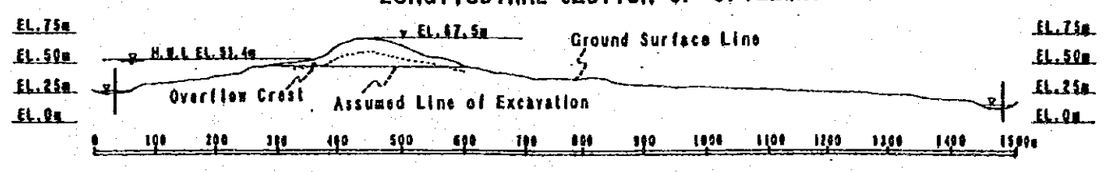












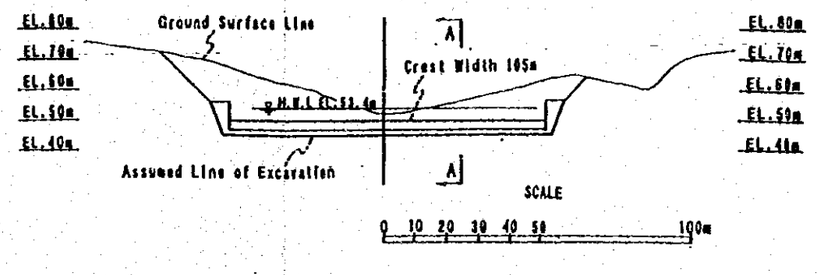
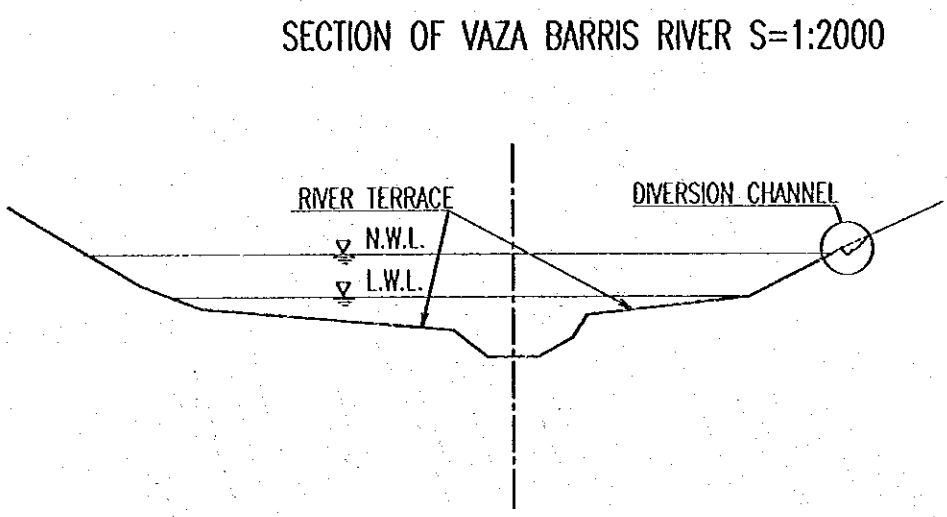


Figure-2.18 (2/2) General Profile of Vaza Barris Dam (Spillway apart from the Dam)



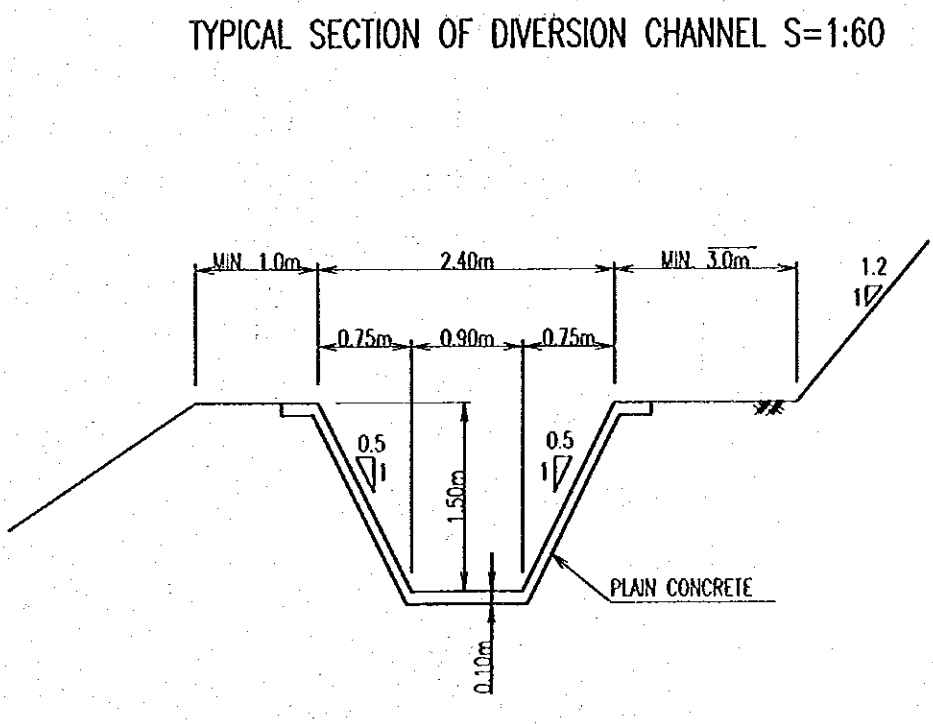


Figure-2.19 Typical Section of Low Flow Diversion Channel

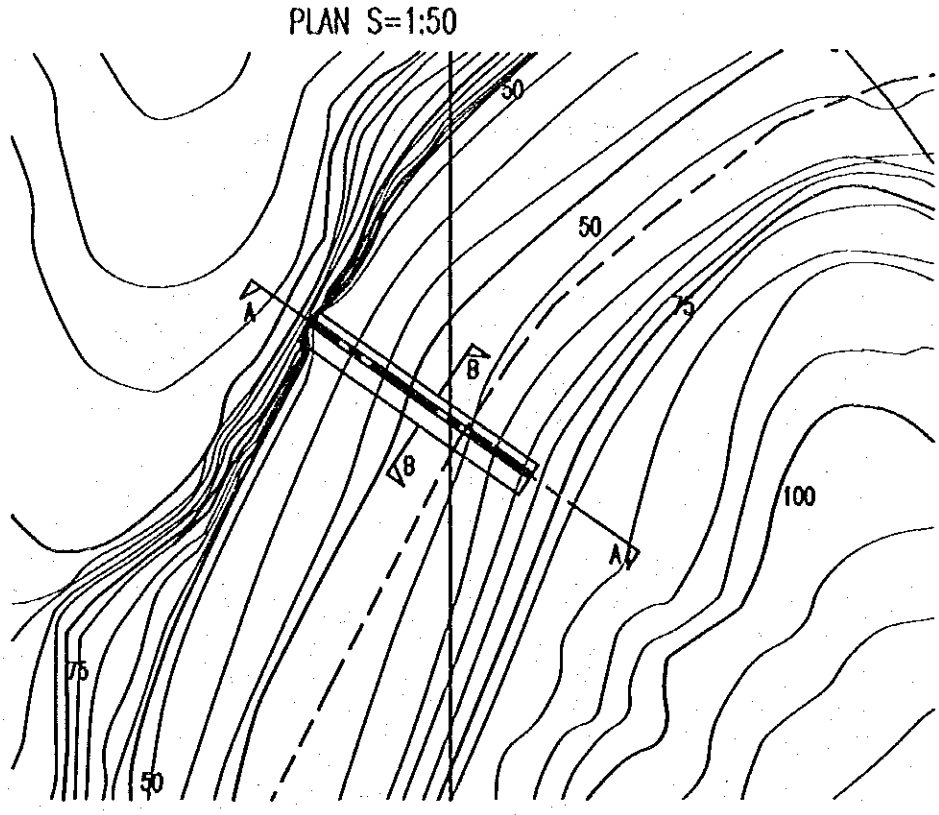
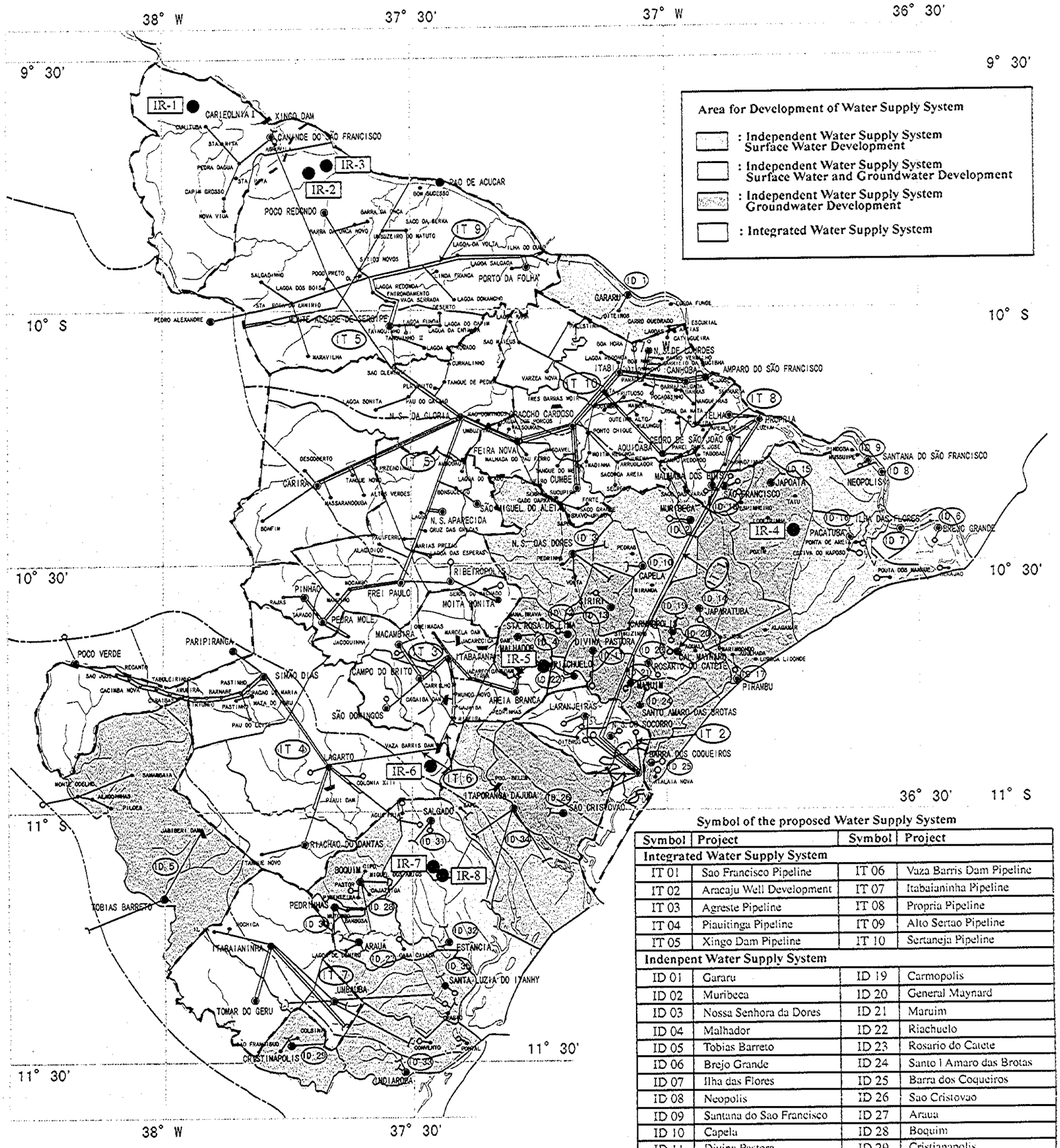


Figure-2.20 General Profile of Check Dam



Symbol of the proposed Water Supply System

Symbol	Project	Symbol	Project
Integrated Water Supply System			
IT 01	Sao Francisco Pipeline	IT 06	Vaza Barris Dam Pipeline
IT 02	Aracaju Well Development	IT 07	Itabaianinha Pipeline
IT 03	Agreste Pipeline	IT 08	Propria Pipeline
IT 04	Piauitinga Pipeline	IT 09	Alto Sertao Pipeline
IT 05	Xingo Dam Pipeline	IT 10	Sertaneja Pipeline
Indenpent Water Supply System			
ID 01	Gararu	ID 19	Carmopolis
ID 02	Muribeca	ID 20	General Maynard
ID 03	Nossa Senhora da Dores	ID 21	Maruim
ID 04	Malhador	ID 22	Riachuelo
ID 05	Tobias Barreto	ID 23	Rosario do Catete
ID 06	Brejo Grande	ID 24	Santo I Amaro das Brotas
ID 07	Ilha das Flores	ID 25	Barra dos Coqueiros
ID 08	Neopolis	ID 26	Sao Cristovao
ID 09	Santana do Sao Francisco	ID 27	Araua
ID 10	Capela	ID 28	Boquim
ID 11	Divina Pastora	ID 29	Cristianapolis
ID 12	Santa Rosa de Lima	ID 30	Pedrinhas
ID 13	Siriri	ID 31	Salgado
ID 14	Japaratuba	ID 32	Estancia
ID 15	Japoata	ID 33	Indiabora
ID 16	Pacatuba	ID 34	Itaporanga D'Ajuda
ID 17	Pirambu	ID 35	Santa Luzia do Itanhy
ID 18	Sao Francisco		
Irrigation Project			
IR 01	Quixabeira	IR 05	Jacarecica II
IR 02	Jacare-Curituba	IR 06	Vaza Barris
IR 03	Sao Francisco	IR 07	Entre Rios
IR 04	Ladeirinhas	IR 08	Estancinha

Figure - 2.21 Plan of Integrated and Independent Water Supply System

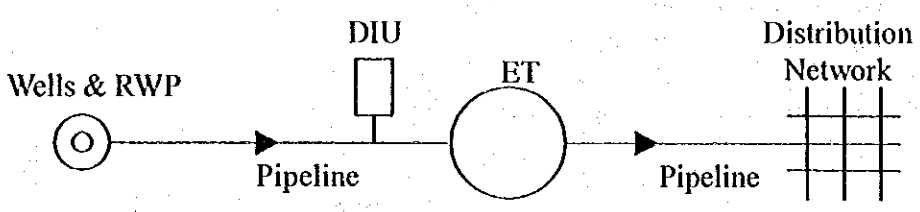
2.4 Small Rural Water Supply

(1) Components Included

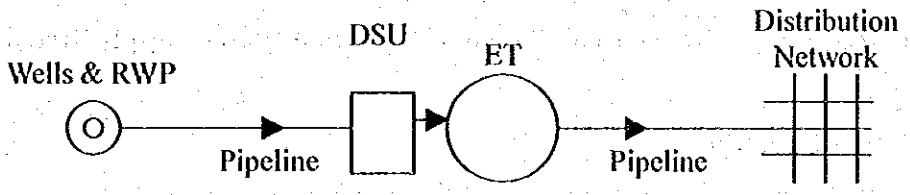
The components included in the Small Rural Water Supply Systems are as follows:

- Well (One well for one system)
- Raw Water Pump RWP
- Pipelines (From Raw water pump to water treatment station)
- Water treatment station WTS, composed of disinfection unit DIU, desalination unit if required DSU and elevated water storage tank ET
- Distribution pipeline and network

Conceptual sketch of the system is as shown in Figure-2.22.



1. The System without Desalination Unit



2. The System with Desalination Unit

Figure-2.22 Conceptual Sketch of Small Rural Water Supply System

(2) Design Conditions

In addition to the design criteria specified in Section 2.1.3 and 2.2.1(1), the following design conditions are followed:

- Depth of well to be 60 m
- Number of drilling to be the required number of wells divided by expected success rate
- Desalination unit to be provided if water in the drilled well contains high salinity.
- Water to be supplied for domestic consumption in small rural areas
- Water supply volume per capita : 70 liter/day
- Served Population : 100 inhabitants
- Water treatment by disinfection only

2.5 Design of Irrigation Water Supply

(1) General

The facility to be dealt with in this section is water conduction facility from water source to the irrigation area. No small-scale facility in each plot is studied.

(2) Components Included

The components included in the Water Supply Systems are as follows:

- Dam or weir where required
- Intake and Raw Water Pump Station RWPS
- Pipelines (From Raw water intake to reservoir or irrigation area)
- Reservoir ET
- Booster pump station BPS, if required
- Pipeline to irrigation area

Conceptual sketch of the system is as shown in Figure-2.23.

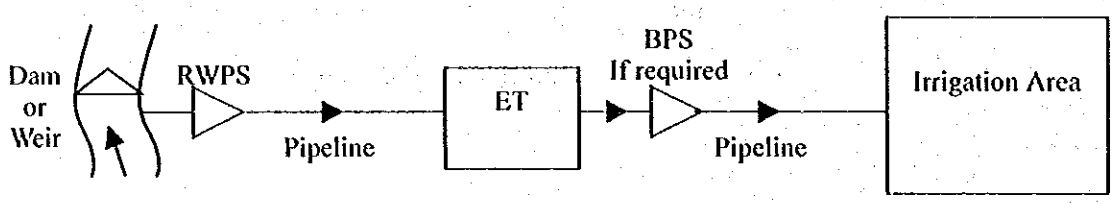


Figure-2.23 Conceptual Sketch of Irrigation Water Supply System

(3) Design Conditions

The water supply system is designed to meet the design water supply volume specified in Table-6.1 of SUPPORTING REPORT (G) WATER RESOURCES DEVELOPMENT PLAN taking geographical condition from water intake point to the irrigation area into consideration.

CHAPTER 3 COST ESTIMATE

3.1 General

The unit costs for each type of facilities related to Water Resources Development have been established by compiling the costs for past and/or existing Projects or other equivalent data that the related organizations have been presented.

3.2 The Related Organizations for Project Cost

The unit costs or other relevant data have been collected from the following organizations:

CEHOP	: State Company of Housing and Public Works
CODEVASF	: Sao Francisco Hydropower Electricity
COHIDRO	: Sergipe Water Resources and Irrigation Development Corporation
DESO	: Sergipe Sanitation Corporation
IBGE	: Brazilian Institute of Geography and Statistics
INCRA	: National Institute of Colonization and Agricultural Reform

3.3 Composition of Project Cost

Project cost in the implementation stage is composed of the following cost items:

(a) Construction Cost, CC

The cost required for the construction of facilities and other related works including the preparatory works. The cost includes material and equipment cost and labor cost including installation and erection of equipment, etc. as a direct cost and direct and indirect benefit, BDI, as an indirect cost.

(b) Load Acquisition and Compensation Cost, LACC

This cost covers the cost associated with the land required for project implementation such as land acquisition, resettlement, temporary use of land and compensation for properties.

(c) Consulting Services Cost, CSC

The cost covers the cost for consulting engineering services required in the whole period of the project implementation.

(d) Administration Cost, AC

Administration cost of the Government covers the cost for supervision and management of the project implementation by the Government staff.

(e) Contingency, CT

Contingency includes the price escalation and the physical contingency.

(f) Government Tax

Government tax is included in the unit costs for estimation.

3.4 Basis for Cost Estimation

(1) General

The Project cost in the Master Plan has been estimated using unit costs per capacity or other equivalent parameter of each facility to be constructed. Unit costs or equivalent data have been collected from the related organizations. Graphs or charts for cost estimation, such as showing the correlation between parameter and cost, have also been utilized. The unit costs for the Master Plan has been established through comparison of the various unit costs collected from the related organizations and the unit costs calculated from the Project costs in the past in the State of Sergipe. Data base of unit costs for construction works prepared by CEHOP is also referred when required.

(2) Cost Estimation Level

Cost estimation for the Study is based on the costs and prices at the time of August 1998. Exchange rate of Brazilian "Real" to US$ as of August 1998 is 1 US$ = 1.18 R$.

3.5 Related Facilities

Facilities subject to cost estimation in the Master Plan are as listed below:

1) Dams and reservoirs
2) Intake weirs and channels
3) Intake pump stations
4) Wells and springs
5) Water channels
6) Water pipelines
7) Irrigation facilities
8) Water treatment facilities
9) Water distribution network
10) Rainwater collection system, Cistern
11) Water supply systems composed of combinations of the above-mentioned facilities

3.6 Land Acquisition and Compensation Cost, LACC

(1) General

This section explains unit cost established for cost estimation of acquisition or expropriation of land and compensation of properties, required for the Projects in the Master Plan. This cost includes the total cost required for acquiring land for installation of facilities.

(2) Source of Information

The information from following organizations is used for establishment of unit cost for acquisition or expropriation of land:

1) INCRA
2) DESO

(3) Unit Cost

Unit cost of land is evaluated for each municipality taking the current situation of land use into consideration. Types of land in concern for the Master Plan are bare land or pasture and unit of measurement is hectare.

Figure-3.1 shows the summary of unit cost for land acquisition in Sergipe State. Land in Sergipe State is classified into five categories as shown in Figure-3.1.
In case of small area, unit cost is three times greater than the above value.

(4) Required Area of Land

(a) Weir

Required area of land for construction of weir including its reservoir area is estimated based on the parameters obtained in the study on Vaza Barris Dam as follows:

- Catchment area for Vaza Barris Dam 15,630 km^2
- Required land area including Reservoir area 1,605 ha

Unit area per 1 km^2 of catchment area for weir is given by 0.1 ha/km^2.

(b) Well

Required area of land for well is estimated based on the standard drawing presented by DESO as follows:

- well $25m^2$ per well field

(c) Water Treatment Station

1) Urban area by weir

Required area of land for water treatment station in urban area is assumed to be two times of the area required for chemical house and reinforced concrete reservoir.
Floor area of Chemical house, AF, is given by the following expression obtained by the analysis of floor area in the existing water treatment stations of DESO:
$AF = 23.898 \ln(P) - 37.844$ (m^2)
Area of reinforced concrete reservoir, AR, is given by the following assumption:

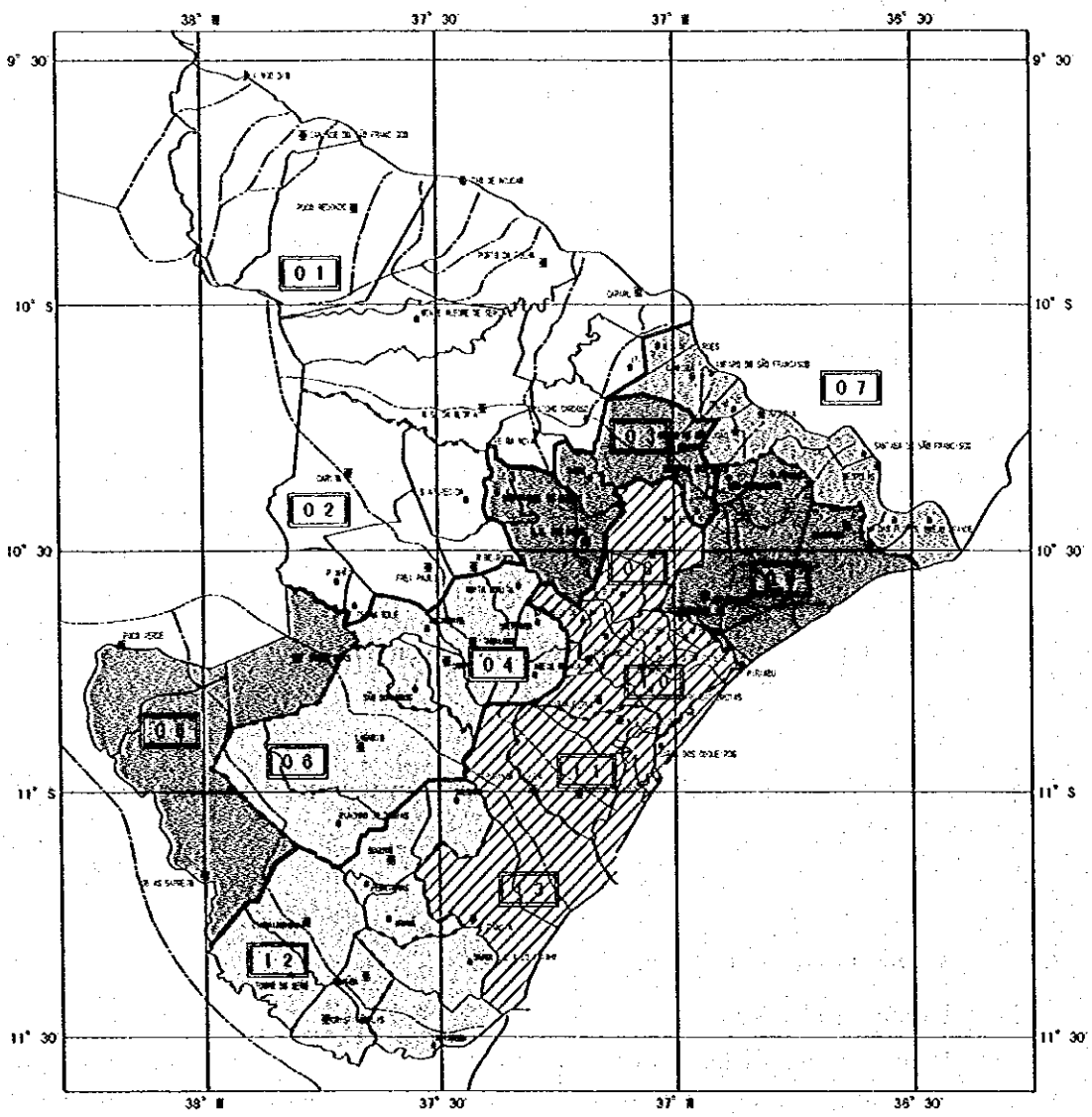
- Height of reservoir is 5 m.
- Storage capacity of reservoir is one third of daily maximum water supply volume for each water supply system.

2) Urban area by wells

Required area of land for water treatment station in rural area is assumed to be two times of the area required for elevated tank and is estimated based on the analysis of data presented by DESO as follows:

- Elevated Tank $41.792 \times e^{0.0097012P}$ (m^2)

where P : Storage capacity of elevated tank.



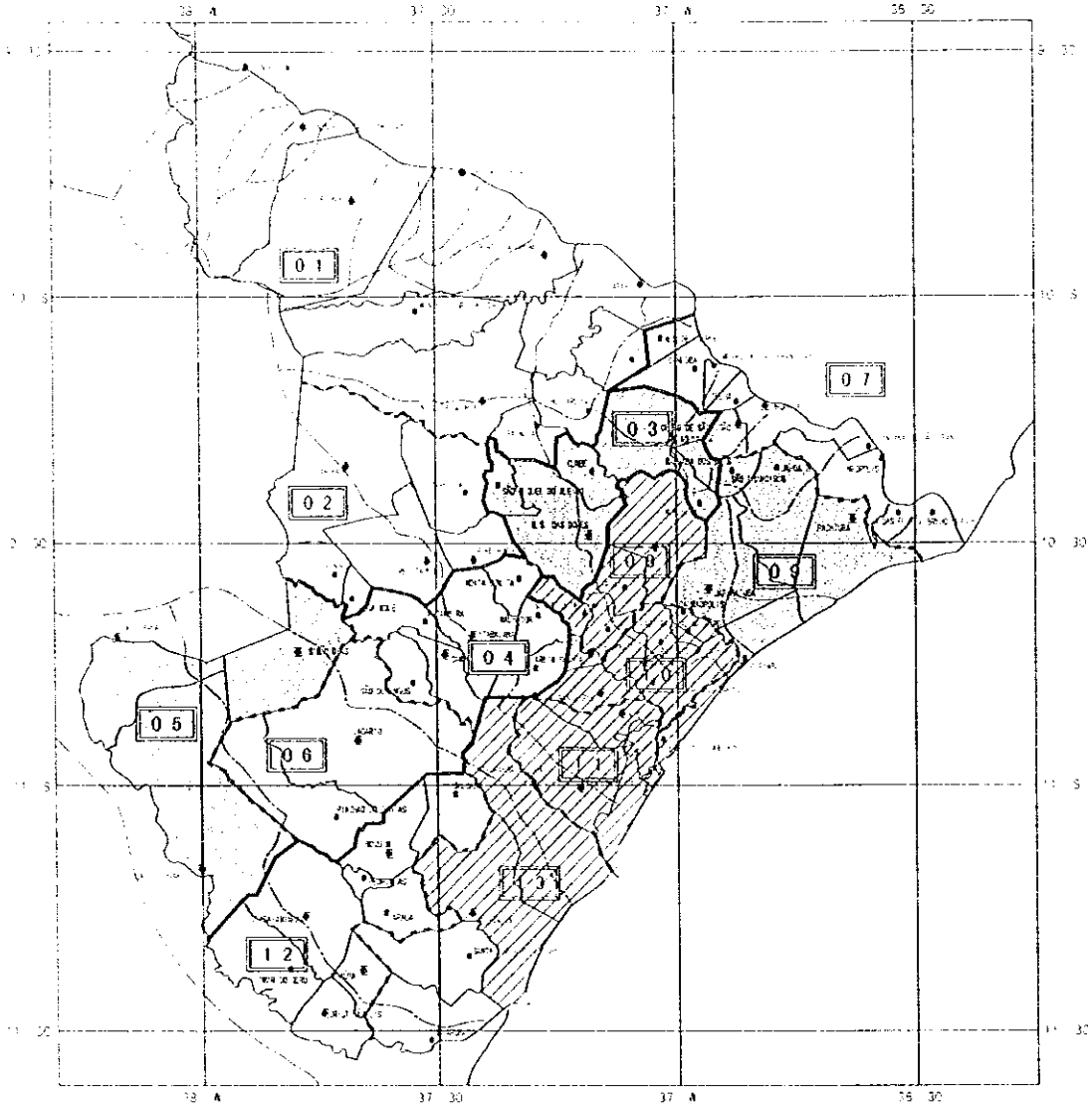
01	Sergipana do Sertao do Sao Francisco	08	Continguiba
02	Caria	09	Japaratuba
03	Nossa Senhora das Dores	10	Baixo Continguiba
04	Agreste de Itabaiana	11	Aracaju
05	Tobias Barreto	12	Boquim
06	Agreste de Lagarto	13	Estancia
07	Propria		

Category of land acquisition cost per hectare (R$/ha)
Bare land or pasture

	1,000
	750
	600
	450
	250

In case of small area, unit price is three times greater than the above value.

Figure-3.1 Distribution of Land Acquisition Cost in the State of Sergipe



01	Sergipana do Sertao do Sao Francisco	08	Continguiba
02	Caria	09	Japaratuba
03	Nossa Senhora das Dores	10	Baixo Continguiba
04	Agreste de Itabaiana	11	Aracaju
05	Tobias Barreto	12	Boquim
06	Agreste de Lagarto	13	Estancia
07	Propria		

Category of land acquisition cost per hectare (R$/ha)
Bare land or pasture

	1.000
	750
	600
	450
	250

In case of small area, unit price is three times greater than the above value.

Figure-3.1 Distribution of Land Acquisition Cost in the State of Sergipe

3) Rural area by wells

Required area is determined based on the data presented by DESO and the manufacture of desalinize as follows:

--	Elevated tank	36 m^2
--	Desalinizer	36 m^2
	Total	72 m^2

(d) Pipeline

--	pipeline	5 m x (Length of pipeline)

3.7 Consulting Engineering Services Cost, CSC

This cost is estimated using the ratio of CSC to CC based on the reference data collected from the related organizations.
The following two sets of data have been presented by DESO as shown in Table-3.1.

Table-3.1 Cost for Planning and Design

Project	No. of Projects in one package	CSC (R$)	CC (R$)	Percentage (%)
Large	2	164,439.13	1,029,116.89	16.0
Small	14	126,866.63	2,460,471.29	5.2

CSC has been taken as 10 % of CC, unless otherwise specified or included in unit costs established in this Study.

3.8 Contingency, CT

(1) Cost Escalation

(a) General

The variation of the Project cost has been taken into consideration for the cost estimation of the Projects included in the Master Plan. The index for variation of the Project cost shall be civil construction cost per square meters of buildings usually used in IBGE reports.

(b) Source of Information

The civil construction cost per square meters of buildings has been taken from annual and monthly statistical reports published by IBGE. The period of index for this analysis is between January 1990 and April 1998.

(c) Summary of Index

1) Related indexes

The following indexes have been analyzed:

a) National Consumer Price Index - NCPI

- NPCI in Brazil
- NPCI in Salvador
- NPCI in Sergipe

b) Average civil construction cost per m^2 – ACCC
   - ACCC in Brazil in R$ and US$
   - ACCC in Sergipe in R$ and US$

c) Foreign exchange rate
   The exchange rate from Brazilian currencies to U.S. dollars

2) Summary

The indexes from January 1990 to June 1994 have been neglected in the analysis due to the lack of reliability caused by hyper-inflation and denomination of local currencies occurred during the said period. Figure-3.2 indicates the variation of the major indexes between July 1994 and April 1998.

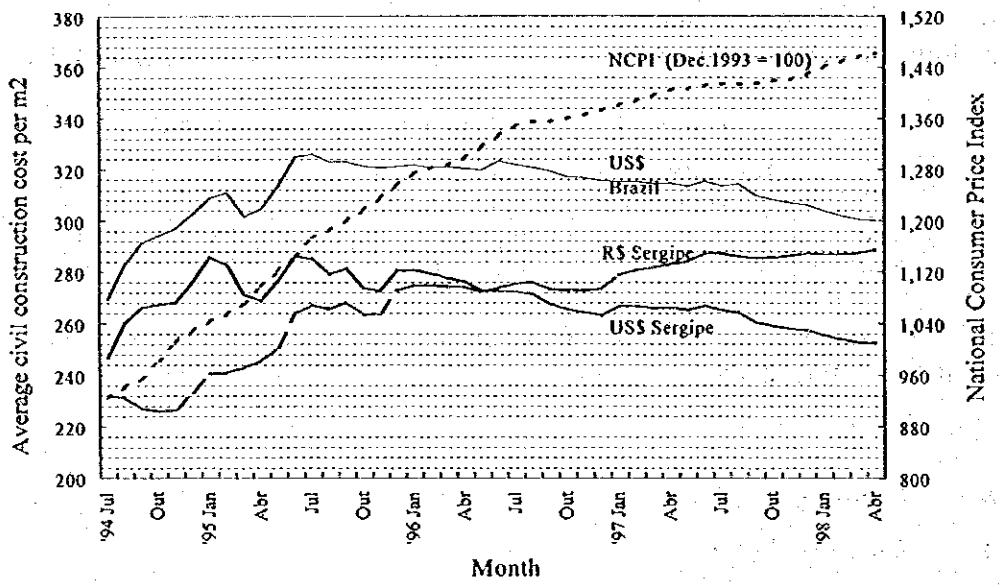


Figure-3.2 Variation of Major Indexes for Construction Cost

(d) Interpretation

NCPI in Brazil from July 1994 to April 1998 varies from 925.72 to 1463.09 with the average increase rate of 1.00 percent per month. NCPI in Sergipe from July 1994 to June 1996 varies from 897.11 to 1058.90 with the monthly average increase rate of 0.46 percent. Monthly NCPI in Sergipe is approximately 10 to 30 percent lower than monthly NCPI in Brazil.

Exchange rate from Brazilian 'Real' to U.S. dollars between July 1995 and April 1998 is raging between 1US$=0.936R$ and 1US$=1.144R$ with the monthly average increase rate of 0.59 percent. This means that the average decrease rate of R$ in US$ is 0.59 percent. ACCC in Brazil in R$ from July 1995 to April 1998 varies from 305.15 R$/$m^2$ to 343.67 R$/$m^2$ with the average increase rate of 0.35 percent per month. ACCC in Sergipe in R$ from July 1995 to April 1998 varies from 267.10 R$/$m^2$ to 288.94 R$/$m^2$ with the average increase rate of 0.23 percent per month.

ACCC in Brazil in US$ from July 1995 to April 1998 varies from 326.01 US$/$m^2$ to 300.33 US$/$m^2$ with the average decrease rate of 0.24 percent per month. ACCC in

Sergipe in US$ from July 1995 to April 1998 varies from 285.36 US$/m^2 to 252.50 US$/m^2 with the average decrease rate of 0.36 percent per month.

In general, monthly increase rate of ACCC R$ is approximately more than half of increase rate of NCPI, which means that construction cost, in general, is less sensitive than NCPI in their increase rate.

On the other hand, although ACCC R$ is increasing month by month, ACCC US$ is decreasing monthly on the contrary. This phenomenon is caused by the difference in monthly increase rate of ACCC R$ and monthly decrease rate of foreign exchange rate, in other words, increase in ACCC R$ turns to be decrease in ACCC US$ because decrease rate of exchange rate is higher than increase rate of ACCC R$. It is also reminded that the estimation of long term price escalation is impossible from the short term data as shown in Fig-3.2.

(e) Conclusion

The Project costs will be evaluated in R$ basis and no escalation will be considered.

(2) Physical Contingency

Physical contingency of 5% of CC, LACC and CSC is considered in the Project Cost.

3.9 Administration Cost, AC

The cost is required for the supervision and management works of the project implementation by the Government staff and is assumed to be 1% of CC, LACC, CSC and CT.

3.10 Government Tax

All taxes are included in the unit costs of construction works.

3.11 Construction Cost, CC

(1) Direct Construction Cost, DCC

Direct construction cost is estimated using unit costs per capacity or other equivalent parameter of each facility to be constructed. The unit costs for cost estimation of DCC include material and equipment cost, labor cost including installation and erection of equipment, etc. Details of cost estimation of DCC are discussed in the following sections.

(2) Indirect Cost

(a) General

Indirect cost means direct and indirect benefit, BDI. The ratio of BDI has been determined by comparing the current percentage of BDI to actual national civil construction cost and the current ratio of BDI used by the related organizations.

(b) National Civil Construction Cost

Source : CARTA IBGE, Year IV · nº 47, June 1998

National civil construction cost, C_N	: R$ 343.67	100%
Material cost, C_{MT}	: R$ 221.45	61%
Labor cost, C_{MO}	: R$ 132.22	39%

$C_N / C_{MT} = 343.67 / 221.45 = 1.552$

(c) Ratio Used by COHIDRO

Material cost, C_{MT}	: C_{MT}
Labor cost, C_{MO1}	: 30% of C_{MT}, $0.3C_{MT}$
BDI, C_{MO2}	: 30% of $(C_{MT} + C_{MO1})$, $0.39C_{MT}$
$C_{MO} = C_{MO1} + C_{MO2} = 0.69C_{MT}$	
C_{MT}	: 59% (1.00/1.69)
C_{MO}	: 41% (0.69/1.69)

$C_N / C_{MT} = 1.69 / 1.00 = 1.69$

(d) Ratio Used by DESO

Material cost, C_{MT}	: C_{MT}
Labor cost, C_{MO1}	: 30% of C_{MT}, $0.3C_{MT}$
BDI, C_{MO2}	: 15% of C_{MT} + 40% of C_{MO1}, $0.27C_{MT}$
$C_{MO} = C_{MO1} + C_{MO2} = 0.54C_{MT}$	
C_{MT}	: 64% (1.00/1.57)
C_{MO}	: 36% (0.57/1.57)

$C_N / C_{MT} = 1.57 / 1.00 = 1.57$

(e) Conclusion

Although both ratios used by COHIDRO and DESO are nearly in the same order as current ratio in national civil construction cost, COHIDRO's BDI ratio to construction cost is adopted for cost estimation of this study because of simplicity in calculation of BDI. Therefore, BDI is taken as 30% of direct construction cost, unless otherwise included in unit costs established in the Study.

3.12 Construction Cost of Dam

Construction cost of dam and unit cost per cubic meters of dam material in Sergipe State is as shown in Table-3.2.

Table-3.2 Construction Cost of Dam and Unit Cost per m³ of Dam Material

Organization	Dam Name	Completion Date	Type of Dam	Material Volume (m³)	Project Cost (R$)	Unit cost (R$/m³)
COHIDRO	Jabiberi	Jan/19/87	Concrete	39,000	4,011,415	102.9
COHIDRO	Jacarecica	Sep/18/86	Concrete/Masonry	31,270	4,684,195	149.7
COHIDRO	Piaui	Mar/27/87	Concrete/Masonry	33,800	2,386,755	70.6
COHIDRO	Ribeira	Sep/28/86	Earth	270,000	4,841,901	17.9
CEHOP	Jacarecica II	U.C.	Earth	659,255	29,876,411	45.3

Note : U.C. : under construction

Unit costs of earth dam are taken from the data base prepared by CEHOP as follows:

–	Deforestation	0.30	R$/m^2
–	Soil excavation	6.60	R$/m^3
–	Rock excavation	49.78	R$/m^3 (excavation by blasting)
–	Filling and compaction	5.46	R$/m^3
–	Reinforced concrete	415.29	R$/m^3

These unit costs include CSC and CC.

3.13 Construction Cost of Weir

Cost of weir is estimated using unit cost per unit volume of concrete used for weir body. The cost presented in the following report prepared by DESO is used for this study. Projeto Executivo de Ampliacao da Barragem do Sistema Poxim, Sao Cristovao – Sergipe, Dec. '95.

Construction cost for Poxim Weir is summarized as shown in Table-3.3.

Table-3.3 Construction Cost of Weir

Item	DCC + BDI (R$)	Plan & Design (R$)	Total Const. Cost (R$)	Volume of Weir Body (m^3)	Unit cost (R$/m^3)
Expansion	23,907	2,391	26,297	110	240
Existing	263,276	26,328	289,604	1,209	240
Total	287,183	28,719	315,901	1,319	240

Catchment area for Weir of Poxim is given in the previous report as 214 km^2. Therefore, unit cost of construction of weir per unit catchment area is given as 1,475 R$/km^2.

3.14 Construction Cost of Water Treatment Station

Construction costs of the existing water treatment stations operated by DESO are analyzed and the correlation between water production capacity P (m^3/day) and total construction cost, CSC + CC (R$), is obtained as follows:

Civil : $CSC + CC = 0.0015642P^2 - 0.0990P + 98,875$
E & M : $CSC + CC = 0.0029781P^2 + 32.0238P + 137,317$
Total : $CSC + CC = 0.0045423P^2 + 31.9248P + 236,192$

E & M means electrical and mechanical construction works.
The components included in water treatment station are Chemical House, Elevated and/or Auxiliary Tank, Conventional Type Filter and Disinfection Facility.

3.15 Construction Cost of Pumping Station

This cost can be divided into the construction cost for civil works and electrical and mechanical works and be regarded as proportional to the power of pump, P (kW).

(1) Power of Pump

Power of pump, P (kW), is given by the following formula:

$$P = g \cdot \rho \cdot Q \cdot H / \eta$$

where g : acceleration of gravity (m/s^2),
ρ : density of liquid (t/m^3),
Q : discharge capacity of pump (m^3/s),
H : total head (m),
and η : efficiency of pump, 0.8.

(2) Construction Cost for Civil Works

$$C_{pfc} = U_{pfc} \times P$$

where U_{pfc} : unit cost for civil works for construction of pump station (R$/kW).

U_{pfc} is determined referring to the following report, updated and taken as 470 R$/kW:

- Estudo de Pre-viabilidade de Perenezacao do Rio Sergipe e pequenos Afluentes do Rio Sao Francisco, COHIDRO, June 1992
- Sistema Adutora Do Sao Francisco, Projeto de Implantacao da 2a etapa, DESO, May 1998

U_{pfc} includes CSC and CC.

(3) Construction Cost for Electrical and Mechanical Works

$$C_{pfe} = U_{pfe} \times P$$

where U_{pfe} : unit cost for electrical and mechanical works for construction of pump station (R$/kW).

U_{pfe} is determined referring to the above-mentioned report, updated and taken as 1,900 R$/kW. U_{pfe} also includes CSC and CC.

(4) Total Head

Total head for calculation of the Power of Pump is given by sum of suction head and friction head loss, neglecting minor head loss in the system. Friction head loss, hf, is calculated by the following Hazen-Williams formula in accordance with 2.1.3(4):

$$h_f = 10.666 \cdot \frac{Q^{1.85}}{C^{1.85} \cdot D^{4.87}} \cdot L$$

where Q : flow volume (m^3/s),
D : diameter of pipe (m),
L : length of pipeline (m),
and C : coefficient of flow velocity, 120.

3.16 Construction Cost of Pipeline

Unit cost for construction of pipeline, C_{pl}, shall be estimated based on the quotation of pipe cost from the manufacturer and transportation and installation cost estimated by the study team. C_{pl} can be expressed as follows;

$$C_{pl} = U_{pl} \times L$$

where U_{pl} : unit cost for construction of pipeline per linear meter(R$/m),
and L : length of pipeline (m).

Upl of several types of pipe are expressed in the function of diameter of pipe D (mm) as follows:

- Steel Pipeline
  $U_{pl} = 0.0028950 \times D^{1.78928}$
- Cast-iron Pipeline
  $U_{pl} = 0.850599 \times D^{1.0739}$
- Reinforced Concrete Pipeline
  $U_{pl} = 0.0009654 \times D^{1.848}$

This cost includes CSC and CC.

3.17 Construction Cost of Distribution Network

Construction costs of water distribution network in the following two projects of DESO have been analyzed:

a) SISTEMA ADUTORA DO PIAUITINGA, Projeto de Melhoria e Ampliacao
b) SISTEMA DE ABASTECIMENTO DE AGUA, POVOADO COLONIA SERGIPE

Unit cost for distribution network is obtained as constant value of 0.24 R$/cap/litter/day as shown in Table-3.4.

Table-3.4 Unit cost for Water Distribution Network

Project Name	Piauitinga	Colonia Sergipe
Population	45,132	1,505
Daily Max. Water Supply Volume (l/cap/day)	210	144
Construction Cost, PDC + DCC + BDI (R$)	2,153,771	52,554
Unit cost (R$/cap/l/day)	0.228	0.243

3.18 Construction Cost of Other Component Facilities

(1) General

Correlation between construction cost or unit cost of other component facilities and capacity or other equivalent parameter is presented in this section.

(2) Construction Cost of Desalinizer

RO desalinazer is applicable to Small Rural Water Supply System only. Correlation between construction cost, CSC + CC (R$), and served population, P, in a village (inhabitants) is as follows:

Civil : CSC + CC = 11.440P + 9,953
E & M : CSC + CC = 67.146P + 8.511
Total : CSC + CC = 78.586P + 18,464

The components included in Desalinizer are Desalinizer House and Desalinizing equipment.

(3) Construction Cost of Elevated Tank

Correlation between construction cost, CSC + CC (R$), and storage capacity of reinforced concrete elevated tank P (m^3) is as follows:

Civil	:	CSC + CC = 50,553ln(P)-125,294
E & M	:	CSC + CC = 21,893ln(P)-79,871
Total	:	CSC + CC = 72,446ln(P)-205,165

Storage capacity of elevated tank is assumed to be one third of daily maximum water supply volume of the system.

(4) Construction Cost of Filter

Correlation between construction cost, CSC + CC (R$), and filtering capacity of direct ascending filter P (m^3/h) is as follows:

CSC + CC = 1,466P+26,648

(5) Construction Cost of Cistern

Correlation between construction cost, CSC + CC (R$), and storage capacity of cistern P (m^3) is as follows:

a) PVC canvas
CSC + CC = 1,703.6ln(P)-4,407.2

b) Masonry
CSC + CC = 2,666.2ln(P)-6,235.6

(6) Construction Cost of Amazonas Well

Correlation between construction cost, CSC + CC (R$), and depth D (m) of amazonas well (shallow well) with diameter of 3m is as follows:

CSC + CC = 165.0D+140.0

(7) Drilling Cost of Deep Well

(a) Drilling Cost

Unit cost for drilling of one well is considered to be constant in each geological region and is determined based on the information presented by COHIDRO. Depth of drilling is 60m for small rural area and 100m for urban and large rural area.

P_D : Drilling cost for wells in category I region, R$ 8,500 (60m), R$ 14,200 (100m)
: Drilling cost for wells in category II region, R$ 5,100 (60m), R$ 8,500 (100m)

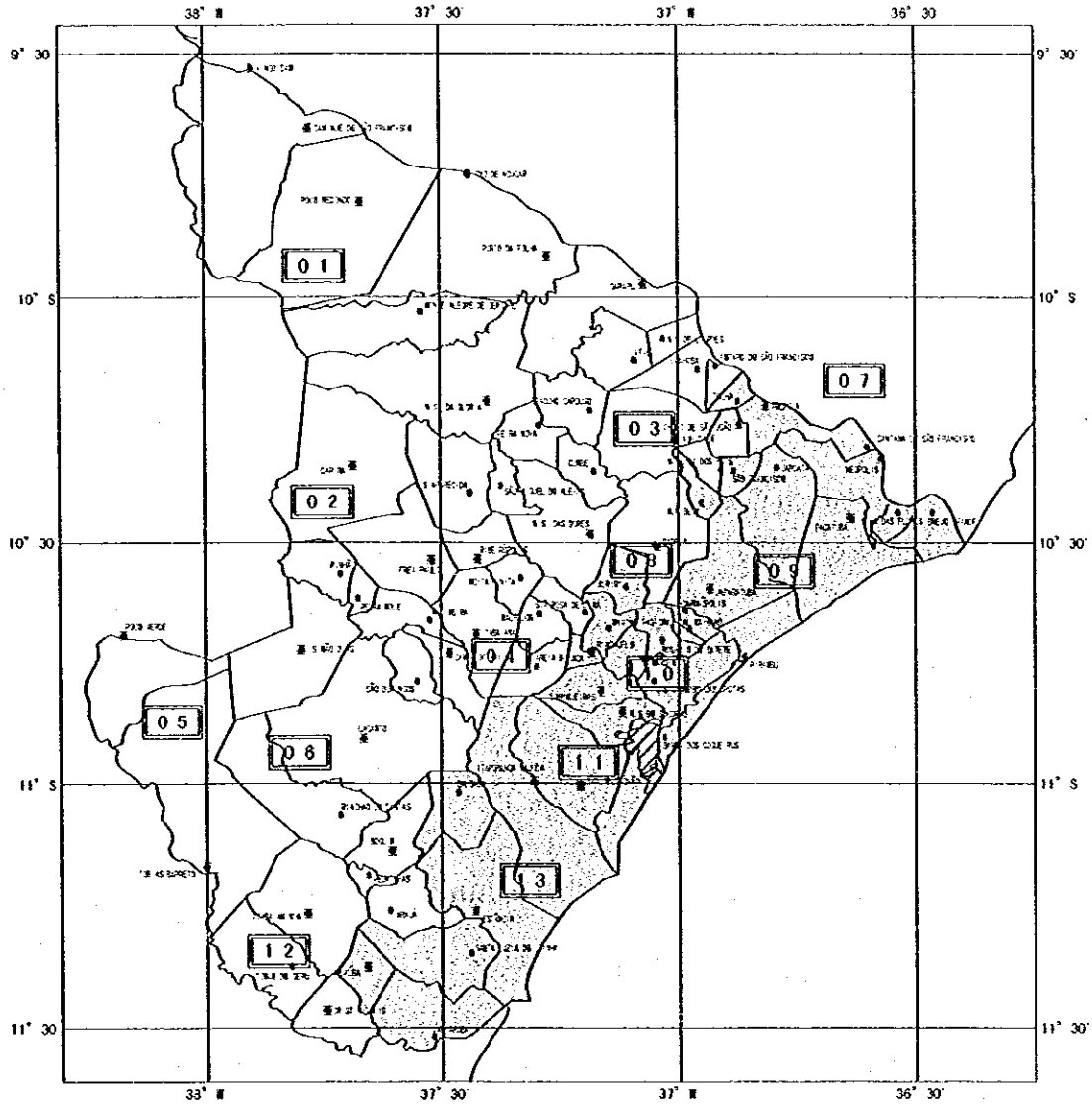
Figure-3.3 shows the distribution of geological region corresponding to the above drilling costs.

(b) Expected Drilling Cost

Expected drilling cost, C_D. can be expressed as follows:

$$C_D = n_W \times P_D / R_S = n_D \times P_D$$

where n_W : number of wells (integer),
n_D : number of drilling for wells (integer),
and R_S : rate of success for one drilling as shown in Table-4.10 of SUPPORTING REPORT (B) GEOLOGY AND HYDROGEOLOGY



01	Sergipana do Sertao do Sao Francisco	08	Continguiba
02	Caria	09	Japaratuba
03	Nossa Senhora das Dores	10	Baixo Continguiba
04	Agreste de Itabaiana	11	Aracaju
05	Tobias Barreto	12	Boquim
06	Agreste de Lagarto	13	Estancia
07	Propria		

Category of region of drilling cost per well

	Region I	8,500 R$
	Region II	5,100 R$

Figure-3.3 Distribution of Unit Price for drilling in Sergipe State

3.19 Construction Cost of Surface Water Supply System by Weir

(1) General

This section explains the relationship between the Construction cost of surface water supply system for urban areas and the water supply volume.
This system is applicable to Integrated Water Supply Systems and Independent Surface Water Supply Systems.
The components of water supply system in the urban areas are as follows:

1) Dam or weir where required
2) Intake and Raw Water Pump Station RWPS
3) Pipelines (From Raw water intake to water treatment station)
4) Water treatment station, WTS, composed of chemical house, filters, auxiliary water storage tank AT, elevated water storage tank ET, and treated water pumps TWP
5) Distribution pipeline and network

Conceptual sketch of the system is as shown in Figure-3.4.

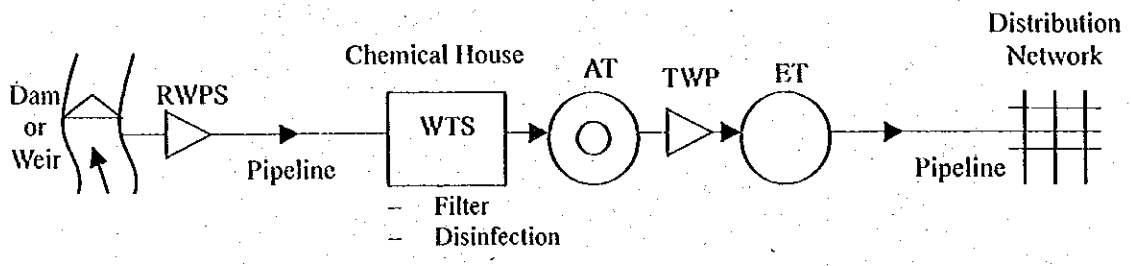


Figure-3.4 Conceptual Sketch of Integrated Surface Water Supply System

(2) Conditions for the Study

1) Water to be supplied for industrial consumption and domestic consumption in urban and large rural areas
2) Water supply volume per capita : 160 liter/day
3) Coefficient of variation K1 = 1.2 for daily variation
   K2 = 1.5 for hourly variation

(3) Required Area of Land

Refer to 3.6 (4).

(4) Dam

Refer to 3.12.

(5) Weir

Refer to 3.13.

(6) Pump Station

Refer to 3.15.

(7) Pipeline

Cast-iron pipe is used.
For unit cost of pipeline, refer to 3.16.

(8) Water Treatment Station

Refer to 3.14.

(9) Water Distribution Network

Refer to 3.17.

(10) Total Construction Cost

Total construction cost of urban water supply system with a specific amount of water supply including industrial water supply can be obtained by summing each one of the cost of component explained above.

3.20 Construction Cost of Independent Groundwater Supply System by Wells

(1) General

This section explains the relationship between the Construction cost of groundwater supply system for urban areas and the water supply volume.
The components of water supply system in the urban areas are as follows:

1) Wells
2) Raw Water Pump RWP
3) Pipelines (From Raw water pump to water treatment station)
4) Water treatment station WTS, composed of disinfection unit DIU, auxiliary water storage tank AT, elevated water storage tank ET, and treated water pumps TWP
5) Distribution pipeline and network

Conceptual sketch of the system is shown in Figure-3.5.

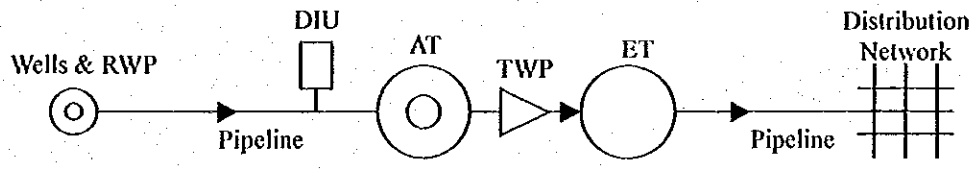


Figure-3.5 Conceptual Sketch of Integrated Groundwater Supply System

(2) Conditions for the Study

Design conditions are as same as for Independent Surface Water Supply System except described below.

1) Depth of well to be 100 m
2) Number of drilling to be the required number of wells divided by expected success rate and fresh rate of groundwater
3) Desalination unit not to be provided even if water in the drilled well contains high salinity. Additional drilling to be performed until to find acceptable well

(3) Required Area of Land

Refer to 3.6 (4).

(4) Well

Refer to 3.18 (7).

(5) Pump Facility

(a) General

Construction cost for pumping facility is estimated based on the cost estimation for water supply projects by well presented by DESO.

(b) Components of Pump Facility

One pump is installed for each well. No stand-by pump is provided. Wells are located separately. Suction head from well is assumed to be 90m.

(c) Composition of Cost

The following costs are regarded as constant for each well

– Material cost such as pipes, accessories, etc.	R$	2,500
– Civil construction cost	R$	600
– Pump installation cost	R$	5,100
– Cost for Electrical works	R$	9,700
– Urbanization cost	R$	500

5% of above cost is added to the above cost as planning and design cost. Cost of pump is evaluated considering the relationship between Power of pump and pump cost. Cost for pump facility in R$ is estimated by the following expression

Civil	:	CSC + CC = 1,115
E & M	:	CSC + CC = 41.57P + 16,860
Total	:	CSC + CC = 41.57P + 17,977

(6) Pipeline

Cast-iron pipe is used.
CSC + CC = 16.357P0.18075

(7) Elevated Tank

The correlation obtained in 3.18 (3) is used as follows:

Civil	:	CSC + CC = 50,554ln(P)-125,295
E & M	:	CSC + CC = 21,893ln(P)-79,871
Total	:	CSC + CC = 72,447ln(P)-205,165

The components included in Elevated tank are tank structure, riser pipings with accessories and disinfection facility. Storage capacity of Elevated Tank is assumed to be one third of daily maximum water supply volume for the system.

(8) Water Distribution Network

Refer to 3.17.

(9) Total Construction Cost

Total construction cost of independent groundwater supply system by well including industrial water supply can be obtained by summing each one of the cost of component explained above.

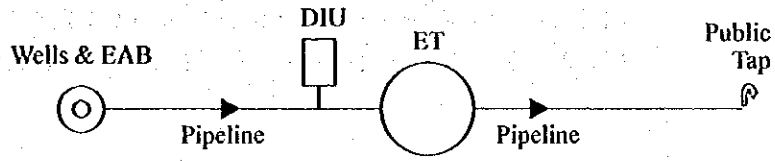
3.21 Construction Cost of Public Tap Water Supply System by Wells

(1) General

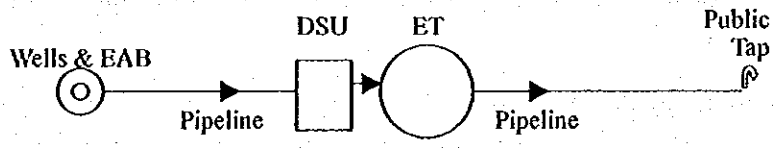
This section explains the details of cost estimation of water supply system by wells for villages through public tap.
The components of this water supply system are as follows:

1) Wells (One well for one system)
2) Raw Water Pump RWP
3) Pipelines (From Raw water pump to water treatment station)
4) Water treatment station WTS, composed of disinfection unit DIU, desalination unit if required DSU and elevated water storage tank ET
5) Distribution pipeline and public tap

Conceptual sketch of the system is as shown in Figure-3.6.



1. The System without Desalination Unit



2. The System with Desalination Unit

Figure-3.6 Conceptual Sketch of Small Rural Water Supply System

(2) Sources for the Study

The relationship has been derived based on the Project costs estimated by DESO for the following four recent representative projects of water supply system in rural area:

1) Colonia Sergipe : Population of 3,010 in 2,018
2) Palmeirinha : Population of 400 in 2,018
3) Palmares : Population of 1,830 in 2,018
4) Pingo Fogo : Population of 1,240 in 2,018

(3) Conditions for the Study

1) Depth of well to be 60 m
2) Number of drilling to be the required number of wells divided by expected success rate
3) Desalination unit to be provided if water in the drilled well contains high salinity.
4) Water to be supplied for domestic consumption in small rural areas
5) Water supply volume per capita : 70 liter/day
6) Served Population : 100 inhabitants
7) Water treatment by disinfection only
8) Coefficient of variation : Not to be considered.

(4) Required Area of Land

Refer to 3.6 (4).

(5) Well

Refer to 3.18 (7).

(6) Desalination Equipment

Desalination equipment will be required when well water contains salinity. Cost of one unit of desalinating station with population, P, of 100, PDES, is as given below:

Civil	:	PDES = 11.440·P + 9,953 = 11.440 x 100 + 9,953 = 11,097
E & M	:	PDES = 67.146·P + 8,511 = 67,146 x 100 + 8,511 = 15,226
Total	:	PDES = 77.586·P + 18,465 = 77,586 x 100 + 18,465 = 26,323

(7) Pumping Facility

(a) General

Construction cost for pumping facility is estimated based on the standard cost estimation by DESO and COHIDRO.

(b) Components of Pump Facility

One pump is installed for each well. No stand-by pump is provided. Wells are located separately. Suction head from well is assumed to be 50m.

(c) Composition of Cost

– Submersible Pump		R$ 2,400 (COHIDRO Standard)
– Material cost such as pipes, accessories, etc.		R$ 2,100
– Civil construction cost		R$ 600
– Pump installation cost		R$ 5,100
– Cost for Electrical works		R$ 9,700
– Urbanization cost		R$ 500
	Total	R$20,300

5% of above cost is added to the above cost as planning and design cost.

(8) Elevated Tank and Public Tap

Construction cost for elevated tank of $8m^3$ with public tap, CET, is obtained from estimated cost of standard design of DESO as follows:

Civil	:	CET = 4,093 x 1.3 x 1.05 = 5,587 (R$)
E & M	:	CET = 3,477 x 1.3 x 1.05 = 4,747 (R$)
Total	:	CET = 5,587 + 4,747 = 10,334 (R$)

(9) Total Construction Cost

Total construction cost of the water supply system by well through public tap for villages with water supply population of 100, CT, can be obtained by summing each one of the cost of component explained above. CT includes planning and design cost of 5% of CC.

3.22 Cost for Irrigation Projects

(1) General

Irrigation Projects include the facilities such as water intake, conduction, drainage, irrigation system for whole of the Project Area including construction of required infrastructure and irrigation for plots in the Project Area.

(2) Source of Information for Cost Estimation

The following sources are used for cost estimation of the Irrigation Projects in the Master Plan:

1) PROJECTOS DE IRRIGACAO: O CUSTO DA TRANSFORMACAO SOCIAL, PRONI, FIPE, 1989
2) SISTEMAS INTEGRADOS DE EXPLORACAO PARA O TROPICO SEMI-ARIDO BRASILEIRO - COEFICIENTES TECNICOS E CUSTOS, SUDENE, 1989
3) Information from CEHOP, CODEVASF and COHIDRO

(3) Components Included

The components included in the Water Supply Systems are as follows:

- Dam or weir where required
- Intake and Raw Water Pump Station RWPS
- Pipelines (From Raw water intake to reservoir or irrigation area)
- Reservoir AT
- Booster pump station BPS, if required
- Pipeline to irrigation area
- Irrigation plot area

Conceptual sketch of the system is as shown in Figure-3.7.

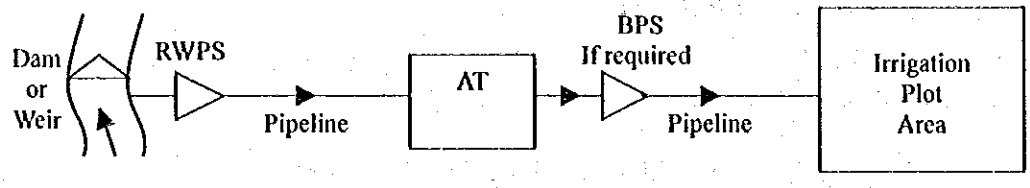


Figure-3.7 Conceptual Sketch of Irrigation Water Supply System

(4) Design Conditions

The water supply system is designed to meet the design water supply volume taking geographical condition from water intake point to the irrigation area into consideration.

(5) Cost Estimation

The costs for Irrigation Projects include the cost for planning, design, land expropriation, the construction costs for water intake structure, pumping facility and pipeline from water intake point to the Project Area, electrical energy, transportation and others. Cost for social infrastructure is not included.

The unit cost has been estimated as 8,300 R$/ha for Irrigation area less than 2,000 ha and 7,000 R$/ha for Irrigation area more than 2,000 ha based on the analysis of Project costs in the past presented in the above information. The unit cost also covers the irrigation and under drain cost for each plot in the Project area.

When the unit length of conduction pipeline is more than 17 m/ha, which is determined from the cost data on Jacarecica II Irrigation Project presented by CEHOP, the additional cost for pumping facility and conduction pipeline shall be calculated. The cost for land expropriation shall be estimated separately based on the unit cost presented in 3.6 using the Project Area which is assumed to be 20% greater than the Irrigation Area.

3.23 Estimated Project Cost

(1) Price Level

Cost estimation for the Master Plan is based on the prices at the time of August 1998. Exchange rate of Brazilian "Real" to US$ as of August 1998 is 1 US$ = 1.18 R$.

(2) Total Project Cost

The estimated total project cost is summarized in Table-3.5.

Table-3.5 Summary of Project Cost

Unit : million R$

Item	Domestic and Industrial Water Supply				Irrigation	Total
	Integrated W/S	Indepen-dent W/S	Small Rural W/S	Total		
1. Construction Cost	600.98	145.47	63.31	809.76	354.72	1,164.48
2. Land Acquisition and Compensation Cost	0.74	0.26	0.01	1.01	11.74	12.75
3. Consulting Services Cost	60.17	14.57	6.33	81.07	36.65	117.72
4. Administration Cost	6.95	1.68	0.73	9.36	4.23	13.59
5. Contingency	33.10	8.02	3.48	44.60	20.16	64.76
(1) Price Escalation	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
(2) Physical Contingency	*33.10*	*8.02*	*3.48*	*44.60*	*20.16*	*64.76*
6. Government Tax	-	-	-	-	-	-
Grand Total	701.94	170.00	73.86	945.80	427.50	1,373.30

Note: Government Tax is included in Construction Cost

(3) Breakdown of the Costs

(a) Project Cost Proposed in Master Plan

The breakdown of the costs for the projects proposed in the Master Plan is shown in Table-3.6.

Table-3.6 Breakdown of Project Cost Proposed in Master Plan

Project	Project Cost (1,000R$)	Project	Project Cost (1,000R$)
Domestic and Industrial Water Supply	**945,806**	Sao Francisco: Deep Well Development	503
Urban/Large Rural Area (Integrated Sys.)	**701,938**	*Carmopolis: Deep Well Development*	612
Project Expansion of Sao Francisco Pipeline Sys.	258,011	General Maynard: Deep Well Development	465
Aracaju Well Development Project	27,003	Maruim: Deep Well Development	1,511
Project Expansion of Agreste Pipeline System	14,562	Riachuelo: Jacarecica R. Development	1,793
Project Expansion of Piauitinga Pipeline System	9,293	: Deep Well Development	2,039
Xingo Dam Pipeline Project	145,662	Rosario do Catete: Siriri R. Development	2,042
1) Caninde Block	53,729	: Deep Well Development	3,454
2) Nossa Senhora da Gloria Block	54,872	S. Amaro das Brotas: Deep Well Development	552
3) Frei Paulo Block	37,061	Barra dos Coqueiros: Deep Well Development	2,925
Vaza Barris Dam Project	154,618	*Sao Cristovao: Deep Well Development*	2,732
(include dam cost allocated with irrigation project)		Araua: Camboata R. Development	1,195
1) Agreste System (Itabaiana)	74,854	: Deep Well Development	1,159
2) Piauitinga System (Lagarto)	79,764	Boquim: Gaiangal R. Development	3,748
Project Expansion of Itabaianinha Pipe. System	34,305	Cristinapolis: Itamirim R. Development	4,106
Project Expansion of Propria Pipeline System	4,814	Pedrinhas: Araua R. Development	2,193
Project Expansion of Alto Sertão Pipeline Sys.	20,518	: Deep Well Development	644
Project Expansion of Sertaneja Pipeline System	33,152	Salgado: Grilo R. Development	2,002
Urban/Large Rural Area (Independent Sys.)	**170,002**	: Deep Well Development	1,159
Gararu: SFR Direct Intake	635	*Estancia: Piauitinga R. Development*	6,825
Muribeca: Deep Well Development	846	*: Piaui R. Development*	4,061
Nossa Senhora das Dores: Pinol R. Development	2,870	*: Deep Well Development*	2,938
Malhador: Vermelho R. Development	2,113	Indiaroba: Paripe R. Development	1,184
: Deep Well Development	598	Itaporanga D'Ajuda: Fundo R. Development	5,851
Tobias Barreto: Jabiberi Dam Raising Project	16,787	: Tejupeba R. Development	63,539
Brejo Grande: Deep Well Development	564	Santa Luzia do Itanhy: Ariquitiba R. Develop.	1,481
Ilha das Flores: Deep Well Development	594	**Small Rural Area (Residential W/S Only)**	73,866
Neopolis: SFR Direct Intake	8,310	Single Well System (Public Tap)	73,866
Santana do Sao Francisco: SFR Direct Intake	1,861	**Irrigation Water Supply**	**427,497**
Capela: Siriri R. Development	3,650	Quixabeira	35,051
: Adeira R. Development	3,301	Jacare-Curituba	37,852
Divina Pastora: Deep Well Development	523	Sao Francisco	223,070
Santa Rosa de Lima: Deep Well Development	457	Ladeirinhas	28,742
Siriri: Deep Well Development	628	Jacarecica II	44,545
Japaratuba: Deep Well Development	1,762	Vaza Barris	54,839
Japoata: Deep Well Development	540	(include dam cost allocated with W/S project)	
Pacatuba: Santo Antonio R. Development	1,922	Entre Rios	2,397
Pirambu: Deep Well Development	1,327	Estancinha	1,001

Note: Vaza Barris irrigation project does not include dam construction cost. No allocation is done.

(b) Multi-Purpose Projects

The costs for Multi-Purpose projects are shown in Table-3.7 and Table-3.8

Table-3.7 Xingo Dam Multi-Purpose Pipeline Project

Project Component	Cost (millions R$)
Xingo Dam Pipeline Project	145.66
Caninde Block	53.73
Nossa Senhora da Gloria Block	54.87
Frei Paulo Block	37.06
Sao Francisco	223.07
Total	368.73

Table-3.8 Vaza Barris Multi-Purpose Dam Project

Project Component	Cost (millions R$)
Vaza Barris Dam Project	186.24
Dam Construction	63.25
Water Supply facilities (Itabaiana)	59.04
Water Supply facilities (Lagarto)	63.95
Vaza Barris	23.22
Total	209.46

(c) Integrated Water Supply Projects Regarding Vaza Barris Multi-Purpose Project

Table-3.9 Cost of Agreste Integrated Water Supply Projects

Project Component	Cost (millions R$)
PROAGUA	14.56
Vaza Barris Pipeline	25.60
Vaza Barris Treatment and Distribution	33.45
Vaza Barris Dam (Allocated Cost)	15.81
Total	89.42

Table- 3.10 Cost of Piauitinga Integrated Water Supply Projects

Project Component	Cost (millions R$)
PROAGUA	9.29
Vaza Barris Pipeline	27.20
Vaza Barris Treatment and Distribution	36.75
Vaza Barris Dam (Allocated Cost)	15.81
Total	89.05

(d) Vaza Barris Dam Construction Project

Table-3.11 Cost of Vaza Barris Multi Purpose Dam Project

Project Component	Cost (millions R$)
(1) Vaza Barris Dam Project (Domestic and Industrial W/S Project)	186.24
Dam Construction	63.25
Water Supply facilities (Itabaiana)	59.04
Water Supply facilities (Lagarto)	63.95
(2) Vaza Barris Irrigation Project	23.22
Total	209.46

Note: Irrigation project does not include dam construction cost. No allocation is done.

APPENDIX-1

Relations of the Construction Costs and the Related Parameters

APPENDICSES

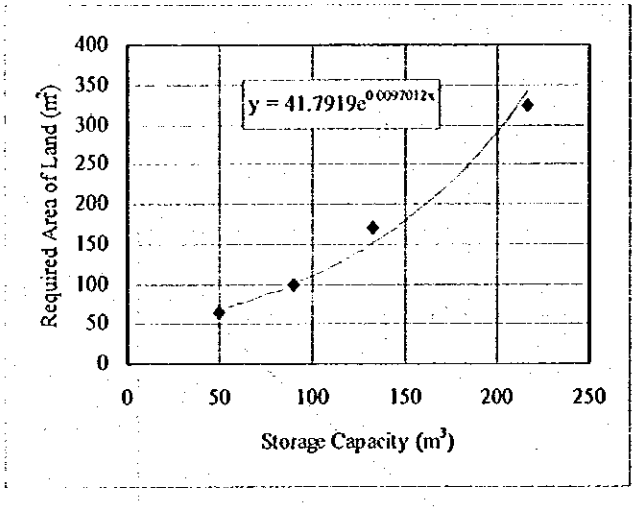
Appendix-1 Relations of the Construction Costs and the Related Parameters

Data and graphs showing the relations of the construction costs and the related parameters concerning the facilities included in the Master Plan.

(1) Required area for Elevated Tanks (to Section 3.6)

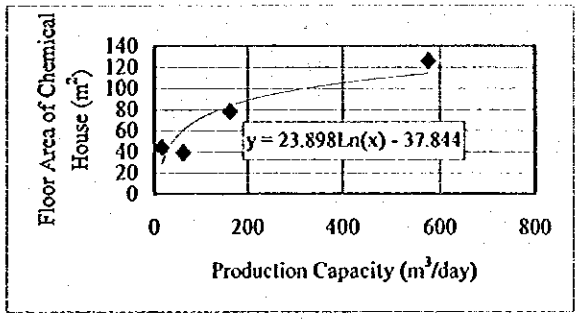
(Costs shown in US$, 1US$=1.18R$)

	Capa. (m^3)	Side L1 (m)	Side L2 (m)	Area (m^2)
Palmeirinha	50	8	8	64
Pinga Fogo	90	10	10	100
Palmares	132	13	13	169
Colonia Sergipe	217	18	18	324



(2) Floor area of chemical house(to Section 3.6)

System	Capacity m^3/h	Floor area m^2
Japoata	16	44
Ilha das Flores	62	39
Cristinapolis	162	78
Piauitinga	576	126



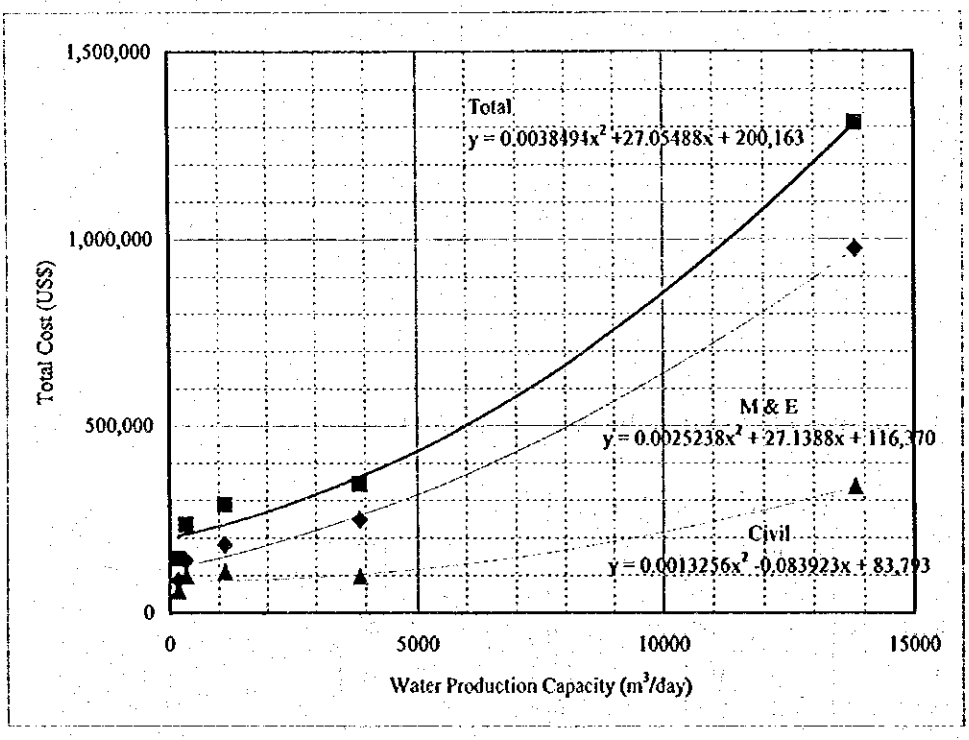
(3) Water Treatment Station (to Section 3.14)

(Costs shown in US$, 1US$=1.18R$)

Facilities included
- Elevated Tank
- Chemical House
- Conventional type filter
- Disinfection

Station	Production	Cost						
		Chemical House	Elevated Tank	Aux. Tank	E&M	Others	P & D	Total
	m³/day	US$	US$	US$	US$	US$	US$	US$
Pov. Cajueiro/Bordada Mata	172.8		52,212		78,761		13,098	144,071
Pov. Fazenda Nova/Aragao	328.8	25,044	61,947		126,549		21,354	234,894
Pov. Cruz da Donezela/Visqueiro	1123.2	30,177	67,425		164,734		26,234	288,570
Cristinapolis	3888.0	27,652	59,295		226,424		31,337	344,708
Piauitinga - Melhoria e ampliacao	13824.0	60,121	90,415		885,909	155,311	119,176	1,310,932

Station		Cost (US$)		
		Civil	E&M	Total
Pov. Cajueiro/Bordada Mata		57,434	86,637	144,071
Pov. Fazenda Nova/Aragao		95,690	139,204	234,894
Pov. Cruz da Donezela/Visqueiro		107,362	181,208	288,570
Cristinapolis		95,642	249,066	344,708
Piauitinga - Melhoria e ampliacao		336,432	974,500	1,310,932

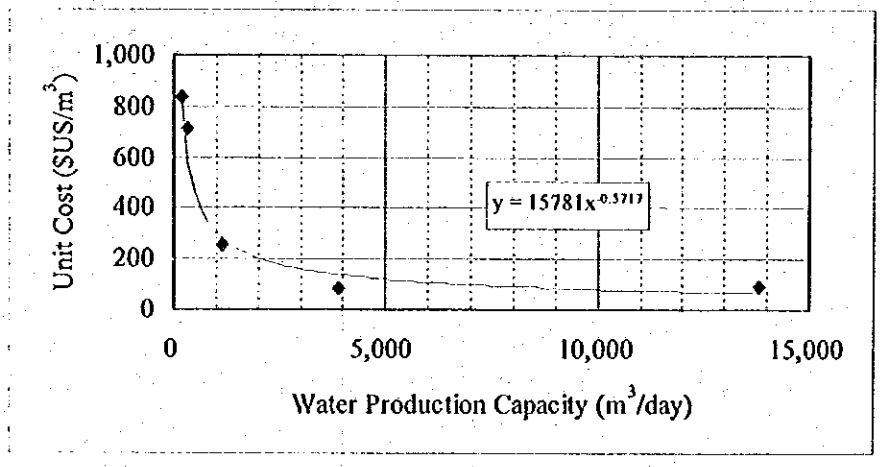


(4) Unit Cost of Water Treatment Station(to Section 3.14)

(Costs shown in US$, 1US$=1.18R$)

Facilities included
- Elevated Tank
- Chemical House
- Conventional type filter
- Disinfection

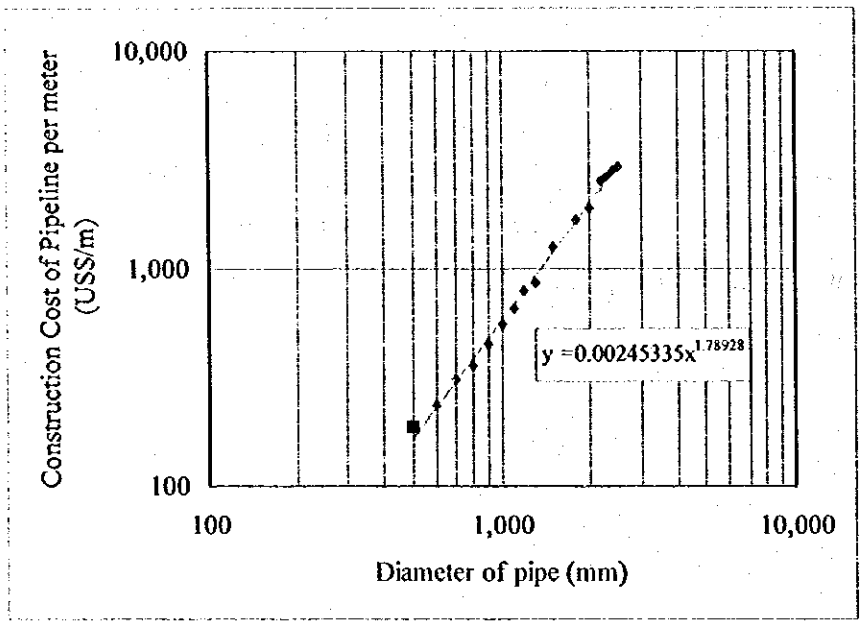
Station	Production		Cost	
			Total	Unit
	m^3/h	m^3/day	US$	US$/$m^3$
Pov. Cajueiro/Bordada Mata	7.2	172.8	144,071	834
Pov. Fazenda Nova/Aragao	13.7	328.8	234,894	714
Pov. Cruz da Donezela/Visqueiro	46.8	1123.2	288,570	257
Cristinapolis	162	3888	344,708	89
Piauitinga - Melhoria e ampliacao	576	13824	1,310,932	95



(5) Unit cost of Steel Pipes (to Section 3.16)

(Costs shown in US$, 1US$=1.18R$)

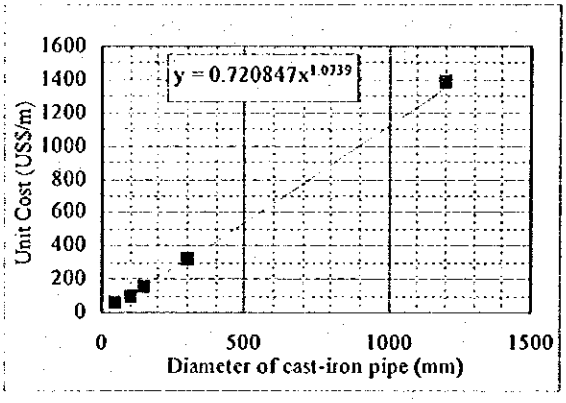
Diameter	Thk.	Weight	Cost (US$/m)						
			Material	Transport	Install	Civil	BDI	Design	Total
500	4.37	0.05389	73.51	12.86	38.78	17.69	25.91	16.87	185.62
600	4.37	0.06466	88.41	19.28	46.54	25.47	32.31	21.20	233.21
700	4.75	0.08200	112.47	32.14	59.02	34.66	43.38	28.17	309.84
800	4.75	0.09371	128.72	32.14	67.45	45.28	48.25	32.19	354.03
900	5.56	0.12341	168.78	32.14	88.82	57.31	60.27	40.73	448.05
1,000	5.56	0.13712	187.73	64.26	98.69	70.75	75.59	49.70	546.72
1,100	6.30	0.17090	236.03	64.26	123.01	85.60	90.09	59.90	658.89
1,200	7.14	0.21130	285.49	64.26	152.08	101.87	104.92	70.86	779.48
1,300	7.14	0.22891	309.51	64.26	164.75	119.56	112.14	77.03	847.25
1,500	7.94	0.29372	397.39	192.80	211.40	159.17	177.05	113.78	1,251.59
1,800	9.52	0.42260	573.49	192.80	304.16	229.21	229.89	152.96	1,682.51
2,000	9.52	0.46956	637.47	192.80	337.96	282.97	249.08	170.03	1,870.31
2,200	12.70	0.68904	936.40	192.80	495.93	342.40	338.75	230.63	2,536.91
2,300	12.70	0.72036	979.38	192.80	518.47	374.23	351.65	241.65	2,658.18
2,400	12.70	0.75168	1,021.93	192.80	541.02	407.48	364.42	252.76	2,780.41
2,500	12.70	0.78300	1,064.91	192.80	563.56	442.14	377.31	264.08	2,904.80



(6) Unit cost of Cast-iron pipes (to Section 3.16)

(Costs shown in US$, 1US$=1.18R$)

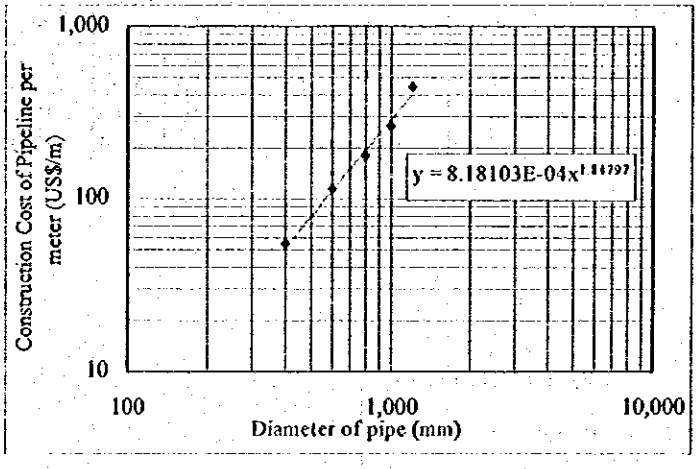
	Diameter	Cost (US$/m)				
	DN	Material	Labor	BDI	Design	Total
Simao Dias/Piauitinga	300	203.22	22.43	67.70	29.00	322.35
Sao Francisco	1200	764.22	196.26	288.14	138.73	1387.35
Richao do Dantas	150	87.83	19.48	32.19	14.00	153.50
Sta Luzia do Itanhy	100	37.25	26.30	19.06	8.00	90.61
Palmeirinha	50	25.57	11.91	11.24	5.00	53.72



(7) Unit cost of Reinforced concrete pipes (to Section 3.16)

(Costs shown in US$, 1US$=1.18R$)

Diameter	Weight	Cost (US$/m)						
		Material	Transport	Install/Civil		BDI	Design	Total
(mm)	(t/m)		Ext.Tr.	Int. Tr.	Labor			
400	0.160	19.25	3.20	6.40	9.02	11.36	4.92	54.15
600	0.354	44.77	7.08	14.16	12.94	23.69	10.26	112.90
800	0.650	67.49	13.00	26.00	17.90	37.32	16.17	177.88
1,000	1.030	93.77	20.60	41.20	28.94	55.35	23.99	263.85
1,200	2.100	140.64	42.00	84.00	44.10	93.22	40.40	444.36



(8) Total construction cost of Desalinizer (to Section 3.18)

(Costs shown in US$, 1US$=1.18R$)

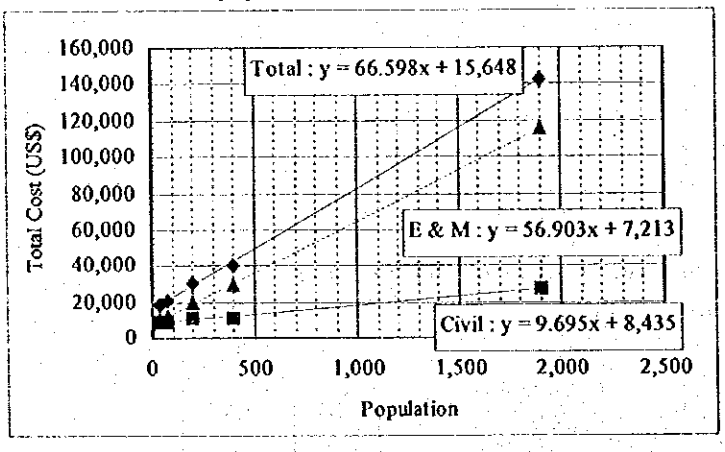
Production	Served	Cost (US$)					O & M
		M & I	House	BDI	P & D	Total	Cost
m³/day	Population	CMI, ①	②	③ 0.3xCMI	④		US$/mes
5	40	6,780	6,600	4,010	870	18,260	45
10	79	8,470	6,600	4,520	980	20,570	90
25	198	14,410	8,250	6,800	1,473	30,933	225
50	397	21,190	8,250	8,830	1,914	40,184	450
240	1,905	84,750	19,800	31,370	6,796	142,716	2,160

Cost for equipment and installation, CMI, by Perenne

Operation and maintenance cost by Perenne : 0.3 US$/m³

Maximum water supply volume per capita : 126 liter/day

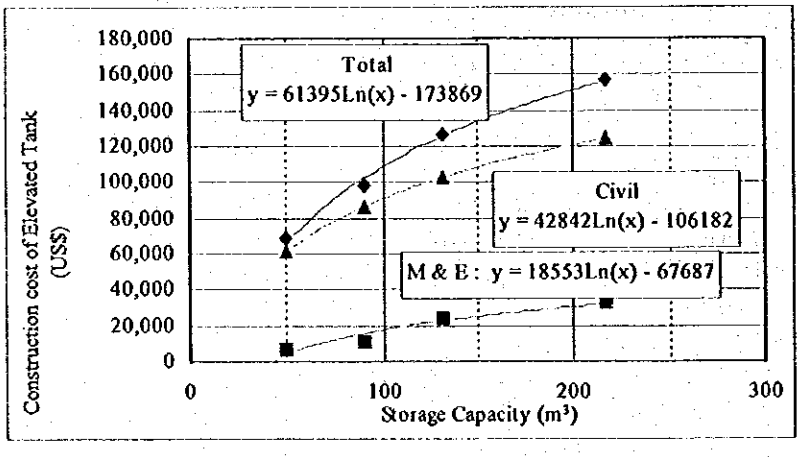
Public Tap System in Rural Area



(9) Total construction cost of Elevated Tank (to Section 3.18)

(Costs shown in US$, 1US$=1.18R$)

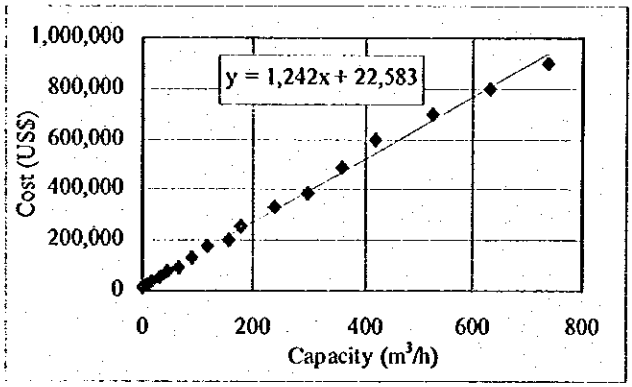
	Population	Supply Capa. (m³/h)	Capa. (m³)	Pipe L. (m)	Material Cost (US$)			Const. C. (US$)	Urban (US$)	P & D (US$)	Total (US$)
					Desinfec.	Other	Subtotal				
Palmeirinha	400	3.6	50	1,000	1,507	5,236	6,743	52,743	6,100	2,942	68,528
Pinga Fogo	1,240	11.2	90	1,000	2,712	8,085	10,797	77,003	6,100	4,155	98,055
Palmares	1,830	16.5	132	1,000	3,977	19,197	23,174	92,826	6,100	4,946	127,046
Colonia Sergipe	3,010	27.1	217	1,000	6,538	24,855	31,393	113,923	6,100	6,001	157,417



(10) Total Construction Cost of Direct Ascending Filter (to Section 3.18)

(Costs shown in US$, 1US$=1.18R$)

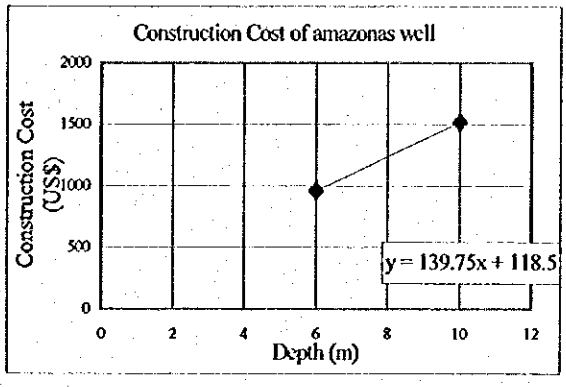
Capacity m^3/h	Cost (US$)			
	M & I CMI	BDI 0.30xCMI	P & D	Total
1	11,514	3,454	1,497	16,465
7	18,849	5,655	2,450	26,954
16	29,532	8,860	3,839	42,231
31	39,611	11,883	5,149	56,643
46	53,887	16,166	7,005	77,058
66	67,417	20,225	8,764	96,406
91	89,553	26,866	11,642	128,061
120	123,904	37,171	16,108	177,183
160	142,703	42,811	18,551	204,065
181	177,632	53,290	23,092	254,014
241	230,525	69,157	29,968	329,650
301	272,197	81,659	35,386	389,242
361	340,866	102,260	44,313	487,439
421	417,612	125,284	54,290	597,186
526	488,905	146,672	63,558	699,135
631	555,850	166,755	72,261	794,866
736	626,538	187,961	81,450	895,949



(11) Total Construction Cost of Amazonas Well with Cover (to Section 3.18)

(Costs shown in US$, 1US$=1.18R$)

Item	Unit	Case 1	Case2	Case3
Diameter	m	3	3	1.5
Depth	m	6	10	6
Cost	US$	957	1516	495
Unit Cost	US$/m	159.5	151.6	82.5
	US$/m³	22.56	21.45	46.69



(12) Total Construction Cost of Cistern (to Section 3.18)

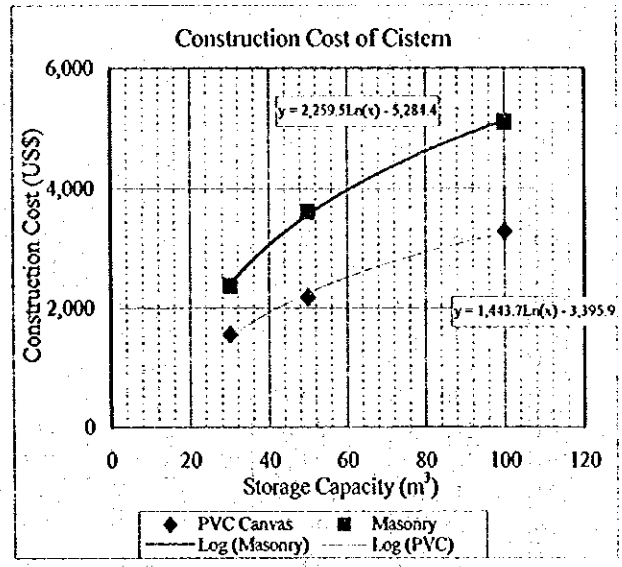
(Costs shown in US$, 1US$=1.18R$)

PVC Canvas

Item	Unit	Case 1	Case2	Case3
Capacity	m^3	30	50	100
Cost	US$	1,557	2,178	3,284
Unit cost	US$/$m^3$	51.9	43.56	32.84

Masonry

Item	Unit	Case 1	Case2	Case3
Capacity	m^3	30	50	100
Cost	US$	2,372	3,605	5,100
Unit cost	US$/$m^3$	79.07	72.1	51

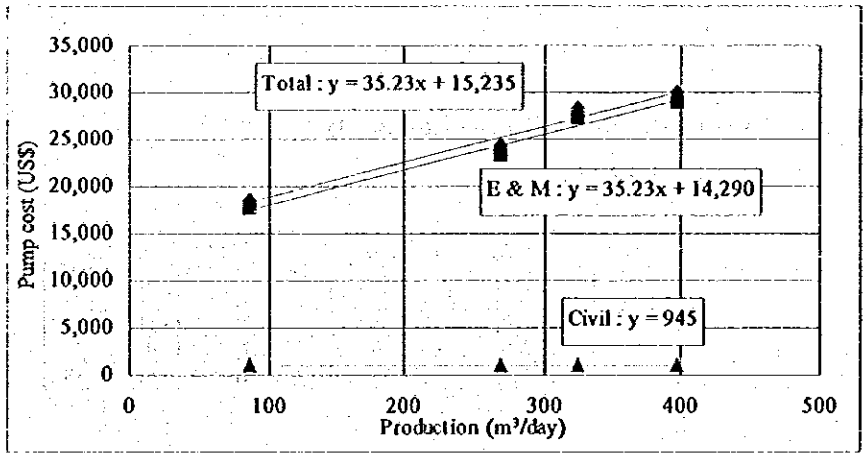


(13) Total Construction Cost of Submersible Pump Station (to Section 3.20, Drilling cost excluded)

(Costs shown in US$, 1US$=1.18R$)

Exch.Rate 1.15
Unit cost 1,590 US$/kW

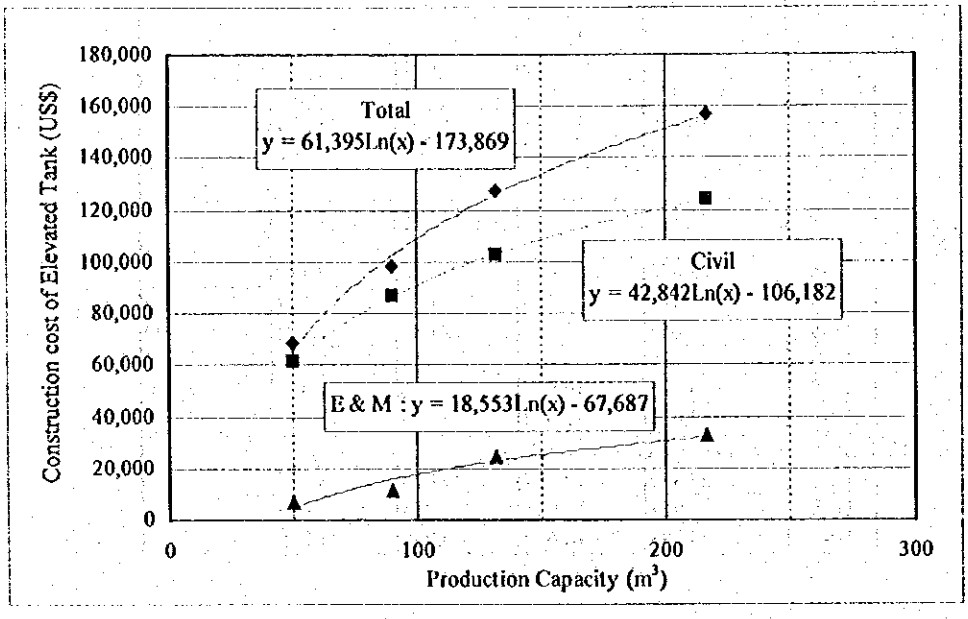
Village	Unit	Colonia Sergipe	Palmeirinha	Palmares	Pinga Fogo	Adopted Value
No. pump		2+0	1+1	1+1	1+1	
Population		3,010	400	1,830	1,240	
No. pump in operation		2	1	1	1	
Supply Capa. per pump	m^3/h	13.5	3.6	16.5	11.2	
	m^3/day	324	86.4	396	268.8	
Total Head	m	166.56	123.23	155.44	133.91	
Power	kW	7.2	1.4	8.2	4.8	
Pump Cost						
Pump	US$	11,448	2,226	13,038	7,632	
Other works (US$)						
Material	US$	2,022	2,063	2,116	2,180	2,100
Civil	US$	425	485	485	507	500
Install	US$	3,652	3,652	2,435	7,304	4,300
Urbanize	US$	228	457	457	457	400
Electrical	US$	6,696	10,957	7,826	7,304	8,200
Subtotal	US$	13,023	17,613	13,318	17,753	15,500
Modified Construction Cost (Planning and Design cost also included)						
E & M	US$	27,350	17,667	29,020	23,344	
Civil	US$	945	945	945	945	
Total	US$	28,295	18,612	29,965	24,289	



(14) Total Construction Cost of Elevated Tanks (to Section 3.20)

(Costs shown in US$, 1US$=1.18R$)

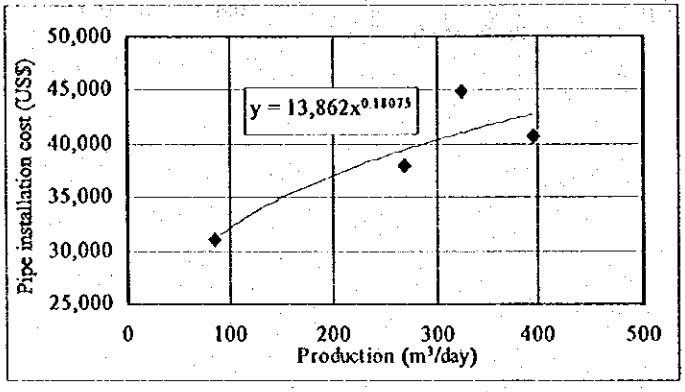
	Population	Supply Capa. (m³/h)	Capa. (m³)	Pipe L. (m)	Material Cost (US$) Desinfec.	Other	Subtotal	Const. C. (US$)	Urban (US$)	P & D (US$)	Total (US$)
Palmeirinha	400	3.6	50	1,000	1,507	5,236	6,743	52,743	6,100	2,942	68,528
Pinga Fogo	1,240	11.2	90	1,000	2,712	8,085	10,797	77,003	6,100	4,155	98,055
Palmares	1,830	16.5	132	1,000	3,977	19,197	23,174	92,826	6,100	4,946	127,046
Colonia Sergipe	3,010	27.1	217	1,000	6,538	24,855	31,393	113,923	6,100	6,001	157,417



(15) Total Construction Cost of Pipelines (to Section 3.20)

(Costs shown in US$, 1US$=1.18R$)

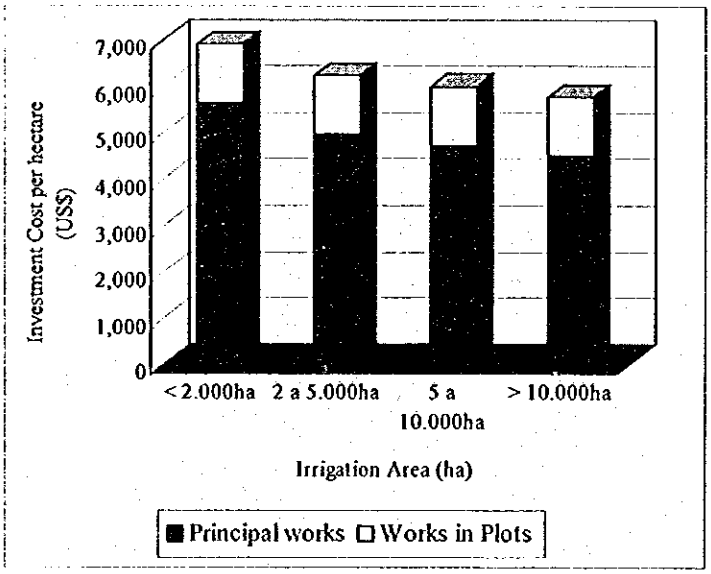
	Production	Pipe Material	Eq. Dia. (mm)	Length (m)	Conduction pipe (US$) Material	Civil	Total	Unit Cost (US$/m) Material	Civil	Total
Colonia Sergipe	324	FoFo	86	1,000	29,300	15,600	44,900	29.3	15.6	44.9
Palmeirinha	86	FoFo	50	1,000	17,500	13,600	31,100	17.5	13.6	31.1
Palmares	396	FoFo	75	1,000	25,700	15,000	40,700	25.7	15.0	40.7
Pinga Fogo	269	FoFo	68	1,000	23,400	14,600	38,000	23.4	14.6	38.0



(16) Investment Cost per hectare of Irrigation Area in Irrigation Projects of CODEVASF (to Section 3.22)

(Costs shown in US$, 1US$=1.18R$)

Type of usage	Project Area			
	< 2.000ha (US$/ha)	2 a 5.000ha (US$/ha)	5 a 10.000ha (US$/ha)	> 10.000ha (US$/ha)
Productive Investment	6,923	6,245	6,018	5,793
Principal works	5,653	4,974	4,748	4,523
Works in Plots	1,270	1,271	1,270	1,270



Source : CODEVASF p.50

APPENDIX-2

Cost Estimation of Water Supply System

Appendix-2 Cost Estimation of Water Supply System

(1) Cost Estimation by Water Supply System

(Costs shown in US$, US$=1.18R$)

Cost Estimation of Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Xingo	35,136	105,782,858	10,581,801	5,819,989	1,222,197	123,441,981
Propria	5,439	3,491,749	349,718	192,346	40,392	4,079,644
Alto Sertao	8,401	14,897,021	1,490,542	819,798	172,157	17,387,919
Sertaneja	18,231	24,065,750	2,408,400	1,324,619	278,169	28,095,169
Itabaianinha	32,596	24,888,407	2,492,100	1,370,655	287,837	29,071,595
Aracaju	27,195	207,025,501	20,705,270	11,387,898	2,391,459	241,537,323
Agreste	8,777	53,461,322	5,347,011	2,940,854	617,580	62,375,544
Piauitinga	976,336	98,182,902	9,915,925	5,453,759	1,145,290	115,674,212
Total	1,112,111	531,795,510	53,290,767	29,309,918	6,155,081	621,663,387

Cost Estimation of Xingo Integrated Water Supply System

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
XINGO TOTAL		-	35,136	105,782,858	10,581,801	5,819,989	1,222,197	123,441,981
XINGO DISTRIBUTION		52,799	13,892	27,720,862	2,773,477	1,525,411	320,336	32,353,978
01-0120	Caninde do Sao Francisco	22,180	552	6,229,853	623,041	342,672	71,961	7,268,079
01-0450	Nossa Senhora da Gloria	16,167	278	3,268,308	326,859	179,772	37,752	3,812,969
02-0140	Canha	3,639	3,683	7,299,213	730,290	401,659	84,348	8,519,193
02-0230	Frei Paulo	3,638	163	964,017	96,418	53,030	11,136	1,124,764
02-0445	Nossa Senhora Aparecida	997	356	653,198	65,355	35,945	7,549	762,403
02-0500	Pedra Mole	223	2,104	2,765,602	276,771	152,224	31,967	3,228,668
02-0520	Pinhao	957	685	935,848	93,653	51,509	10,817	1,092,512
02-0600	Ribeiropolis	2,476	1,141	2,531,694	253,284	139,306	29,254	2,954,679
03-0700	Sao Miguel do Aleixo	272	1,977	868,306	87,028	47,866	10,052	1,015,229
04-0410	Moita Bonita	2,250	2,953	2,204,823	220,778	121,428	25,500	2,575,482
Xingo Pipeline System		43,080	21,244	78,061,996	7,808,324	4,294,578	901,861	91,088,003

Cost Estimation of Propria Integrated Water Supply System

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
PROPRIA TOTAL		7,427	5,439	3,491,749	349,718	192,346	40,392	4,079,644
03-0380	Malhada dos Bois	996	1,995	1,328,819	133,081	73,195	15,371	1,552,461
07-0160	Cedro de Sao Joao	186	1,357	337,693	33,905	18,648	3,916	395,519
07-0570	Propria	6,116	737	1,504,663	150,540	82,797	17,387	1,756,124
07-0730	Telha	129	1,350	320,574	32,192	17,706	3,718	375,540

Cost Estimation of Alto Sertao Integrated Water Supply System

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
ALTO SERTAO TOTAL		-	8,401	14,897,021	1,490,542	819,798	172,157	17,387,919
ALTO SERTAO		6,594	2,315	4,857,517	485,752	267,279	56,129	5,668,992
01-0420	Monte Alegre de Sergipe	3,008	157	692,515	69,267	38,097	8,000	808,036
01-0540	Poco Redondo	2,170	2,018	3,317,152	331,917	182,554	38,336	3,871,977
01-0560	Porto da Folha	1,416	140	568,421	56,856	31,271	6,567	663,255
Alto Sertao Pipeline System		1,920	6,086	10,318,933	1,032,502	567,876	119,254	12,044,651

Cost Estimation of Sertaneja Integrated Water Supply System

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
SERTANRJA TOTAL		-	18,231	24,065,750	2,408,400	1,324,619	278,169	28,095,169
SERTANEJA		7,793	10,219	8,185,972	819,621	450,791	94,665	9,561,268
01-0220	Feira Nova	2,269	149	783,959	78,411	43,126	9,056	914,701
01-0240	Gararu	162	892	544,353	54,525	29,988	6,298	636,056
01-0260	Gracho Cardoso	499	129	340,254	34,038	18,721	3,931	397,073
01-0310	Itabi	464	128	285,154	28,528	15,691	3,295	332,796
03-0020	Aquidaba	2,643	3,586	3,962,169	396,576	218,117	45,804	4,626,252
03-0190	Cumbe	345	2,564	1,061,782	106,435	58,539	12,293	1,241,613
07-0010	Amparo de Sao Francisco	151	483	244,483	24,497	13,473	2,829	285,765
07-0470	Nossa Senhora de Lourdes	1,260	2,288	963,818	96,611	53,136	11,159	1,127,012
Sertaneja Pipeline System		10,800	8,012	15,879,778	1,588,779	873,828	183,504	18,533,901

Cost Estimation of Itabaianinha Integrated Water Supply System

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
ITABAIANINHA TOTAL		15,985	32,596	24,888,407	2,492,100	1,370,655	287,837	29,071,595
12-0300	Itabaianinha	8,082	4,383	6,425,091	642,947	353,621	74,260	7,500,302
12-0750	Tomar do Geru	3,175	3,234	3,074,283	307,752	169,263	35,545	3,590,077
12-0760	Umbauba	4,728	410	1,415,484	141,589	77,874	16,354	1,651,711
	Itabaianinha pipeline system 1	11,327	14,905	8,748,146	876,305	481,968	101,213	10,222,537
	Itabaianinha pipeline system 2	4,658	9,664	5,225,403	523,507	287,929	60,465	6,105,968

Cost Estimation of Aracaju Integrated Water Supply System

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
ARACAJU TOTAL		206,870	27,195	207,025,501	20,705,270	11,387,898	2,391,459	241,537,323
ARACAJU WELL DISTRI.		27,951	11,492	18,713,502	1,872,500	1,029,875	216,274	21,843,643
10-0360	Laranjeiras	11,263	1,665	1,848,143	184,981	101,739	21,365	2,157,893
11-0030	Aracaju	11,763	4,928	6,661,284	666,621	366,642	76,995	7,776,470
11-0480	Nossa Senhora do Socorro	4,925	1,492	1,583,957	158,545	87,200	18,312	1,849,506
	Aracaju well conduction pipeline	27,951	3,407	8,620,118	862,353	474,294	99,602	10,059,774
ARACAJU SAO FRANCISCO DISTRI.		178,919	12,063	76,044,540	7,605,660	4,183,113	878,454	88,723,830
10-0360	Laranjeiras	73,308	3,296	25,212,702	2,521,600	1,386,880	291,245	29,415,723
11-0030	Aracaju	73,558	6,552	39,996,472	4,000,302	2,200,166	462,035	46,665,527
11-0480	Nossa Senhora do Socorro	32,053	2,215	10,835,366	1,083,758	596,067	125,174	12,642,580
ARACAJU SAO FRANCISCO PIPE		178,919	0	111,379,222	11,137,922	6,125,857	1,286,430	129,929,431
10-0360	Laranjeiras	73,308	0	0	0	0	0	0
11-0030	Aracaju	73,558	0	0	0	0	0	0
11-0480	Nossa Senhora do Socorro	32,053	0	0	0	0	0	0
ARACAJU WELL		27,951	3,640	888,237	89,188	49,053	10,301	1,040,419

Cost Estimation of Agreste Integrated Water Supply System

		Developed Discharge (m³/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
AGRESTE TOTAL		73,771	8,777	53,461,322	5,347,011	2,910,854	617,580	62,375,511
AGRESTE PROAGUA		26,640	0	10,578,860	1,057,886	581,837	122,186	12,340,769
01-0050	Areia Branca	5,834	0	0	0	0	0	0
01-0100	Campo do Brito	2,664	0	0	0	0	0	0
01-0290	Itabaiana	16,654	0	0	0	0	0	0
01-0370	Macambira	498	0	0	0	0	0	0
01-0680	Sao Domingos	990	0	0	0	0	0	0
AGRESTE VAZA BARRIS TOTAL		-	8,777	42,882,462	4,289,125	2,359,017	495,394	50,034,775
AGRESTE VAZA BARRIS DISTRI.		47,131	5,803	24,291,231	2,429,704	1,336,336	280,631	28,343,705
01-0050	Areia Branca	10,321	2,315	10,397,570	1,039,989	571,994	120,119	12,131,987
01-0100	Campo do Brito	4,713	1,053	3,288,022	328,908	180,899	37,989	3,836,871
01-0290	Itabaiana	29,464	397	7,677,593	767,799	422,289	88,681	8,956,759
01-0370	Macambira	881	1,014	1,177,119	117,813	64,797	13,607	1,374,350
01-0680	Sao Domingos	1,752	1,024	1,750,927	175,195	96,357	20,235	2,043,738
AGRESTE VAZA BARRIS PIPELINE		47,160	2,974	18,591,231	1,859,421	1,022,681	214,763	21,691,070
AGRESTE VAZA BARRIS DAM		-	0	0	0	0	0	0

Cost Estimation of Piauitinga Integrated Water Supply System

		Developed Discharge (m³/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
PIAUITINGA TOTAL		81,041	976,336	98,182,902	9,915,925	5,453,759	1,145,290	115,674,212
PIAUITINGA PROAGUA		36,240	0	6,751,019	675,102	371,306	77,974	7,875,401
05-0550	Poco Verde	1,195	0	0	0	0	0	0
05-0710	Simao Dias	4,884	0	0	0	0	0	0
06-0350	Lagarto	28,919	0	0	0	0	0	0
06-0580	Riachao do Dantas	1,242	0	0	0	0	0	0
PIAUITINGA VAZA BARRIS TOTAL		-	976,336	91,431,883	9,240,823	5,082,453	1,067,316	107,798,811
PIAUITINGA VAZA BARRIS DISTRI		44,801	10,162	26,686,489	2,669,666	1,468,316	308,347	31,142,980
05-0550	Poco Verde	1,477	4,101	5,597,675	560,178	308,098	64,701	6,534,753
05-0710	Simao Dias	6,038	3,266	9,519,486	952,275	523,751	109,988	11,108,766
06-0350	Lagarto	35,750	453	8,186,364	818,682	450,275	94,558	9,550,332
06-0580	Riachao do Dantas	1,536	2,342	3,382,964	338,531	186,192	39,100	3,949,129
PIAUITINGA VAZA BARRIS PIPELINE		44,880	3,174	19,758,456	1,976,163	1,086,890	228,247	23,052,930
PIAUITINGA VAZA BARRIS DAM		-	963,000	44,986,938	4,594,994	2,527,247	530,722	53,602,901

Cost Estimation of Independent Surface Water Supply System (1/2)

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
SERGIPE		136,050	191,356	102,580,902	10,277,227	5,652,473	1,187,018	119,888,976
Water Supply Region								
A- North Sergipe		29,485	3,482	9,931,521	993,501	546,425	114,749	11,589,678
B- Central Sergipe		27,241	74,748	10,692,312	1,076,706	592,188	124,358	12,560,312
B1- Japaratuba		13,191	16,533	6,429,451	644,599	354,529	74,450	7,519,562
B2- Itabaiana		1,162	3,861	1,531,190	153,505	84,428	17,730	1,790,714
B3- Aracaju		12,888	54,354	2,731,671	278,602	153,231	32,178	3,250,036
C- South Sergipe		79,324	113,126	81,957,069	8,207,020	4,513,860	947,911	95,738,986
C1- Lagarto		9,273	8,104	12,187,160	1,219,526	670,740	140,855	14,226,385
C2- Boquim		11,810	45,244	9,576,273	962,152	529,183	111,128	11,223,980
C3- Estancia		58,241	59,778	60,193,636	6,025,342	3,313,937	695,928	70,288,621
Meso-Region								
Sertao Sergipano		612	131	461,310	46,144	25,379	5,330	538,291
Agreste Sergipano		14,398	13,390	15,801,556	1,581,494	869,823	182,662	18,448,925
Leste Sergipano		121,040	177,835	86,318,036	8,649,589	4,757,271	999,026	100,901,757
Micro-Region								
01- Sergipana do Sertao do Sao Francisco		612	131	461,310	46,144	25,379	5,330	538,291
02- Carira		0	0	0	0	0	0	0
03- Nossa Senhora das Dores		3,963	1,425	2,083,206	208,463	114,655	24,077	2,431,826
04- Agreste de Itabaiana		1,162	3,861	1,531,190	153,505	84,428	17,730	1,790,714
05- Tobias Barreto		9,273	8,104	12,187,160	1,219,526	670,740	140,855	14,226,385
06- Agreste de Lagarto		0	0	0	0	0	0	0
07- Propria		24,910	1,926	7,387,005	738,894	406,391	85,342	8,619,558
08- Cotinguiba		8,033	13,138	5,036,281	504,942	277,718	58,320	5,890,399
09- Japaratuba		5,158	3,395	1,393,170	139,657	76,811	16,130	1,629,163
10- Baixo Cotinguiba		12,888	54,354	2,731,671	278,602	153,231	32,178	3,250,036
11- Aracaju		0	0	0	0	0	0	0
12- Boquim		11,810	45,244	9,576,273	962,152	529,183	111,128	11,223,980
13- Estancia		58,241	59,778	60,193,636	6,025,342	3,313,937	695,928	70,288,621
Municipality								
01-0120	Caninde do Sao Francisco	-	-	-	-	-	-	-
01-0220	Feira Nova	-	-	-	-	-	-	-
01-0240	Gararu	612	131	461,310	46,144	25,379	5,330	538,294
01-0260	Gracho Cardoso	-	-	-	-	-	-	-
01-0310	Itabi	-	-	-	-	-	-	-
01-0420	Monte Alegre de Sergipe	-	-	-	-	-	-	-
01-0450	Nossa Senhora da Gloria	-	-	-	-	-	-	-
01-0540	Poco Redondo	-	-	-	-	-	-	-
01-0560	Porto da Folha	-	-	-	-	-	-	-
02-0140	Carira	-	-	-	-	-	-	-
02-0230	Frei Paulo	-	-	-	-	-	-	-
02-0415	Nossa Senhora Aparecida	-	-	-	-	-	-	-
02-0500	Pedra Mole	-	-	-	-	-	-	-
02-0520	Pinhao	-	-	-	-	-	-	-
02-0600	Ribeiropolis	-	-	-	-	-	-	-
03-0020	Aquidaba	-	-	-	-	-	-	-
03-0190	Cumbe	-	-	-	-	-	-	-
03-0380	Malhada dos Bois	-	-	-	-	-	-	-
03-0430	Muribeca	-	-	-	-	-	-	-
03-0460	Nossa Senhora das Dores	3,963	1,425	2,083,206	208,463	114,655	24,077	2,431,826
03-0700	Sao Miguel do Aleixo	-	-	-	-	-	-	-
04-0050	Areia Branca	-	-	-	-	-	-	-
04-0100	Campo do Brito	-	-	-	-	-	-	-
04-0290	Itabaiana	-	-	-	-	-	-	-
04-0370	Macambira	-	-	-	-	-	-	-
04-0390	Malhador	1,162	3,861	1,531,190	153,505	84,428	17,730	1,790,714
04-0410	Moita Bonita	-	-	-	-	-	-	-
04-0680	Sao Domingos	-	-	-	-	-	-	-
05-0550	Poco Verde	-	-	-	-	-	-	-
05-0710	Simao Dias	-	-	-	-	-	-	-
05-0740	Tobias Barreto	9,273	8,104	12,187,160	1,219,526	670,740	140,855	14,226,385
06-0350	Lagarto	-	-	-	-	-	-	-
06-0580	Riachao do Dantas	-	-	-	-	-	-	-
07-0010	Amparo de Sao Francisco	-	-	-	-	-	-	-
07-0070	Brejo Grande	-	-	-	-	-	-	-
07-0110	Canhoba	-	-	-	-	-	-	-
07-0160	Cedro de Sao Joao	-	-	-	-	-	-	-
07-0270	Ilha das Flores	-	-	-	-	-	-	-
07-0440	Neopolis	20,300	1,245	6,035,960	603,721	332,046	69,730	7,042,702
07-0470	Nossa Senhora de Lourdes	-	-	-	-	-	-	-
07-0570	Propri	-	-	-	-	-	-	-

Cost Estimation of Independent Surface Water Supply System (2/2)

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
07-0730	Telha	-	-	-	-	-	-	-
07-0999	Santana do Sao Francisco	4,610	681	1,351,045	135,173	74,345	15,612	1,576,856
08-0130	*Capela*	5,396	9,046	2,642,504	265,155	145,835	30,625	3,093,165
		2,637	4,092	2,393,777	239,787	131,883	27,695	2,797,234
08-0200	Divina Pastora	-	-	-	-	-	-	-
08-0650	Santa Rosa de Lima	-	-	-	-	-	-	-
08-0720	*Siriri*	-	-	-	-	-	-	-
09-0330	Japaratuba	-	-	-	-	-	-	-
09-0340	Japoata	-	-	-	-	-	-	-
09-0490	Pacatuba	5,158	3,395	1,393,170	139,657	76,811	16,130	1,629,163
09-0530	Pirambu	-	-	-	-	-	-	-
09-0690	Sao Francisco	-	-	-	-	-	-	-
10-0150	*Carmopolis*	-	-	-	-	-	-	-
10-0250	General Maynard	-	-	-	-	-	-	-
10-0360	Laranjeiras	-	-	-	-	-	-	-
10-0400	Maruim	-	-	-	-	-	-	-
10-0590	Riachuelo	4,608	34,049	1,268,223	130,227	71,625	15,041	1,519,165
10-0610	Rosario do Catete	8,280	20,305	1,463,418	148,375	81,606	17,137	1,730,871
10-0660	Santo Amaro das Brotas	-	-	-	-	-	-	-
11-0030	Aracaju	-	-	-	-	-	-	-
11-0060	Barra dos Coqueiros	-	-	-	-	-	-	-
11-0480	Nossa Senhora do Socorro	-	-	-	-	-	-	-
11-0670	*Sao Cristovao*	-	-	-	-	-	-	-
12-0040	Araua	1,128	7,916	860,117	86,803	47,742	10,026	1,012,604
12-0067	Boquim	3,520	7,298	2,715,591	272,289	149,759	31,449	3,176,386
12-0170	Cristinapolis	3,186	23,983	2,959,055	298,304	164,067	34,454	3,479,863
12-0300	Itabaianinha	-	-	-	-	-	-	-
12-0510	Pedrinhas	1,480	3,557	1,589,283	159,284	87,606	18,397	1,858,127
12-0620	Salgado	2,496	2,490	1,452,227	145,472	80,009	16,802	1,697,000
12-0750	Tomar do Geru	-	-	-	-	-	-	-
12-0760	Umbauba	-	-	-	-	-	-	-
13-0210	*Estancia*	13,840	27,734	4,930,179	495,791	272,685	57,264	5,783,653
		11,170	1,013	2,949,173	295,019	162,260	34,075	3,441,540
13-0280	Indiaroba	1,326	3,449	856,769	86,022	47,312	9,936	1,003,488
13-0320	Itaporanga d'Ajuda	7,280	5,782	4,244,833	425,062	233,784	49,095	4,958,556
		22,288	18,793	46,139,865	4,615,866	2,538,726	533,132	53,846,382
13-0630	Santa Luzia do Itanhy	2,337	3,007	1,072,817	107,582	59,170	12,426	1,255,002

Cost Estimation of Independent Groundwater Supply System (1/2)

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
SERGIPE		53,827	27,484	20,700,910	2,072,840	1,140,062	239,414	24,180,710
Water Supply Region								
A- North Sergipe		2,371	3,529	1,451,966	145,550	80,052	16,812	1,697,909
B- Central Sergipe		45,579	19,668	14,967,584	1,498,725	824,299	173,102	17,483,378
B1- Japaratuba		8,637	6,044	4,164,233	417,027	229,365	48,166	4,864,835
B2- Itabaiana		491	838	433,758	43,460	23,903	5,020	506,979
B3- Aracaju		36,451	12,786	10,369,593	1,038,238	571,031	119,916	12,111,564
C- South Sergipe		5,877	4,287	4,281,360	428,565	235,711	49,500	4,999,423
C1- Lagarto		0	0	0	0	0	0	0
C2- Boquim		2,377	2,700	2,148,545	215,125	118,319	24,848	2,509,537
C3- Estancia		3,500	1,587	2,132,815	213,440	117,392	24,652	2,489,886
Meso-Region								
Sertao Sergipano		0	0	0	0	0	0	0
Agreste Sergipano		1,049	1,470	1,047,802	104,928	57,710	12,120	1,224,030
Leste Sergipano		52,778	26,014	19,653,108	1,967,912	1,082,352	227,294	22,956,680
Micro-Region								
01- Sergipana do Sertao do Sao Francisco		0	0	0	0	0	0	0
02- Carira		0	0	0	0	0	0	0
03- Nossa Senhora das Dores		558	632	614,044	61,468	33,807	7,100	717,051
04- Agreste de Itabaiana		491	838	433,758	43,460	23,903	5,020	506,979
05- Tobias Barreto		0	0	0	0	0	0	0
06- Agreste de Lagarto		0	0	0	0	0	0	0
07- Propria		1,813	2,897	837,922	84,082	46,245	9,712	980,858
08- Cotinguiba		1,672	3,167	1,165,121	116,828	64,256	13,493	1,362,865
09- Japaratuba		6,965	2,877	2,999,112	300,199	165,109	34,673	3,501,970
10- Baixo Cotinguiba		23,399	9,101	6,263,216	627,231	344,977	72,445	7,316,970
11- Aracaju		13,052	3,685	4,106,377	411,007	226,054	47,471	4,794,594
12- Boquim		2,377	2,700	2,148,545	215,125	118,319	24,848	2,509,537
13- Estancia		3,500	1,587	2,132,815	213,440	117,392	24,652	2,489,886
Municipality								
01-0120	Caninde do Sao Francisco	-	-	-	-	-	-	-
01-0220	Feira Nova	-	-	-	-	-	-	-
01-0240	Gararu	-	-	-	-	-	-	-
01-0260	Gracho Cardoso	-	-	-	-	-	-	-
01-0310	Itabi	-	-	-	-	-	-	-
01-0420	Monte Alegre de Sergipe	-	-	-	-	-	-	-
01-0450	Nossa Senhora da Gloria	-	-	-	-	-	-	-
01-0540	Poco Redondo	-	-	-	-	-	-	-
01-0560	Porto da Folha	-	-	-	-	-	-	-
02-0140	Carira	-	-	-	-	-	-	-
02-0230	Frei Paulo	-	-	-	-	-	-	-
02-0445	Nossa Senhora Aparecida	-	-	-	-	-	-	-
02-0500	Pedra Mole	-	-	-	-	-	-	-
02-0520	Pinhao	-	-	-	-	-	-	-
02-0600	Ribeiropolis	-	-	-	-	-	-	-
03-0020	Aquidaba	-	-	-	-	-	-	-
03-0190	Cumbe	-	-	-	-	-	-	-
03-0380	Malhada dos Bois	-	-	-	-	-	-	-
03-0430	Muribeca	558	632	614,044	61,468	33,807	7,100	717,051
03-0460	Nossa Senhora das Dores	-	-	-	-	-	-	-
03-0700	Sao Miguel do Aleixo	-	-	-	-	-	-	-
04-0050	Areia Branca	-	-	-	-	-	-	-
04-0100	Campo do Brito	-	-	-	-	-	-	-
04-0290	Itabaiana	-	-	-	-	-	-	-
04-0370	Macambira	-	-	-	-	-	-	-
04-0390	Malhador	491	838	433,758	43,460	23,903	5,020	506,979
04-0410	Moita Bonita	-	-	-	-	-	-	-
04-0680	Sao Domingos	-	-	-	-	-	-	-
05-0550	Poco Verde	-	-	-	-	-	-	-
05-0710	Simao Dias	-	-	-	-	-	-	-
05-0740	Tobias Barreto	-	-	-	-	-	-	-
06-0350	Lagarto	-	-	-	-	-	-	-
06-0580	Riachao do Dantas	-	-	-	-	-	-	-
07-0010	Amparo de Sao Francisco	-	-	-	-	-	-	-
07-0070	Brejo Grande	867	1,447	408,139	40,959	22,527	4,731	477,803
07-0110	Canhoba	-	-	-	-	-	-	-
07-0160	Cedro de Sao Joao	-	-	-	-	-	-	-
07-0270	Ilha das Flores	946	1,450	429,783	43,123	23,718	4,981	503,055
07-0440	Neopolis	-	-	-	-	-	-	-
07-0470	Nossa Senhora de Lourdes	-	-	-	-	-	-	-
07-0570	Propri	-	-	-	-	-	-	-

Cost Estimation of Independent Groundwater Supply System (2/2)

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
07-0730	Telha	-	-	-	-	-	-	-
07-0999	Santana do Sao Francisco	-	-	-	-	-	-	-
08-0130	*Capela*	-	-	-	-	-	-	-
		0	0	0	0	0	0	0
08-0200	Divina Pastora	575	1,039	379,052	38,009	20,905	4,390	443,395
08-0650	Santa Rosa de Lima	368	1,035	330,949	33,198	18,259	3,834	387,275
08-0720	*Siriri*	729	1,093	455,120	45,621	25,092	5,269	532,195
09-0330	Japaratuba	3,353	851	1,279,480	128,033	70,418	14,788	1,493,570
09-0340	Japoata	566	623	391,305	39,193	21,556	4,527	457,204
09-0490	Pacatuba	-	-	-	-	-	-	-
09-0530	Pirambu	2,598	781	963,583	96,436	53,040	11,138	1,124,978
09-0690	Sao Francisco	448	622	364,744	36,537	20,095	4,220	426,218
10-0150	*Carmopolis*	1,070	1,095	443,848	44,494	24,472	5,139	519,048
10-0250	General Maynard	466	1,032	337,072	33,810	18,596	3,905	394,415
10-0360	Laranjeiras	-	-	-	-	-	-	-
10-0400	Maruim	3,588	1,437	1,096,243	109,768	60,372	12,678	1,280,498
10-0590	Riachuelo	4,710	1,619	1,479,328	148,095	81,452	17,105	1,727,599
10-0610	Rosario do Catete	12,758	2,833	2,506,697	250,953	138,024	28,985	2,927,492
10-0660	Santo Amaro das Brotas	807	1,085	400,028	40,111	22,061	4,633	467,918
11-0030	Aracaju	-	-	-	-	-	-	-
11-0060	Barra dos Coqueiros	7,533	1,928	2,123,118	212,505	116,878	24,544	2,478,973
11-0480	Nossa Senhora do Socorro	-	-	-	-	-	-	-
11-0670	*Sao Cristovao*	5,519	1,757	1,983,259	198,502	109,176	22,927	2,315,621
12-0040	Araua	888	928	840,944	84,187	46,303	9,724	982,086
12-0067	Boquim	-	-	-	-	-	-	-
12-0170	Cristinapolis	-	-	-	-	-	-	-
12-0300	Itabaianinha	-	-	-	-	-	-	-
12-0510	Pedrinhas	497	850	466,818	46,767	25,722	5,402	545,559
12-0620	Salgado	992	922	840,783	84,171	46,294	9,722	981,892
12-0750	Tomar do Geru	-	-	-	-	-	-	-
12-0760	Umbauba	-	-	-	-	-	-	-
13-0210	*Estancia*	3,500	1,587	2,132,815	213,440	117,392	24,652	2,489,886
		0	0	0	0	0	0	0
13-0280	Indiaroba	-	-	-	-	-	-	-
13-0320	Itaporanga d'Ajuda	-	-	-	-	-	-	-
		0	0	0	0	0	0	0
13-0630	Santa Luzia do Itanhy	-	-	-	-	-	-	-

Cost Estimation of Public Tap System (1/2)

	Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
SERGIPE	9,353	9,646	53,651,336	5,366,098	2,951,352	619,786	62,598,218
Water Supply Region							
A- North Sergipe	1,932	1,919	13,215,441	1,321,737	726,956	152,664	15,418,717
B- Central Sergipe	3,373	3,686	18,710,345	1,871,402	1,029,270	216,145	21,830,848
B1- Japaratuba	729	782	4,341,311	434,212	238,816	50,151	5,065,302
B2- Itabaiana	1,253	1,459	7,300,554	730,201	401,611	84,337	8,518,162
B3- Aracaju	1,390	1,445	7,068,450	706,989	388,843	81,657	8,247,384
C- South Sergipe	4,049	4,041	21,725,550	2,172,959	1,195,126	250,977	25,348,653
C1- Lagarto	1,524	1,549	8,641,951	864,350	475,393	99,832	10,083,075
C2- Boquim	1,641	2,038	10,543,071	1,054,511	579,979	121,797	12,301,396
C3- Estancia	884	454	2,540,528	254,098	139,754	29,348	2,964,182
Meso-Region							
Sertao Sergipano	1,157	694	8,064,039	806,474	443,562	93,150	9,407,919
Agreste Sergipano	3,124	3,379	18,385,591	1,838,897	1,011,394	212,391	21,451,652
Leste Sergipano	5,073	5,573	27,201,706	2,720,727	1,496,396	314,245	31,738,647
Micro-Region							
01- Sergipana do Sertao do Sao Francisco	810	497	5,780,154	578,065	317,937	66,767	6,743,420
02- Carira	346	197	2,283,885	228,409	125,625	26,383	2,664,499
03- Nossa Senhora das Dores	347	371	2,443,086	244,346	134,390	28,222	2,850,415
04- Agreste de Itabaiana	1,253	1,459	7,300,554	730,201	401,611	84,337	8,518,162
05- Tobias Barreto	545	476	3,197,534	319,801	175,891	36,937	3,730,639
06- Agreste de Lagarto	978	1,073	5,444,417	544,549	299,502	62,895	6,352,436
07- Propria	428	854	2,708,316	270,917	149,004	31,292	3,160,383
08- Cotinguiba	305	543	2,556,320	255,686	140,627	29,532	2,982,708
09- Japaratuba	424	239	1,785,021	178,526	98,189	20,619	2,082,594
10- Baixo Cotinguiba	149	189	857,297	85,748	47,161	9,904	1,000,299
11- Aracaju	1,241	1,256	6,211,153	621,241	341,682	71,753	7,247,085
12- Boquim	1,641	2,038	10,543,071	1,054,511	579,979	121,797	12,301,396
13- Estancia	884	454	2,540,528	254,098	139,754	29,348	2,964,182
Municipality							
01-0120	Canhinde do Sao Francisco	156	93	1,093,311	109,340	60,137	12,629	1,275,510
01-0220	Feira Nova	8	10	109,588	10,960	6,028	1,266	127,852
01-0240	Gararu	108	62	714,129	71,419	39,281	8,249	833,140
01-0260	Gracho Cardoso	35	24	270,285	27,031	14,867	3,122	315,329
01-0310	Itabi	27	19	215,491	21,551	11,853	2,489	251,403
01-0320	Monte Alegre de Sergipe	66	40	462,967	46,301	25,465	5,348	540,121
01-0350	Nossa Senhora da Gloria	105	62	714,129	71,419	39,281	8,249	833,140
01-0540	Poco Redondo	95	59	704,261	70,432	38,738	8,135	821,625
01-0560	Porto da Folha	211	128	1,495,993	149,612	82,287	17,280	1,745,300
02-0140	Carira	145	83	961,606	96,169	52,893	11,108	1,121,859
02-0230	Frei Paulo	81	45	519,566	51,961	28,579	6,002	606,153
02-0445	Nossa Senhora Aparecida	33	21	247,476	24,750	13,612	2,859	288,718
02-0500	Pedra Mole	30	17	192,682	19,270	10,598	2,226	224,793
02-0520	Pinhao	19	12	137,888	13,790	7,585	1,593	160,868
02-0600	Ribeiropolis	38	19	224,667	22,469	12,358	2,595	262,108
03-0020	Aquidaba	143	152	980,719	98,087	53,948	11,329	1,144,235
03-0190	Cumbe	17	25	160,695	16,072	8,840	1,856	187,488
03-0380	Malhada dos Bois	32	38	247,474	24,751	13,613	2,859	288,735
03-0430	Muribeca	60	55	402,242	40,230	22,126	4,647	469,300
03-0460	Nossa Senhora das Dores	82	84	546,055	54,614	30,038	6,308	637,099
03-0700	Sao Miguel do Aleixo	12	17	105,901	10,592	5,825	1,223	123,558
04-0050	Areia Branca	311	314	1,649,823	165,014	90,758	19,059	1,924,968
04-0100	Campo do Brito	104	135	657,442	65,758	36,167	7,595	767,097
04-0290	Itabaiana	419	505	2,481,939	248,244	136,534	28,672	2,895,894
04-0370	Macambira	59	73	362,549	36,262	19,944	4,188	423,016
04-0390	Malhador	159	185	926,954	92,714	50,993	10,708	1,081,554
04-0410	Moita Bonita	138	168	827,313	82,748	45,511	9,557	965,297
04-0680	Sao Domingos	64	79	394,534	39,461	21,704	4,558	460,336
05-0550	Poco Verde	49	46	315,130	31,518	17,335	3,640	367,669
05-0710	Simao Dias	244	219	1,446,521	144,674	79,571	16,710	1,687,695
05-0740	Tobias Barreto	252	211	1,435,883	143,609	78,985	16,587	1,675,275
06-0350	Lagarto	697	736	3,773,242	377,398	207,569	43,589	4,402,534
06-0580	Riachao do Dantas	281	337	1,671,175	167,151	91,933	19,306	1,949,902
07-0010	Amparo de Sao Francisco	19	56	160,691	16,075	8,841	1,857	187,520
07-0070	Brejo Grande	39	56	212,994	21,305	11,718	2,461	248,534
07-0110	Canhoba	36	94	270,275	27,037	14,870	3,123	315,399
07-0160	Cedro de Sao Joao	22	56	160,691	16,075	8,841	1,857	187,520
07-0270	Ilha das Flores	94	122	454,287	45,441	24,992	5,248	530,090
07-0440	Neopolis	23	38	128,705	12,874	7,081	1,487	150,185
07-0470	Nossa Senhora de Lourdes	77	179	517,742	51,792	28,486	5,982	604,181
07-0570	Propri	57	103	351,644	35,175	19,346	4,063	410,331

Cost Estimation of Public Tap System (2/2)

		Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
07-0730	Telha	51	122	357,052	35,717	19,645	4,125	416,661
07-0999	Santana do Sao Francisco	11	28	94,235	9,426	5,184	1,089	109,962
08-0130	*Capela*	174	295	1,157,916	115,824	63,703	13,378	1,351,146
08-0200	Divina Pastora	27	42	188,471	18,851	10,368	2,177	219,909
08-0650	Santa Rosa de Lima	13	21	86,778	8,680	4,774	1,003	101,256
08-0720	*Siriri*	92	105	489,531	48,964	26,930	5,655	571,185
09-0330	Japaratuba	118	80	633,594	63,367	34,852	7,319	739,212
09-0340	Japoata	98	67	530,180	53,025	29,164	6,124	618,560
09-0490	Pacatuba	119	76	602,127	60,220	33,121	6,955	702,499
09-0530	Pirambu	78	55	429,771	42,983	23,640	4,964	501,413
09-0690	Sao Francisco	12	13	94,237	9,425	5,184	1,089	109,948
10-0150	*Carmopolis*	20	28	128,706	12,873	7,080	1,487	150,174
10-0250	General Maynard	19	28	128,706	12,873	7,080	1,487	150,174
10-0360	Laranjeiras	6	14	59,765	5,978	3,288	690	69,735
10-0400	Maruim	65	84	386,119	38,620	21,241	4,461	450,525
10-0590	Riachuelo	14	21	94,236	9,426	5,184	1,089	109,956
10-0610	Rosario do Catete	21	28	128,706	12,873	7,080	1,487	150,174
10-0660	Santo Amaro das Brotas	6	14	59,765	5,978	3,288	690	69,735
11-0030	Aracaju	0	0	0	0	0	0	0
11-0060	Barra dos Coqueiros	1,135	1,025	5,082,103	508,313	279,572	58,710	5,929,723
11-0480	Nossa Senhora do Socorro	31	35	163,177	16,321	8,977	1,885	190,395
11-0670	*Sao Cristovao*	75	84	401,468	40,155	22,085	4,638	468,430
12-0040	Araua	94	112	564,405	56,452	31,048	6,520	658,537
12-0067	Boquim	98	107	545,282	54,539	29,996	6,299	636,223
12-0170	Cristinapolis	386	393	2,029,613	203,001	111,650	23,447	2,368,104
12-0300	Itabaianinha	343	404	1,999,857	200,026	110,014	23,103	2,333,404
12-0510	Pedrinhas	42	45	237,526	23,757	13,066	2,744	277,138
12-0620	Salgado	235	202	1,213,587	121,379	66,758	14,019	1,415,945
12-0750	Tomar do Geru	218	253	1,270,381	127,063	69,885	14,676	1,482,258
12-0760	Umbauba	225	213	1,221,134	122,135	67,174	14,107	1,424,763
13-0210	*Estancia*	398	421	2,025,691	202,611	111,436	23,402	2,363,561
13-0280	Indiaroba	136	124	727,826	72,795	40,037	8,408	849,190
13-0320	Itaporanga d'Ajuda	119	133	633,586	63,372	34,855	7,319	739,265
13-0630	Santa Luzia do Itanhy	231	197	1,179,116	117,931	64,862	13,621	1,375,727

(2) Cost Estimation by River Basin

(Costs shown in US$, US$=1.18R$)

Grand Total of Cost Estimation of Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	49,994	108,061,695	10,811,171	5,946,144	1,248,691	126,117,695
Japaratuba	48,021	24,502,098	2,455,011	1,350,254	283,550	28,638,934
Sergipe	96,861	303,012,196	30,310,910	16,670,997	3,500,909	353,591,873
Vaza Barris	96,816	92,778,528	9,287,536	5,108,145	1,072,710	108,343,735
Piaui	953,768	136,052,787	13,700,655	7,535,358	1,582,427	159,824,995
Real	95,137	44,321,353	4,441,648	2,442,908	513,012	51,814,058
Total	1,340,597	708,728,657	71,006,931	39,053,806	8,201,299	828,331,290

Cost Estimation of Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	38,536	86,539,099	8,657,764	4,761,770	999,970	100,997,139
Japaratuba	5,214	6,135,172	614,040	337,722	70,921	7,163,069
Sergipe	46,284	279,751,799	27,979,810	15,388,892	3,231,669	326,398,454
Vaza Barris	72,805	42,009,947	4,208,277	2,314,552	486,054	49,091,635
Piaui	889,827	95,609,308	9,649,914	5,307,452	1,114,565	112,571,066
Real	59,444	21,750,184	2,180,962	1,199,531	251,902	25,442,023
Total	1,112,110	531,795,509	53,290,767	29,309,919	6,155,081	621,663,386

Cost Estimation of Independent Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	9,814	11,150,678	1,116,051	613,827	128,904	13,019,274
Japaratuba	41,957	13,820,396	1,386,234	762,427	160,109	16,171,123
Sergipe	48,152	10,579,044	1,062,720	584,498	122,743	12,397,157
Vaza Barris	23,254	46,087,193	4,611,045	2,536,074	532,576	53,790,142
Piaui	61,231	26,006,604	2,606,784	1,433,731	301,085	30,409,435
Real	34,432	15,637,897	1,567,233	861,978	181,015	18,282,555
Total	218,840	123,281,812	12,350,067	6,792,535	1,426,432	144,069,686

COST ESTIMATION OF PUBLIC TAP SYSTEM

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	1,644	10,371,918	1,037,356	570,547	119,817	12,101,282
Japaratuba	850	4,546,530	454,737	250,105	52,520	5,304,742
Sergipe	2,425	12,681,353	1,268,380	697,607	146,497	14,796,262
Vaza Barris	757	4,681,388	468,214	257,519	54,080	5,461,958
Piaui	2,710	14,436,875	1,443,957	794,175	166,777	16,844,494
Real	1,261	6,933,272	693,453	381,399	80,095	8,089,480
Total	9,647	53,651,336	5,366,097	2,951,352	619,786	62,598,218

Cost Estimation of Xingo Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	12,976	53,044,045	5,305,703	2,918,136	612,808	61,893,668
Japaratuba	0	0	0	0	0	0
Sergipe	12,960	30,443,519	3,045,648	1,675,106	351,773	35,529,006
Vaza Barris	9,200	22,295,294	2,230,450	1,226,747	257,616	26,019,307
Piaui	0	0	0	0	0	0
Real	0	0	0	0	0	0
Total	35,136	105,782,858	10,581,801	5,819,989	1,222,197	123,441,981

Cost Estimation of Propria Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	5,385	3,455,884	346,126	190,370	39,977	4,037,742
Japaratuba	54	35,865	3,592	1,976	415	41,902
Sergipe	0	0	0	0	0	0
Vaza Barris	0	0	0	0	0	0
Piaui	0	0	0	0	0	0
Real	0	0	0	0	0	0
Total	5,439	3,491,749	349,718	192,346	40,392	4,079,644

Cost Estimation of Alto Sertao Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	8,401	14,897,021	1,490,542	819,798	172,157	17,387,919
Japaratuba	0	0	0	0	0	0
Sergipe	0	0	0	0	0	0
Vaza Barris	0	0	0	0	0	0
Piaui	0	0	0	0	0	0
Real	0	0	0	0	0	0
Total	8,401	14,897,021	1,490,542	819,798	172,157	17,387,919

Cost Estimation of Sertaneja Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	11,774	15,142,149	1,515,393	833,466	175,028	17,677,810
Japaratuba	5,160	6,099,307	610,448	335,746	70,506	7,121,167
Sergipe	1,296	2,824,294	282,559	155,407	32,635	3,296,191
Vaza Barris	0	0	0	0	0	0
Piaui	0	0	0	0	0	0
Real	0	0	0	0	0	0
Total	18,230	24,065,750	2,408,400	1,324,619	278,169	28,095,168

Cost Estimation of Itabaianinha Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	0	0	0	0	0	0
Japaratuba	0	0	0	0	0	0
Sergipe	0	0	0	0	0	0
Vaza Barris	0	0	0	0	0	0
Piaui	15,766	12,145,873	1,216,164	668,890	140,467	14,187,160
Real	16,830	12,742,534	1,275,936	701,765	147,370	14,884,435
Total	32,596	24,888,407	2,492,100	1,370,655	287,837	29,071,595

Cost Estimation of Aracaju Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	0	0	0	0	0	0
Japaratuba	0	0	0	0	0	0
Sergipe	27,195	207,025,501	20,705,270	11,387,898	2,391,459	241,537,323
Vaza Barris	0	0	0	0	0	0
Piaui	0	0	0	0	0	0
Real	0	0	0	0	0	0
Total	27,195	207,025,501	20,705,270	11,387,898	2,391,459	241,537,323

Cost Estimation of Agreste Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	0	0	0	0	0	0
Japaratuba	0	0	0	0	0	0
Sergipe	4,833	39,458,485	3,946,333	2,170,481	455,802	46,035,934
Vaza Barris	3,944	14,002,837	1,400,678	770,373	161,778	16,339,610
Piaui	0	0	0	0	0	0
Real	0	0	0	0	0	0
Total	8,777	53,461,322	5,347,011	2,940,854	617,580	62,375,544

Cost Estimation of Piauitinga Integrated Water Supply System

	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	0	0	0	0	0	0
Japaratuba	0	0	0	0	0	0
Sergipe	0	0	0	0	0	0
Vaza Barris	59,661	5,711,816	577,149	317,432	66,660	6,732,718
Piaui	874,061	83,463,435	8,433,750	4,638,562	974,098	98,383,906
Real	42,614	9,007,650	905,026	497,766	104,532	10,557,588
Total	976,336	98,182,901	9,915,925	5,453,760	1,145,290	115,674,212

Cost Estimation of Independent Surface Water Supply System

	Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	30,680	5,452	9,241,485	924,695	508,581	106,802	10,787,015
Japaratuba	17,832	33,709	7,345,135	737,884	405,836	85,225	8,607,789
Sergipe	8,481	39,290	4,491,640	453,093	249,202	52,331	5,285,556
Vaza Barris	25,903	21,529	44,139,501	4,416,103	2,428,856	510,060	51,516,049
Piaui	39,850	56,944	21,725,244	2,178,219	1,198,020	251,585	25,410,012
Real	13,305	34,432	15,637,897	1,567,233	861,978	181,015	18,282,555
Total	136,051	191,356	102,580,902	10,277,227	5,652,473	1,187,018	119,888,976

Cost Estimation of Independent Groundwater Supply System

	Developed Discharge (m^3/day)	Compensation Cost LCC (US$)	Construction Cost CC (US$)	Consulting Engineering Service Cost ESC (US$)	Contingency CT (US$)	Administration Cost AC (US$)	Total Project Cost (US$)
Sao Francisco	3,584	4,362	1,909,193	191,356	105,246	22,102	2,232,259
Japaratuba	21,432	8,248	6,475,261	648,350	356,591	74,884	7,563,334
Sergipe	17,514	8,862	6,087,404	609,627	335,296	70,412	7,111,601
Vaza Barris	5,420	1,725	1,947,692	194,942	107,218	22,516	2,274,093
Piaui	5,877	4,287	4,281,360	428,565	235,711	49,500	4,999,423
Real	0	0	0	0	0	0	0
Total	53,827	27,484	20,700,910	2,072,840	1,140,062	239,414	24,180,710