JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO.,LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :				
WORK : Pipeline from WLPS2 to CR4 (Piauitinga)			UNIT : SECOND PHASE				PAGE 1/4
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)			REMARKS
				Unit Price	Sub-total	Total	
1	Supply and Installation of pipes, fittings, valves, accessories and equipment	lot	1		7.704,105		
2	Execution of civil works	lot	1		517,957		
	Grand Total					8.222,062	
	(BDI = 0,3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :			
WORK : Pipeline from WLPS2 to CR4 (Piauitinga)			UNIT : SECOND PHASE			PAGE 2/4
				Prices (R$)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Supply and Installation of pipes, fittings, valves and accessories					7,704,105	
1.1	Ductile Iron Pipes					7,588,336	
1.1.1	Push-on Joint Pipes					7,588,336	
	ϕ 600 - L=6000 - TK7	pcs	1,294	3362.63	4,351,243		
	ϕ 500 - L=6000 - TK7	pcs	1,176	2752.63	3,237,093		
1.2	Ductile Iron Fittings					115,769	
1.2.1	Flanged Spigot Pipe					27,636	
	ϕ 600 - L=5800 - PN10	pcs	2	7928.86	15,858		
	ϕ 500 - L=5800 - PN10	pcs	2	5889.00	11,778		
1.2.2	Double Socket Sleeve					2,913	
	ϕ 600	pcs	1	1086.50	1,087		
	ϕ 500	pcs	2	913.16	1,826		
1.2.3	Double Socket 90° Bend					1,407	
	ϕ 500	pcs	1	1407.17	1,407		
1.2.4	Double Socket 45° Bend					13,833	
	ϕ 600	pcs	7	1654.11	11,579		
	ϕ 500	pcs	2	1127.19	2,254		
1.2.5	Double Socket 22.5° Bend					9,913	
	ϕ 600	pcs	5	1282.68	6,413		
	ϕ 500	pcs	4	874.95	3,500		
1.2.6	Double Socket 11.25° Bend					4,508	
	ϕ 600	pcs	5	901.59	4,508		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY - JICA			YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :					
WORK : Pipeline from WLPS2 to CR4 (Piauitinga)			UNIT : SECOND PHASE					PAGE 3/4
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)				REMARKS
				Unit Price	Sub-total	Total		
1.2.7	Double Flanged 45° Bend					14,977		
	ϕ 600 - PN10	pcs	2	3086.58	6,173			
	ϕ 500 - PN10	pcs	4	2201.10	8,804			
1.2.8	Double Socket Taper					1,378		
	ϕ 600 x ϕ 500	pcs	1	1377.83	1,378			
1.2.9	Double Socket Tee with Flanged Branch					26,009		
	ϕ 600 x ϕ 100	pcs	6	1760.03	10,560			
	ϕ 500 x ϕ 100	pcs	11	1404.49	15,449			
1.2.10	Air Release Valves					10,262		
	ϕ 100 - PN10	pcs	13	789.37	10,262			
1.2.11	Flanged Gate Valves					2,933		
	ϕ 100 - PN10	pcs	4	733.20	2,933			
	(BDI = 0.3)							

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :				
WORK : Pipeline from WLPS2 to CR4 (Piauitinga)			UNIT : SECOND PHASE				PAGE 4/4
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2	Execution of civil works					517,957	
2.1	Preliminary Works					8,556	
	Location of the work	m	14,989	0.26	3,897		
	Demolition and restoration of Asphalt Pavement	m^2	93	50.1	4,659		
2.2	Earthworks					503,331	
2.2.1	Mechanical excavation of trench in 1st category of soil					121,322	
	Depth less than 2.0m	m^3	56,299	2.09	117,665		
	Depth less than 2.0m with sheetpile	m^3	1,597	2.29	3,657		
2.2.2	Backfill of trench					366,734	
2.2.2.1	Backfill with compaction control - DC > 95%NP	m^3	24,964	9.44	235,660		
2.2.2.2	Backfill without compaction control	m^3	29,323	4.47	131,074		
2.2.3	Disposal of excavated material (Transportation of 1 km)	m^3	3,685	2.86	10,539	10,539	
2.2.4	Gravel	m^3	2	26.48	53	53	
2.2.5	Sheet Piling	m^2	1,043	4.49	4,683	4,683	
2.3	Concrete works					6,070	
2.3.1	Structural concrete, fck=21Mpa	m^3	16	142.38	2,278	2,278	
2.3.2	Plain concrete, fck=15Mpa	m^3	2	129.1	258	258	
2.3.3	Reinforcing steel	kg	1,280	1.69	2,163	2,163	
2.3.4	Form	m^2	70	19.59	1,371	1,371	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : One Directional Surge Tank No.1 (Piauitinga)		UNIT : FIRST PHASE					PAGE 1/5
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Supply and Installation of pipes, fittings, valves, accessories and equipment	lot	1		52,255		
2	Execution of civil works	lot	1		29,871		
	Grand Total					82,126	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : One Directional Surge Tank No.1 (Piauitinga)		UNIT : FIRST PHASE					PAGE 2/5
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Supply and Installation of pipes, fittings, valves and accessories					52,255	
1.1	Ductile Iron Pipes					15,205	
1.1.1	Double Flanged pipes					12,701	
	ϕ 50 - L=800 - PN10	pcs	1	121.56	122		
	ϕ 50 - L=1300 - PN10	pcs	1	266.08	266		
	ϕ 50 - L=2000 - PN10	pcs	1	268.28	268		
	ϕ 50 - L=2900 - PN10	pcs	1	271.13	271		
	ϕ 50 - L=1700 - PN10	pcs	2	267.35	535		
	ϕ 50 - L=5800 - PN10	pcs	2	280.25	561		
	ϕ 50 - L=4150 - PN10	pcs	2	275.05	550		
	ϕ 100 - L=500 - PN10	pcs	2	157.73	315		
	ϕ 300 - L=250 - PN10	pcs	2	590.73	1,181		
	ϕ 300 - L=2200 - PN10	pcs	2	1225.9	2,452		
	ϕ 300 - L=1300 - PN10	pcs	2	1013.12	2,026		
	ϕ 300 - L=5800 - PN10	pcs	2	2077.02	4,154		
1.1.2	Push-on Joint Pipes					2,504	
	ϕ 300 - L=6000 - TK7	pcs	2	1252.12	2,504		
1.2	Ductile Iron Fittings					16,619	
1.2.1	Double Flanged 90°Bends - PN10					2,705	
	ϕ 50	pcs	5	104.47	522		
	ϕ 100	pcs	2	131.14	262		
	ϕ 300	pcs	2	960.61	1,921		
1.2.2	Flanged Spigot Pipe - PN10					5,814	
	ϕ 300 - L=5000	pcs	2	2907.11	5,814		
1.2.3	Reel					419	
	ϕ 50	pcs	2	209.34	419		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : One Directional Surge Tank No.1 (Piauitinga)		UNIT : FIRST PHASE					PAGE 3/5
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)			REMARKS
				Unit Price	Sub-total	Total	
1.2.4	Gibault Joint ϕ 300	pcs	2	334.54	669	669	
1.2.5	All Flanged Tee - PN10 ϕ 300 x ϕ 100	pcs	2	1251.11	2,502	2,502	
1.2.6	All Socket Tee - PN10 ϕ 400 x ϕ 300	pcs	2	894.75	1,790	1,790	
1.2.7	Double Flanged Rib Pipe - PN10 ϕ 50	pcs	2	195.22	390	390	
1.2.8	One Flanged Rib Pipe - PN10 ϕ 300 - 500	pcs	3	776.69	2,330	2,330	
1.2.9	Double Flanged Taper - PN10 ϕ 100 x 50	pcs	2	169.12	338	338	
1.3	Valves and accessories					19,580	
1.3.1	Flanged Gate valves - PN10					14,980	
	ϕ 50	pcs	2	290.00	580		
	ϕ 300	pcs	4	3600.00	14,400		
1.3.2	Flanged Check valves - PN10 ϕ 300	pcs	2	1800.00	3,600	3,600	
1.3.2	Flanged gate valves with float- PN10 ϕ 50	pcs	2	500.00	1,000	1,000	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. : YEC | DATE: 30/9/99

PROJECT : Vaza Barris Water Supply Project | LOCATION :

WORK : One Directional Surge Tank No.1 (Piauitinga) | UNIT : FIRST PHASE | PAGE 4/5

ITEM	DESCRIPTION	UNIT	Q'TY	Prices (R$) Unit Price	Sub-total	Total	REMARKS
1.4	Others					851	
1.4.1	Steel Ladder	m	4.5	30.80	139		
1.4.2	Steel Ladder with Safe Guard	m	7.0	81.54	571		
1.4.3	Manhole Cover	m^2	1.0	140.90	141		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. - YEC | DATE: 30/9/99

PROJECT : Vaza Barris Water Supply Project | LOCATION :

WORK : One Directional Surge Tank No.1 (Piauitinga) | UNIT : FIRST PHASE | PAGE 5/5

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)			REMARKS
				Unit Price	Sub-total	Total	
2	Execution of civil works					29,871	
2.1	Preliminary works					37	
2.1.1	Location of the work	m^2	20	1.61	32		
2.1.2	Deforest and Stripping	m^2	40	0.12	5		
2.2	Earthworks					399	
2.2.1	Mechanical excavation of soil	m^3	64	2.09	134		
2.2.2	Disposal of excavated material (1km)	m^3	13	2.86	37		
2.2.3	Compacted backfill	m^3	51	4.47	228		
2.3	Concrete works					23,241	
2.3.1	Plain concrete, fck=15Mpa	m^3	3	129.1	387		
2.3.2	Structural concrete, fck=25Mpa	m^3	47	152.01	7,144		
2.3.3	Reinforcing steel	kg	5,181	1.69	8,756		
2.3.4	Form	m^2	355	19.59	6,954		
2.4	Scaffolding and Stage					3,120	
	Scaffolding	m^3	279	7.94	2,215		
	Stage	m^2	114	7.94	905		
2.5	Surface finish and treatment					2,660	
2.5.1	Filling by mortar of cement and sand 1:3	m^3	1	131.6	132		
2.5.2	Waterproofing with acrylic base crystallized cement	m^2	75	33.7	2,528		
2.6	Paint					414	
2.6.1	Latex paint	m^2	92	4.36	401		
2.6.2	Enamel paint for metal	m^2	2	6.7	13		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :			
WORK : One Directional Surge Tank No.2 (Piauitinga)			UNIT : FIRST PHASE			PAGE 1/5
			Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Supply of pipes, fittings, valves, accessories and equipment	lot	1		49,033		
2	Execution of civil works	lot	1		41,117		
	Grand Total					90,150	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :			
WORK : One Directional Surge Tank No.2 (Piauitinga)			UNIT : FIRST PHASE			PAGE 2/5
			Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Supply and Installation of pipes, fittings, valves and accessories					49,033	
1.1	Ductile Iron Pipes					12,356	
1.1.1	Double Flanged pipes					9,852	
	ϕ 50 - L=800 - PN10	pcs	1	121.56	122		
	ϕ 50 - L=1300 - PN10	pcs	1	266.08	266		
	ϕ 50 - L=2000 - PN10	pcs	1	268.28	268		
	ϕ 50 - L=2900 - PN10	pcs	1	271.13	271		
	ϕ 50 - L=1700 - PN10	pcs	2	267.35	535		
	ϕ 50 - L=5800 - PN10	pcs	2	280.25	561		
	ϕ 50 - L=1150 - PN10	pcs	2	265.6	531		
	ϕ 100 - L=500 - PN10	pcs	2	157.73	315		
	ϕ 300 - L=250 - PN10	pcs	2	590.73	1,181		
	ϕ 300 - L=2200 - PN10	pcs	2	1225.9	2,452		
	ϕ 300 - L=4100 - PN10	pcs	2	1675.1	3,350		
1.1.2	Push-on Joint Pipes					2,504	
	ϕ 300 - L=6000 - TK7	pcs	2	1252.12	2,504		
1.2	Ductile Iron Fittings					16,619	
1.2.1	Double Flanged 90°Bends - PN10					2,705	
	ϕ 50	pcs	5	104.47	522		
	ϕ 100	pcs	2	131.14	262		
	ϕ 300	pcs	2	960.61	1,921		
1.2.2	Flanged Spigot Pipe - PN10					5,814	
	ϕ 300 - L=5000	pcs	2	2907.11	5,814		
1.2.3	Reel					419	
	ϕ 50	pcs	2	209.34	419		
	(BDI = 0.3.)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :				
WORK : One Directional Surge Tank No.2 (Piauitinga)			UNIT : FIRST PHASE				PAGE 3/5
					Prices (RS)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.2.4	Gibauly Joint ϕ 300	pcs	2	334.54	669	669	
1.2.5	All Flanged Tee - PN10 ϕ 300 x ϕ 100	pcs	2	1251.11	2,502	2,502	
1.2.6	All Socket Tee - PN10 ϕ 400 x ϕ 300	pcs	2	894.75	1,790	1,790	
1.2.7	Double Flanged Rib Pipe - PN10 ϕ 50	pcs	2	195.22	390	390	
1.2.8	One Flanged Rib Pipe - PN10 ϕ 300 - 500	pcs	3	776.69	2,330	2,330	
1.2.9	Double Flanged Taper - PN10 ϕ 100 x 50	pcs	2	169.12	338	338	
1.3	Valves and accessories					19,580	
1.3.1	Flanged Gate valves - PN10					14,980	
	ϕ 50	pcs	2	290.00	580		
	ϕ 300	pcs	4	3600.00	14,400		
1.3.2	Flanged Check valves - PN10 ϕ 300	pcs	2	1800.00	3,600	3,600	
1.3.2	Flanged gate valves with float- PN10 ϕ 50	pcs	2	500.00	1,000	1,000	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : One Directional Surge Tank No.2 (Piauitinga)		UNIT : FIRST PHASE					PAGE 4/5
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	QTY	Unit Price	Sub-total	Total	REMARKS
1.4	Others					478	
1.4.1	Steel Ladder	m	3.0	30.80	92		
1.4.2	Steel Ladder with Safe Guard	m	3.0	81.54	245		
1.4.3	Manhole Cover	m^2	1.0	140.90	141		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC			DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :			
WORK : One Directional Surge Tank No.2 (Piauitinga)			UNIT : FIRST PHASE			PAGE 5/5
				Prices (RS)		
ITEM	DESCRIPTION	UNIT	QTY	Unit Price	Sub-total	Total	REMARKS
2	Execution of civil works					41,117	
2.1	Preliminary works					51	
2.1.1	Location of the work	m^2	30	1.61	48		
2.1.2	Stripping	m^2	50	0.05	3		
2.2	Earthworks					553	
2.2.1	Mechanical excavation of soil	m^3	89	2.09	186		
2.2.2	Disposal of excavated material (1km)	m^3	19	2.86	54		
2.2.3	Compacted backfill	m^3	70	4.47	313		
2.3	Concrete works					31,087	
2.3.1	Plain concrete, fck=15Mpa	m^3	4	129.1	516		
2.3.2	Structural concrete, fck=25Mpa	m^3	70	152.01	10,641		
2.3.3	Reinforcing steel	kg	7,678	1.69	12,976		
2.3.4	Form	m^2	355	19.59	6,954		
2.4	Scaffolding and Stage					4,287	
	Scaffolding	m^3	346	7.94	2,747		
	Stage	m^2	194	7.94	1,540		
2.5	Surface finish and treatment					4,446	
2.5.1	Filling by mortar of cement and sand 1:3	m^3	1	131.6	132		
2.5.2	Waterproofing with acrylic base crystallized cement	m^2	128	33.7	4,314		
2.6	Paint					693	
2.6.1	Latex paint	m^2	156	4.36	680		
2.6.2	Enamel paint for metal	m^2	2	6.7	13		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. : YEC | DATE: 30/9/99

PROJECT : Vaza Barris Water Supply Project | LOCATION :

WORK : Deforestation and Reforestation works | UNIT : FIRST PHASE | PAGE 1/6

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)			REMARKS
				Unit Price	Sub-total	Total	
1	Reforestation work	lot	1		546,610	546,610	
2	Deforestation work	lot	1		172,800	172,800	
	Grand Total					719,410	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. : YEC | DATE: 30/9/99

PROJECT : Vaza Barris Water Supply Project | LOCATION :

WORK : Deforestation and Reforestation works | UNIT : FIRST PHASE | PAGE 2/6

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$) Unit Price	Sub-total	Total	REMARKS
1	Reforestation work					546,610	
1.1	Dam					546,610	
1.1.1	Dam and Reservoir Site						
	Natural trees	nos	17,290	26.61	460,087		
	Market trees	nos	5,010	17.27	86,523		
1.1.2	Check Dam Site						
	Natural trees	nos	7,770	26.61	206,760		
	Market trees	nos	3,330	17.27	57,509		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA				YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project				LOCATION :				
WORK : Deforestation and Reforestation works				UNIT : FIRST PHASE				PAGE 3/6
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)				REMARKS
				Unit Price	Sub-total	Total		
2	Deforestation work					172,800		
	Deforestation and transportation	nos	72,000	2.40	172,800			
	(BDI = 0.3)							

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Deforestation and Reforestation works		UNIT : FIRST PHASE					PAGE 4/6
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-1	Unit Cost for Reforestation work					26.61	
1.1	Earth work					7.47	
	Manual Excavation	m^3	0.25	6.37	1.59		
	Planting of tree with fertilizer	pcs	1	5.88	5.88		
1.2	Transportation					2.13	
	Manual Transportation, Max.500m	pcs	1	2.13	2.13		
1.3	Maintenance					17.01	
	Maintenance by watering	pcs	1	17.01	17.01		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Deforestation and Reforestation works		UNIT : FIRST PHASE					PAGE 5/6
				Prices (RS)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-2	Unit Cost for Reforestation work with marketing trees					17.27	
1.1	Planting work					7.83	
	Manual Excavation	m^3	0.13	6.37	0.83		
	Supply and Planting of tree with fertilizer	pcs	1	7.83	7.83		
1.2	Transportation					0.94	
	Transportation by truck, 5km	m^3	0.09	4.58	0.41		
	Manual Transportation, Max.200m	pcs	1	0.53	0.53		
1.3	Maintenance					8.50	
	Maintenance by watering	pcs	1	8.50	8.50		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Deforestation and Reforestation works		UNIT : FIRST PHASE					PAGE 6/6
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-3	Unit Cost for Deforestation work					2.40	
1.1	Deforestation					0.93	
	Cutting off of trees and branches	pcs	1	0.93	0.93		
1.2	Transportation					1.47	
	Manual Transportation, Max.500m	pcs	1	1.06	1.06		
	Truck Transportation, 5km	m^3	0.09	4.58	0.41		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA | YACHIYO ENGINEERING CO., LTD. : YEC | DATE: 30/9/99

PROJECT : Vaza Barris Water Supply Project | LOCATION :

WORK : Land Acquisition work | UNIT : FIRST PHASE | PAGE 1/2

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$)			REMARKS
				Unit Price	Sub-total	Total	
1	Land Acquisition work	lot	1		1,004,880	1,004,880	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Land Acquisition work		UNIT : FIRST PHASE					PAGE 2/2
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1	Land Acquisition work					1,004,880	
1.1	Dam					1,003,020	
1.1.1	Dam and reservoir	ha	1,522.1	600	913,260		
1.1.2	Check dam and reservoir	ha	149.6	600	89,760		
1.2	Piauitinga Water Supply Facility					900	
1.2.1	Water Treatment Stations	ha	0.7	600	420		
1.2.2	Water Intake and Lift Pump Stations	ha	0.8	600	480		
1.3	Agreste Water Supply Facility					960	
1.3.1	Water Treatment Stations	ha	0.8	600	480		
1.3.2	Water Intake and Lift Pump Stations	ha	0.8	600	480		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA — YACHIYO ENGINEERING CO., LTD. : YEC — DATE: 30/9/99

PROJECT : Vaza Barris Water Supply Project — LOCATION :

WORK : Compensation work — UNIT : FIRST PHASE — PAGE 1/3

ITEM	DESCRIPTION	UNIT	QTY	Prices (R$) Unit Price	Prices (R$) Sub-total	Prices (R$) Total	REMARKS
1	Compensation work	lot	1		1,531,260		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project			LOCATION :				
WORK : Compensation work			UNIT : FIRST PHASE				PAGE 2/3
					Prices (R$)		
ITEM	DESCRIPTION	UNIT	QTY	Unit Price	Sub-total	Total	REMARKS
1	Compensation work					1,531,260	
1.1	Dam and related facility					1,519,740	
1.1.1	Resettlement of Residents	lot	1		1,519,740		
1.2	Piauitinga Water Supply Facility					7,260	
1.2.1	Land Compensation for Pipelines	ha	12.1	600	7,260		
1.3	Agreste Water Supply Facility					4,260	
1.3.1	Land Compensation for Pipelines	ha	7.1	600	4,260		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris Water Supply Project		LOCATION :					
WORK : Compensation work		UNIT : FIRST PHASE					PAGE 3/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
S-1	Resettlement work					1,519,740	
1	Resettlement of Residents					1,519,740	
1.1	Mobilization max.5km	m^3	379.9	4.58	1,740		
1.2	Construction of new residences	m^2	5,060.0	300	1,518,000		
	(BDI = 0.3)						

APPENDIX-3

Cost Estimation of Alternative for Low Flow Bypass

Appendix-3 Cost Estimation of Alternatives for Low Flow Bypass

(1) Box Culvert 1.050 x 1.050

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050			UNIT : FIRST PHASE				PAGE 1/3
					Prices (RS)		
ITEM	DESCRIPTION	UNIT	QTY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works	lot	1		2,916,208	32,829,990	
2.	Civil works	lot	1		29,913,782		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :				
WORK : Low Flow Bypass - Box Culvert 1.050 x 1.050		UNIT : FIRST PHASE				PAGE 2/3
				Prices (R$)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works					2,916,208	
1.1	Mobilization and demobilization	lot	1		300,000	300,000	
1.2	Site office, work spaces and camps	lot	1		900,000	900,000	
1.3	Access road					1,683,870	
1.3.1	Access Road (New construction) Total Distance = 1500 m x 3 routes Road Width = 5 m Waiting Area Per 500 m					844,931	
1.3.1.1	Regularization Of Sub-Base	m^2	22,950	0.42	9,639		20301001
1.3.1.2	Reinforcement Of Sub-Base (Distance = 1500 m, Thk = 0.5 m)	m^3	11,250	3.94	44,325		20302001
1.3.1.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,885	9.85	67,817		20307003
1.3.1.4	Excavation	m^3	75,000	2.09	156,750		20307003
1.3.1.5	Embankment	m^3	60,000	9.44	566,400		20307003
1.3.2	Access Road (Expansion of existing pathway) Total Distance = 3500 m x 3 routes Expansion of Road Width = 2 m Waiting Area Per 500 m					838,939	
1.3.2.1	Regularization Of Sub-Base	m^2	22,050	0.42	9,261		20301001
1.3.2.2	Reinforcement Of Sub-Base (Distance = 3500 m, Thk = 0.5 m)	m^3	10,500	3.94	41,370		20302001
1.3.2.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,615	9.85	65,158		20307003
1.3.2.4	Excavation	m^3	75,000	2.09	156,750		20307003
1.3.2.5	Embankment	m^3	60,000	9.44	566,400		20307003
1.4	Deforestation	m^2	269,485.00	0.12	32,338	32,338	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :					
WORK : Low Flow Bypass - Box Culvert 1,050 x 1,050		UNIT : FIRST PHASE					PAGE 3/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2.	Civil works					29,913,782	
2.1	Box Culvert					27,237,672	
2.1.1	Box Culvert 1,050 x 1,050	m	27,720.00	982.60	27,237,672		
2.2	Earth work					2,676,110	
2.2.1	Mechanical Soil Excavation	m^3	239,509.00	3.38	809,540		
2.2.2	Embankment w/ excavated soil, 95% Proctor	m^3	205,796.00	9.07	1,866,570		
	(BDI = 0.3)						

(2) Open Channel 1.500 x 1.500

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :					
WORK : Low Flow Bypass - Open Channel 1.500 x 1.500		UNIT : FIRST PHASE					PAGE 1/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works	lot	1		3,376,338	47,094,678	
2.	Civil works	lot	1		43,718,340		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - Open Channel 1,500 x 1,500			UNIT : FIRST PHASE				PAGE 2/3
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$) Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works					3,376,338	
1.1	Mobilization and demobilization	lot	1		450,000	450,000	
1.2	Site office, work spaces and camps	lot	1		1,200,000	1,200,000	
1.3	Access road					1,683,870	
1.3.1	Access Road (New construction) Total Distance = 1500 m x 3 routes Road Width = 5 m Waiting Area Per 500 m					844,931	
1.3.1.1	Regularization Of Sub-Base	m^2	22,950	0.42	9,639		
1.3.1.2	Reinforcement Of Sub-Base (Distance = 1500 m, Thk = 0.5 m)	m^3	11,250	3.94	44,325		
1.3.1.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,885	9.85	67,817		
1.3.1.4	Excavation	m^3	75,000	2.09	156,750		
1.3.1.5	Embankment	m^3	60,000	9.44	566,400		
1.3.2	Access Road (Expansion of existing pathway) Total Distance = 3500 m x 3 routes Expansion of Road Width = 2 m Waiting Area Per 500 m					838,939	
1.3.2.1	Regularization Of Sub-Base	m^2	22,050	0.42	9,261		
1.3.2.2	Reinforcement Of Sub-Base (Distance = 3500 m, Thk = 0.5 m)	m^3	10,500	3.94	41,370		
1.3.2.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,615	9.85	65,158		
1.3.2.4	Excavation	m^3	75,000	2.09	156,750		
1.3.2.5	Embankment	m^3	60,000	9.44	566,400		
1.4	Deforestation	m^2	353,900	0.12	42,468	42,468	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT :	Vaza Barris water Supply Project	LOCATION :					
WORK :	Low Flow Bypass - Open Channel 1.500 x 1.500	UNIT : FIRST PHASE					PAGE 3/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2.	Civil Works					43,718,340	
2.1	Earth work					5,505,236	
2.1.1	Soil Excavation	m^3	480,800	2.09	1,004,872		
2.1.2	Rock Excavation	m^3	21,560	61.01	1,315,376		
2.1.3	Embankment	m^3	182,100	9.44	1,719,024		
2.1.4	Disposal of surplus soil	m^3	484,100	2.86	1,384,526		
2.1.5	Slope protection	m^2	193,900	0.42	81,438		
2.2	Concrete Works					25,589,956	
2.2.1	Leveling Concrete	m^3	4,730	111.6	527,868		
2.2.2	Concrete Fck=21Mpa	m^3	24,950	150.28	3,749,486		
2.2.3	Concrete Fck=24Mpa	m^3	31,830	163.78	5,213,117		
2.2.4	Form	m^2	224,760	19.59	4,403,048		
2.2.5	Reinforcement 120kg/m3	kg	6,814,460	1.69	11,516,437		
2.2.6	Water-Stop	m	60,000	3.00	180,000		
2.3	Scaffolding and Support					11,284,148	
2.3.1	Scaffolding	m^3	388,840	28.87	11,225,811		
2.3.2	Support	m^2	7,820	7.46	58,337		
2.4	Gravel					343,439	
	Compacted gravel	m^3	12,970	26.48	343,439		
2.5	Maintenance Road for Bridge Portion					995,561	
	Total Distance = 18840 m						
	Road Width = 4 m						
2.5.1	Regularization Of Sub-Base	m^2	75,360	0.42	31,651		
2.5.2	Base With Graded Crushed Stone (Distance = 18840 m, Thk = 0.2 m)	m^3	15,072	9.85	148,459		
2.5.3	Excavation	m^3	81,900	2.09	171,171		
2.5.4	Embankment (BDI = 0.3)	m^3	68,250	9.44	644,280		

(3) ϕ 1000 Pipeline

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA			YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project			LOCATION :				
WORK : Low Flow Bypass - ϕ 1000 Pipeline			UNIT : FIRST PHASE				PAGE 1/3
ITEM	DESCRIPTION	UNIT	QTY	Prices (R$) Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works	lot	1		3,116,208	44,506,981	
2.	Civil works	lot	1		41,390,773		
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC					DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :					
WORK : Low Flow Bypass - ϕ 1000 Pipeline		UNIT : FIRST PHASE					PAGE 2/3
				Prices (R$)			
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
1.	Preliminary works					3,116,208	
1.1	Mobilization and demobilization	lot	1		400,000	400,000	
1.2	Site office, work spaces and camps	lot	1		1,000,000	1,000,000	
1.3	Access road					1,683,870	
1.3.1	Access Road (New construction) Total Distance = 1500 m x 3 routes Road Width = 5 m Waiting Area Per 500 m					844,931	
1.3.1.1	Regularization Of Sub-Base	m^2	22,950	0.42	9,639		
1.3.1.2	Reinforcement Of Sub-Base (Distance = 1500 m, Thk = 0.5 m)	m^3	11,250	3.94	44,325		
1.3.1.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,885	9.85	67,817		
1.3.1.4	Excavation	m^3	75,000	2.09	156,750		
1.3.1.5	Embankment	m^3	60,000	9.44	566,400		
1.3.2	Access Road (Expansion of existing pathway) Total Distance = 3500 m x 3 routes Expansion of Road Width = 2 m Waiting Area Per 500 m					838,939	
1.3.2.1	Regularization Of Sub-Base	m^2	22,050	0.42	9,261		
1.3.2.2	Reinforcement Of Sub-Base (Distance = 3500 m, Thk = 0.5 m)	m^3	10,500	3.94	41,370		
1.3.2.3	Base With Graded Crushed Stone (Thk = 0.3 m)	m^3	6,615	9.85	65,158		
1.3.2.4	Excavation	m^3	75,000	2.09	156,750		
1.3.2.5	Embankment	m^3	60,000	9.44	566,400		
1.4	Deforestation (BDI = 0.3)	m^2	269,485.00	0.12	32,338	32,338	

JAPAN INTERNATIONAL COOPERATION AGENCY : JICA		YACHIYO ENGINEERING CO., LTD. : YEC				DATE: 30/9/99
PROJECT : Vaza Barris water Supply Project		LOCATION :				
WORK : Low Flow Bypass - ϕ 1000 Pipeline		UNIT : FIRST PHASE				PAGE 3/3
				Prices (RS)		
ITEM	DESCRIPTION	UNIT	Q'TY	Unit Price	Sub-total	Total	REMARKS
2.	Civil works					41,390,773	
2.1	Pipe installation works					20,412,686	
2.1.1	Steel Pipe ϕ 1000x11.1mm, Material, Transportation And Installation	m	12,800.00	811.28	10,384,384		
2.1.2	Steel Pipe ϕ 1000x9.52mm, Material, Transportation And Installation	m	11,400.00	686.02	7,820,628		
2.1.3	Steel Pipe ϕ 1000x7.94mm, Material, Transportation And Installation	m	3,520.00	627.18	2,207,674		
2.2	Earth work					4,830,087	
2.2.1	Mechanical Soil Excavation	m^3	435,629.00	3.38	1,472,426		
2.2.2	Backfill w/ excavated soil, 95% Proctor	m^3	369,644.00	9.07	3,352,671		
2.2.3	Bedding, Compaction 95% Proctor, Thk=15cm	m^2	55,440.00	0.09	4,990		
2.3	Cathodic Protection of Steel Pipe	Lot	1	16,148,000	16,148,000	16,148,000	
	(BDI = 0.3)						

JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME II)
FEASIBILITY STUDY

[J] IMPLEMENTATION PROGRAM

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (J)
IMPLEMENTATION PROGRAM

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CHAPTER 1 INSTITUTIONAL FORMALITIES FOR PROJECT IMPLEMENTATION

1.1 Jurisdiction

The Vaza Barris River belongs to federal domain, so the Vaza Barris Dam project is also placed under jurisdiction of the federal government. As far as the JICA study team is informed so far, the management of the Sergipe portion of Vaza Barris River will be delegated to the state government under the inspection of the federal organs in the future. For the time being, however, the water resources management for the proposed project is under federal jurisdiction. The project management unit (UGP-PROVABASE) has to implement the project through regulation formalities regarding water resources management under the "National Policy".

In terms of environment assessment, UGP-PROVABASE has to get licenses from the competent agencies at the respective implementation stages. Since the river belongs to the federal domain, the IBAMA is competent to issue licenses from the federal standpoint. On the other hand, the proposed projects are located in state territory, so the ADEMA is also competent to issue licenses from the state standpoint. UGP-PROVABASE would conduct environmental studies under the guidance of both IBAMA and ADEMA.

By the time of commencement of the project, the financial sources must be provided through proper formalities. In order to procure finances from international or local financial organizations, UGP-PROVABASE has to ask the State House to authorize a permission of finance. After that, the state government gets an approval from the competent agency of foreign loans in the federal government, i.e., External Financial Commission (COFIEX or Comissao de Financiamentos Externos) under Ministry of Planning, Budget and Management (MP or Ministerio do Planejamento, Orcamento e Gestao). Besides, the permission from the Upper House is prerequisite for the project entity to procure international loans, under consideration of allowance of debt services.

Just after the approval from COFIEX, the state government applies for construction license of Vaza Barris Dam through Secretariat of Water Resources (SRH or Secretaria de Recusos Hidricos) under Ministry of Environment, Water Resources and Legal Amazon (MMARHAL or Ministerio de Meio Ambiente, dos Recusos Hidricos e da Amazonia Legal), since the Vaza Barris river is under jurisdiction of the federal SRH. In addition to the construction license, the state government intends to take over the authorization of water right granting of Vaza Barris river by means of delegation from the federal government. Once the federal government approves this application, the state government (SEPLANTEC) will be able to have a power on granting of water resources use right on Vaza Barris river and its tributaries as well.

1.2 Coordination with PROAGUA

At present, State Unit of PROAGUA Management (UEGP or Unidade Estadual de Gestao do PROAGUA) applies for the two projects within the Sergipe State to the federal government, i.e., UGP (Unidade Gestora de PROAGUA) under MMARHL. They are (a) Project Expansion of Agreste Pipeline Project and (b) Project Expansion of Piauitinga Pipeline Project. Although these projects are around one year behind the original schedule as of September 1999, the UEGP expects that these projects will be implemented just after the approval of the UGP head office and also the World Bank. The state SRH of SEPLANTEC, the counterpart organization to UEGP, is also coordinating these projects prudently, since these projects have close relationship with the proposed project.

1.3 Prospect of Formalities

Table-1.1 shows the tasks of the state government, i.e., UGP-PROVABASE, till the time of project completion. The major works are classified into three categories as shown in the table. They are (a) administrative or legal formalities, (b) procurement of finances for project implementation and (c) designing and construction of the project. After this JICA study, the first task for the UGP-PROVABASE is to obtain financial sources for the project implementation. The external loans are expected to cover a sizable portion of the capital investment. Thus, the UGP-PROVABASE has to commence negotiating with the agencies concerned as shown in the table below. Just after the prospects for finances look bright, the UGP-PROVABASE starts to get various licenses such as construction license, environmental license and water right license from the agencies concerned. Besides, the UGP-PROVABASE works out the schedule of project designing and construction. The timetable for the designing construction is assembled as shown in the table below.

Table-1.1 Administrative and Financial Formalities

Work Item	1 1999	2 2000	3 2001	4 2002	5 2003	6 2004	7 2005	8 2006
State Government (UGP)								
Project Office (UGP) Establishment	▼							
Administrative & Legal Formalities								
Water Right License		▲	▼					
Construction License		▲	▼					
Environmental License		▲	▼					
Land Acquisition in Project Sites				▬				
Procurement of Finances								
Approval of State House	▲	▼						
Approval of Upper House		▲	▼					
Formulation of I/P		▬						
Approval of International Financial Organs		▲	▼					
Study, Design & Construction								
Study (M/P & F/S)	▬	▬						
Designing				▬	▬			
Construction						▬	▬	▬
JICA								
M/P and F/S	▬	▬						
International Financial Institutes								
Project Identification	▼							
Pledge			▼					
Loan Agreement				▼				

Legend: ▲: Application; ▼: Approval; ▬: Execution of Activity

CHAPTER 2 ORGANIZATION OF PROJECT IMPLEMENTATION

2.1 Establishment of UGP-PROVABASE

In parallel with the JICA study, Management Unit of the Project of Water Resources Development and Supply in Vaza Barris River (UGP-PROVABASE) was established by the State Decree No.18297 on 1st of September 1999. It is subordinated directly the Secretary of SEPLANTEC as shown in Appendix 1 of this Supporting Report. Its major competence is as follows:

1) To coordinate and to follow up on the Project of Vaza Barris Multi-purpose Dam and related Projects.
2) To keep institutional linkage with public and private organs concerned.
3) To carry out duties attributed to SEPLANTEC.

2.2 Organizational Strengthening of UGP-PROVABASE

At present, the UGP-PROVABASE is assigned to carry out preparation of the Project. In the future, it is expected to manage financial arrangement, a feasibility study for the irrigation component and to compile environmental impact assessment reports, and subsequently to implement the project employing consultants and contractors.

The UGP-PROVABASE takes and should continue to take a core part in project implementation. At present, the UGP-PROVABASE consists of a coordinator and a secretary only. With the development of the project preparation and implementation, the UGP-PROVABASE should be strengthened to meet with the. Strong administrative supports to the UGP-PROVABASE, such as legal advisory, matters related to public relation, coordination with federal and state organs and general administrative affairs, should be given by the SEPLANTEC.

At present the State Government or SEPLANTEC has a plan to strengthen the UGP-PROVABASE as follows:

Preparation Stage I (1999):
- Duties: Preparation for the approvals of the federal organs
- Staff: A Coordinator and a secretary

Preparation Stage II (2000):
- Duties: Preparation for "Environmental Impact Assessment Report (RIMA)" and for the application to an international financial institute
- Staff: Adding a civil engineer

Preparation Stage III (2001):
- Duties: Preparation of international bidding for procurement of consultants
- Staff: Adding a document specialist with translators (if necessary)

Implementation State (2002-2006):
- Duties: total management of project implementation
- Staff: Adding a financial staff and technical assistants as required

2.2.1 Major Duties of UGP-PROVABASE

In this section, organization at the implementation stage is discussed. In the implementation stage, major tasks to be managed with 1) land acquisition, 2) designing, 3) construction and its supervision.

Item 1) should be carried out in accordance with relevant laws and regulations such as Decree-Law No. 21st June 1941 and its amendments, with juridical support of the State Government such as legal advisors to SEPLANTEC and Office of the State General Prosecutor. Some involvement of UGP-PROVABASE will be necessary for investigations and negotiations for the land acquisition.

As for 2) and 3), UGP-PROVABASE or SEPLANTEC should hire consultants and conclude contracts with contractors. Bidding procedure should be placed under the inspection of international financial institutes, federal organs in charge and the State Procurement Office. Actual tendering, tender evaluation, negotiations and contract awarding should proceed with the initiative of UGP-PROVABASE. Although the consultants and contractors will undertake most of the engineering works and construction works, some responsibilities will remain to the project office. Check of the results of the works by consultants and contractors is necessary to be done by UGP-PROVABASE. During the construction works, many administrative permissions may be required. Liaison to relevant authorities, such as police, will be necessary.

2.2.2 Organization and Staffing

According to the major duties as described above of UGP-PROVABASE, following organization at implementation stage would be recommendable. The contents and volume of each section will vary according to the development of the project implementation.

For staffing at the implementation stage, employment of engineers in DESO or COHIDRO is very important because of their experiences in similar projects, especially for the domestic water supply components and the irrigation component. Staff of CEHOP, if available, may take major roles in land acquisition, tendering, and construction supervision because of their abundant experiences in these fields.

Preferably, each section should have a core staff responsible for duties assigned to the section, and short-term assistance should be acquired from relevant sections of the Government, state companies and autarchies.

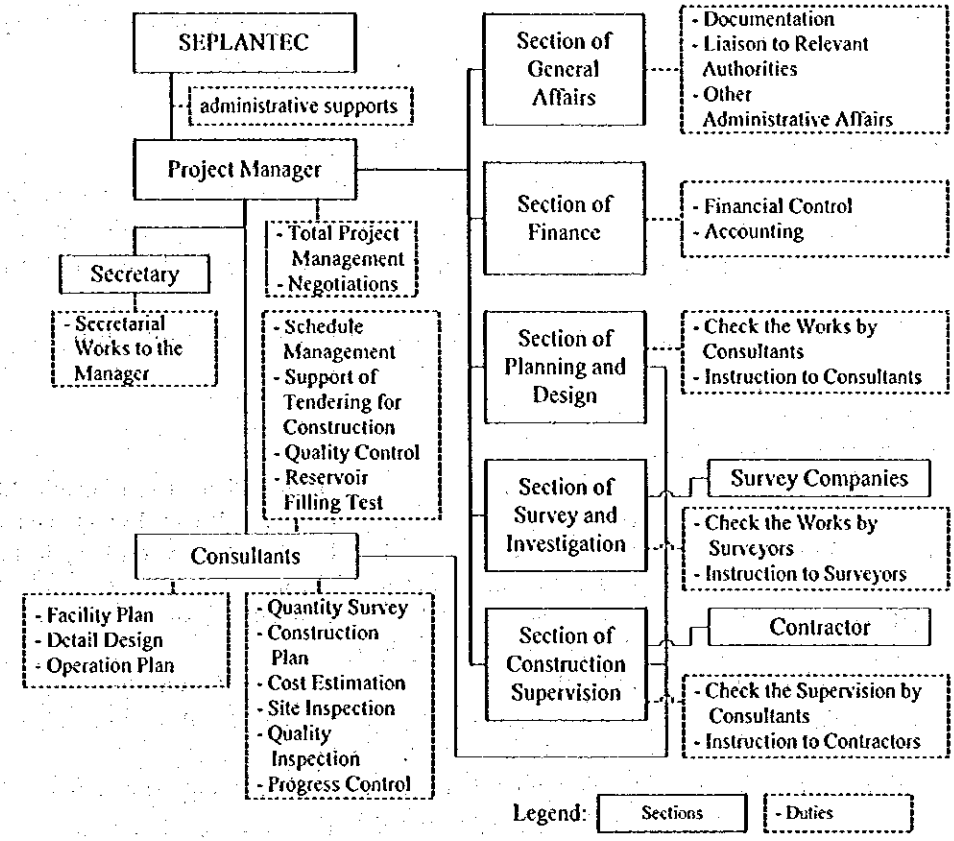

Figure-2.1 Proposed Organization of UGP-PROVABASE at Implementation Stage

CHAPTER 3 SCHEDULE OF PROJECT IMPLEMENTATION AND FINANCIAL DISBURSEMENT

3.1 Project Components and Construction Packaging

The project components are summarized as shown in Table-3.1 below. Considering the type of work and site location of the components, the project is divided into five (5) construction packages, which is the same division of the components shown in Table-3.1.

Table-3.1 Project Components and Construction Packaging

Project Components Construction Package	Specification
(1) Vaza Barris Multipurpose Dam	
Main Dam	Type: Gravity concrete dam, Height: 48.2m, Crest Length::280.0m
Spillway	Type: Free overflow, Design discharge: Width: 15.00m, Height: 5.2m
Check Dam (or Intake Dam)	Type: Gravity concrete dam, Height: 20.0m, Crest Length: 127.0m Width of Overflow Section: 70.0m
Low Flow Bypass	Type: Concrete Box Culvert, Length: 27.7 km, Size: 1.05m x 1.05m Design discharge: 0.75m³/s
(2) Domestic/Industrial Water Supply Facilities:	**< Itabaiana City Area >**
Water Conveyance Pipeline	Raw water pump station: 0.546 m³/s, Ductile cast iron pipe: Diameter ϕ 500-700mm, Total length:25.4km
Treatment and distribution facilities	Municipalities: Itabaiana, Areia Branca, Campo do Brito, Macambira, Sao Domingos
(3) Domestic/Industrial Water Supply Facilities:	**< Lagarto City Area >**
Water Conveyance Pipeline	Raw water pump station: 0.52 m³/s, Ductile cast iron pipe: Diameter ϕ 500-700mm, Total length:24.0km
Treatment and distribution facilities	Municipalities: Lagarto, Poco Verde, Simao Dias, Riachao do Dantes
(4) Forestation for Environmental Protection	
Forestation	Total 300 ha (main dam site: 150 ha, check dam site: 50 ha reservoir: 100 ha)
(5) Irrigation Water Supply Facilities	
Water Conveyance Pipeline	Raw water pump station: 2.912 m³/s, Water Conveyance to agricultural land
Irrigation Facilities	Irrigation area: 4,553 ha, Beneficial municipalities: Lagarto, Itaporanga de Ajuda, Salgado

3.2 Procurement Method

3.2.1 Consulting Services

The procurement of consulting services is to be made between January 2001 and December 2001. The recommended method for the selection of a competent consultant is the Short List method in accordance with the Guidelines for the Employment of Consultants by borrowers of a foreign soft loan. However, the direct appointment of a specific consulting company should be considered, as the JICA Study Team has already studied the project in some detail. Similarly, the contract with the consultant should be made in one package for both the design stage and construction stage, in order to assist in the coordination and smooth execution of the project.

3.2.2 Construction Work

The procurement of contractors is to commence from July 2002 and to be completed by December 2003. In accordance with the Guidelines for Procurement under foreign soft loans, International Competitive Bidding (ICB) is proposed. The project involves the construction of a concrete dam, a check dam, a low flow bypass, water supply facilities, forestation works and irrigation facilities. ICB will be the best method for achieving the economic and efficient implementation of the project. In the interests of the broadest possible competition, contract packages have been made a reasonable size to attract bids on an international basis. Tenders will be limited to contractors who have pre-qualified and been accepted onto the short list.

3.3 Implementation Schedule

The project is composed of the following work items:

1) Project Preparation
2) Loan procedure for Foreign Soft Loan
3) Procurement for consulting services and construction work
4) Consulting services including project management, detailed design and construction supervision.
5) Construction work
6) Land acquisition and compensation

The overall implementation schedule is shown in Table-3.2. Following procurement of the consulting services, the total required period for the main works is five (5) years which comprises four (4) main stages: i) 24 months for the detailed design, ii) 12 months for land acquisition and compensation, iii) 18 months for procurement of contractors (overlapping with the design stage), iv) 36 months (3 years) for construction.

3.4 Financial Disbursement Schedule

Finance for the project is requested from the foreign soft loan with the exception of the costs for land acquisition and compensation, government administration and government tax which will be borne by the federal or state budget. Although loan amount to be borrowed is limited to 60 % of the total project cost, 50 % of that is assumed to be loaned taking into account of the State financial conditions.

The financial disbursement schedule of the project in phase-1 is summarized in Table-3.3.

Table-3.2 Implementation Schedule: Project of Water resources Development and Supply in Vaza Barris River- Sergipe

Fiscal Year / Month	(1) 1999	(2) 2000	(3) 2001	(4) 2002	(5) 2003	(6) 2004	(7) 2005	(8) 2006	(10) 2012	(11) 2013	(12) 2014	(12) 2015	(12) 2016
Project Stages	Preparation Stage			Implementation Stage (Phase-1)					Implementation Stage (Phase-2)				
0 Project Preparation													
(1) F/S of the Project	■	■											
(2) Basic Design of Water Supply Facilities		■											
(3) F/S on Irrigation Project		■	■										
(4) Formulation of RIMA		■	■										
(5) Approval of Project Implementation		■	■										
(6) Formulation of I/P		■	■										
1 Loan Arrangement													
(1) Project Identification		*											
(2) Pledge (Exchange of Note)			*										
(3) Loan Agreement			*										
2 Procurement													
(1) Consulting Services			■	■					■		■		
(2) Construction Work				■	■					■		■	
3 consulting Services													
(1) Assistance for Project Management				■	■	■	■	■		■	■	■	■
(2) Detailed Design				■	■					■		■	
(3) Construction Supervision						■	■	■			■		■
4 Construction Works													
(1) Dam, Check Dam and Low Flow Bypass						■	■	■					
(2) Urban Water Supply Facilities to Itabaiana							■	■			■		
(3) Urban Water Supply Facilities to Lagarto							■	■					■
(4) Forestation for Environmental Protection							■	■					
(5) Irrigation Water Supply Facilities							■	■					
5 Land Acquisition and Compensation													
(1) Land Acquisition and Compensation				■	■								

Table-3.3 Finance and Disbursement Schedule of Phase-1 Project

(Unit: R$1000)

Item		Total	2002	2003	2004	2005	2006
Consulting Services							
Construction Works							
Land Acquisition & Compensation							
1. Construction Costs	Total	224,232	0	0	39,213	112,512	72,508
	Base Cost	176,253	0	0	32,229	88,920	55,103
	Price Esc.	47,980	0	0	6,982	23,594	17,405
(1) Dam Construction	Total	83,597	0	0	38,337	45,260	0
	Base Cost	67,280	0	0	31,510	35,770	0
	Price Esc.	16,317	0	0	6,827	9,490	0
(2) Itabaiana Water Supply	Total	44,667	0	0	0	21,444	23,223
	Base Cost	34,597	0	0	0	16,948	17,649
	Price Esc.	10,070	0	0	0	4,496	5,574
(3) Lagarto Water Supply	Total	47,419	0	0	0	22,439	24,980
	Base Cost	36,716	0	0	0	17,733	18,983
	Price Esc.	10,703	0	0	0	4,706	5,997
(4) Reforestation	Total	875	0	0	875	0	0
	Base Cost	719	0	0	719	0	0
	Price Esc.	156	0	0	156	0	0
(5) Irrigation Water Supply	Total	47,675	0	0	0	23,370	24,305
	Base Cost	36,941	0	0	0	18,470	18,471
	Price Esc.	10,734	0	0	0	4,900	5,834
2. Land Acquisition & Compensation	Total	2,929	951	1,978	0	0	0
	Base Cost	2,536	845	1,691	0	0	0
	Price Esc.	393	106	287	0	0	0
3. Consulting Services	Total	21,906	3,644	3,789	3,940	5,163	5,370
	Base Cost	17,877	3,239	3,239	3,239	4,080	4,081
	Price Esc.	4,029	405	550	701	1,083	1,289
4.Administration	Total	2,516	465	483	502	523	543
	Base Cost	2,065	413	413	413	413	413
	Price Esc.	451	52	70	89	110	130
5. Contingency	Total	12,452	235	292	2,163	5,876	3,886
	Base Cost	9,833	208	251	1,777	4,644	2,953
	Price Esc.	2,619	27	41	385	1,233	933
Total Project Costs	Total	264,038	5,294	6,542	45,818	124,075	82,308
	Base Cost	208,564	4,705	5,593	37,658	98,057	62,548
	Price Esc.	55,474	589	949	8,160	26,018	19,759
Foreign Soft Loan		132,019	2,647	3,271	22,909	62,037	41,154
Total Project Costs (US$1000)		137,520	2,757	3,407	23,864	64,622	42,868
Foreign Soft Loan (US$1000)		68,760	1,379	1,704	11,932	32,311	21,434

Note: - Exchange rate: US$ 1 = R$ 1.92 as of September 1999
- 4 % of annual price escalation is set since the year of 2000
- 50 % of the project cost is assumed to be raised with Foreign Soft Loan, taking into account of the state financial condition.

JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME II)
FEASIBILITY STUDY

[K] ENVIRONMENT IMPACT ASSESSMENT

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (K)
ENVIRONMENT IMPACT ASSESSMENT

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CHAPTER 1 INTRODUCTION

This Study was implemented over two phases: the Master Plan Study and the Feasibility Study for Vaza Barris Dam Project. This report mentions results of the Environmental Impact Assessment on Vaza Barris Dam Project.

Several field surveys were conducted to identify present environmental situation at the Vaza Barris and check dam sites, the reservoir area and the pipeline alignments. Basic information on the existing environmental conditions of these areas were provided by ADEMA (Administracao do Meio Ambiente) as the local environment management organization. Satellite images and aerial photographs were used to identify the vegetation and land use in the reservoir area.

With regard to Vaza Barris River Estuary where there is expected to be environmental effects from the Vaza Barris dam construction, a specific ecological survey was conducted by the Federal University of Sergipe in the Feasibility Study. Outline of this survey is as follows:

Survey Purpose:
- Collecting baseline data for the Environmental Impact Assessment in JICA's Study
- Providing the information to related environmental organizations such as ADEMA and IBAMA
- Collecting baseline data for the Monitoring Program

Contractor:
FAPESE - Supporting Foundation Research and Extension of Sergipe (The Federal University of Sergipe)

Survey Item:
- Large Fish or Commercial Fish (Fishery Resources)
- Small Fish
- Phytoplankton
- Zooplankton
- Water Quality
- Sediment
- Flora

Total Term:
July 1999 - October 1999 (90 days)

Sampling Period:
July 8th 1999 - July 15th 1999

The general objectives of this supporting report related Environmental Impact Assessment are as follows:

1) To provide a baseline information of the existing environmental conditions in the Study Area.
2) To indicate the potential environmental impacts and mitigation measures associated with Vaza Barris Dam Project.
3) To suggest an Environmental Study to be conducted by Sergipe side at the next stage and Environmental Monitoring Plan to be conducted during the operation stage.

CHAPTER 2 ENVIRONMENTAL CONDITION IN THE STUDY AREA

2.1 Vaza Barris River Basin

Catchment area of Vaza Barris dam in Sergipe State is 1,890 km^2. The upper area of this basin is plain or hilly area where agriculture is the main economic activity. The steep slopes of the riverside are mainly covered by shrub in the upper valley.

With regard to the downstream area, because the river channel is fixed, there are no flood plains. Due to the small quantity of the flow and the sedimentation, a delta such as Sao Francisco River is not formed. The sediments are composed of coral sand mainly at the river mouth. There are no irrigation areas and intake facilities from Vaza Barris River in the downstream area of Vaza Barris dam.

Areas of each land use category in Vaza Barris River Basin estimated from satellite image are shown in Table-2.1.

Table-2.1 Area of Each Land Use Category in Vaza Barris River Basin

Unit: km^2

Sub Drainage Basin No.		401	402	403	404	405	406	407	408	Total	Total %
Area		436.93	274.00	521.00	188.97	173.80	233.81	274.07	456.42	2559.00	100.00%
Town		0.80	0.16	1.05	0.27	0.38	0.35	0.23	1.79	5.03	0.20%
Forest Area	Plain	8.55	0.00	7.52	0.00	0.00	0.00	2.36	37.79	56.22	2.20%
	Hill	7.57	25.19	6.93	3.43	5.82	0.63	26.03	25.95	101.55	3.97%
	Mountain	0.00	0.00	6.18	20.24	2.50	0.32	1.57	0.00	30.81	1.20%
Wood Land	Plain	99.74	0.00	0.44	0.00	0.00	0.00	4.47	24.48	129.13	5.05%
	Hill	38.84	62.13	29.69	0.00	15.79	36.16	132.00	14.80	329.41	12.87%
	Mountain	0.00	26.22	24.81	55.92	30.62	0.00	0.00	0.00	137.57	5.38%
Pasture (Vegetation density > 20%)	Plain	59.74	14.03	165.19	64.39	59.65	121.30	79.40	52.70	616.40	24.09%
	Hill	22.68	57.13	107.05	0.16	13.03	0.00	0.02	58.09	258.16	10.09%
	Mountain	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Pasture (Vegetation density < 20%)	Plain	0.66	0.00	0.00	9.49	0.00	0.00	4.35	14.90	29.40	1.15%
	Hill	23.95	78.06	7.65	4.12	8.88	0.00	6.21	16.95	145.82	5.70%
	Mountain	0.00	0.00	0.00	0.00	2.76	8.94	0.00	0.00	11.70	0.46%
Mangrove		0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.24	73.24	2.86%
Salt Marsh		0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.46	2.46	0.10%
Dunes Vegetation		0.00	0.00	0.00	0.00	0.00	0.00	0.00	46.27	46.27	1.81%
Cultivation Area	Dense	0.77	5.79	17.10	13.13	33.60	61.49	16.47	0.00	148.35	5.80%
	Plane	173.58	5.01	142.18	6.69	0.00	2.85	0.54	36.53	367.38	14.36%
	Hill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Exposed Rock/Soil		0.00	0.28	5.06	11.13	0.77	0.00	0.42	4.22	21.88	0.86%
Water		0.05	0.00	0.15	0.00	0.00	1.77	0.00	46.25	48.22	1.88%

Upper Basin ← → Lower Basin

2.2 Project Area

2.2.1 Social Environment

Vaza Barris dam site, check dam site and two pipeline construction sites are located in the three municipalities of Itabaiana, Sao Domingos and Lagarto. These project sites are located in plain or hilly areas where agriculture is the only economic activity. These agricultural activities are mainly extensive livestock farming. Most of the project area is extensive pasture land or grassland. Small cultivated-pasture lands and riverside forests are dispersed in the area. The steep slopes of the riverside are mainly covered by shrub. Areas of each land use category by each municipality estimated from satellite image are shown in Table-2.2. Main livestock population and density by each municipality are shown in Table-2.3 and Table-2.4 respectively.

Table-2.2 Area of Each Land Use Category by Municipality

Unit: km²

Municipality		ITABAIANA		SAO DOMINGOS		LAGARTO		Total	
Area		338.40	100.0%	102.30	100.0%	962.50	100.0%	1403.20	100.0%
Town		2.35	0.7%	0.21	0.2%	1.64	0.2%	4.20	0.3%
Forest Area	Plain	—	—	—	—	5.86	0.6%	5.86	0.4%
	Hill	0.02	0.0%	1.58	1.5%	131.82	13.7%	133.42	9.5%
	Mountain	1.08	0.3%	12.29	12.0%	28.68	3.0%	42.05	3.0%
	Sub-Total	1.10	0.3%	13.87	13.6%	166.36	17.3%	181.33	12.9%
Wood Land	Plain	—	—	—	—	—	—	—	—
	Hill	15.34	4.5%	0.03	0.0%	107.77	11.2%	123.14	8.8%
	Mountain			24.32	23.8%	51.62	5.4%	75.94	5.4%
	Sub-Total	15.34	4.5%	24.35	23.8%	159.39	16.6%	199.08	14.2%
Pasture (Vegetation density > 20%)	Plain	169.13	50.0%	15.28	14.9%	396.89	41.2%	581.30	41.4%
	Hill	1.86	0.5%	11.72	11.5%	17.51	1.8%	31.09	2.2%
	Mountain	—	—	—	—	—	—	—	—
	Sub-Total	170.99	50.5%	27.00	26.4%	414.40	43.1%	612.39	43.6%
Pasture (Vegetation density < 20%)	Plain	—	—	—	—	8.91	0.9%	8.91	0.6%
	Hill	—	—	3.40	3.3%	25.84	2.7%	29.24	2.1%
	Mountain	0.45	0.1%	—	—	—	—	0.45	0.0%
	Sub-Total	0.45	0.1%	3.40	3.3%	34.75	3.6%	38.60	2.8%
Mangrove		—	—	—	—	—	—	—	—
Salt Marsh		—	—	—	—	—	—	—	—
Dunes Vegetation		—	—	—	—	—	—	—	—
Cultivation Area	Dense	135.95	40.2%	20.69	20.2%	140.55	14.6%	297.19	21.2%
	Plane	10.41	3.1%	0.06	0.1%	27.48	2.9%	37.95	2.7%
	Hill	—	—	—	—	14.83	1.5%	14.83	1.1%
	Sub-Total	146.36	43.3%	20.75	20.3%	182.86	19.0%	349.97	24.9%
Exposed Rock/Soil		—	—	12.72	12.4%	1.13	0.1%	13.85	1.0%
Water		1.81	0.5%	—	—	1.97	0.2%	3.78	0.3%

Table-2.3 Livestock Population by Municipality

Unit: heads

Municipality	ITABAIANA	SAO DOMINGOS	LAGARTO	Total
Cattle	19,200	5,200	68,130	92,530
Sheep	1,360	600	11,800	13,760
Goat	280	260	4,250	4,790
House	1,440	455	19,530	21,425

Source: Production by Municipal Livestock (IBGE)

Table-2.4 Livestock Population Density by Municipality

Unit: heads / km²

Municipality	ITABAIANA	SAO DOMINGOS	LAGARTO	Average
Cattle	112	171	152	142
Sheep	8	20	26	21
Goat	2	9	9	7
House	8	15	43	33

State road (SE-110) crosses Vaza Barris River at about 20 km above Vaza Barris dam site. Electric wires exist near check dam site. In and around Vaza Barris dam site, there are only farm roads that are only possible by tractors and jeeps. There are no other infrastructure facilities around the reservoir area. There are no towns and cultural properties in the inundated area. The nearest residence from Vaza Barris dam site is located 4 km upstream.

In Sao Domingos town located near the reservoir, groundwater is the main source of water supply. The outlet of wastewater from Sao Domingos town is located 3 km away from the reservoir.

2.2.2 Natural Environment

Most of the project area is extensive pasture land or grassland, where the vegetation is monotonous biologically. Small forest areas are scattered along the riverside. These riverside forests provide habitats of wildlife such as birds, small mammals and insects. Steep slopes of the riverside where the cattle can not approach are mainly covered by shrub forests. The riverside and shrub forests consist of several species and have no precise dominant species. Main plant species likely to occur in the project area are as follows:

Tapirira guianensis	*Byrsonima sericea*
Sclerolobium densiflorum	*Bowdichia virgiloides*
Thyrsodium sp.	*Cecropia sp.*
Cassia ramiflora	*Cedrella sp.*

Vaza Barris dam site is located in hilly pasture land. There is a large forest area 1.5 km downstream from the site. This forest is the largest forest identified by the field surveys around the project area. Extensive areas of undisturbed forest and wildlife habitat do not exist in and around the inundated area. In the upper valley of the reservoir area, most of the riversides are steep slopes and covered with shrub forests.

Rare or endangered wildlife species have not been identified around the reservoir area. Migratory fishes that swim up the river from sea to spawn have not been identified in Vaza Barris River.

The reservoir area is shown in Figure-2.1 (1/4)~(4/4). The typical land use patterns (cross section) are shown in Figure-2.2 (1/3)~(3/3). The land use around Vaza Barris dam site is shown in Figure-2.3.

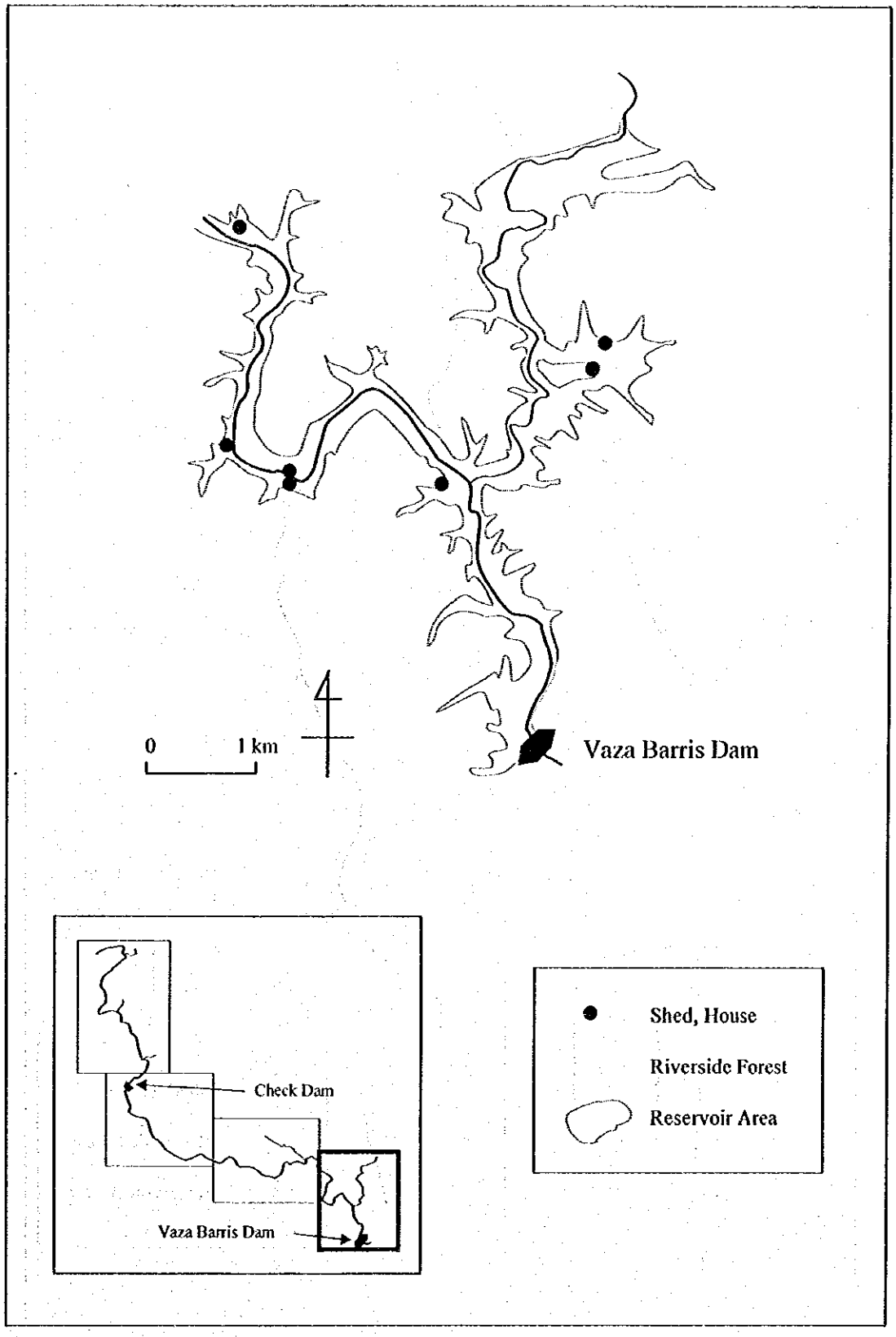

Figure-2.1 (1/4) Reservoir Area

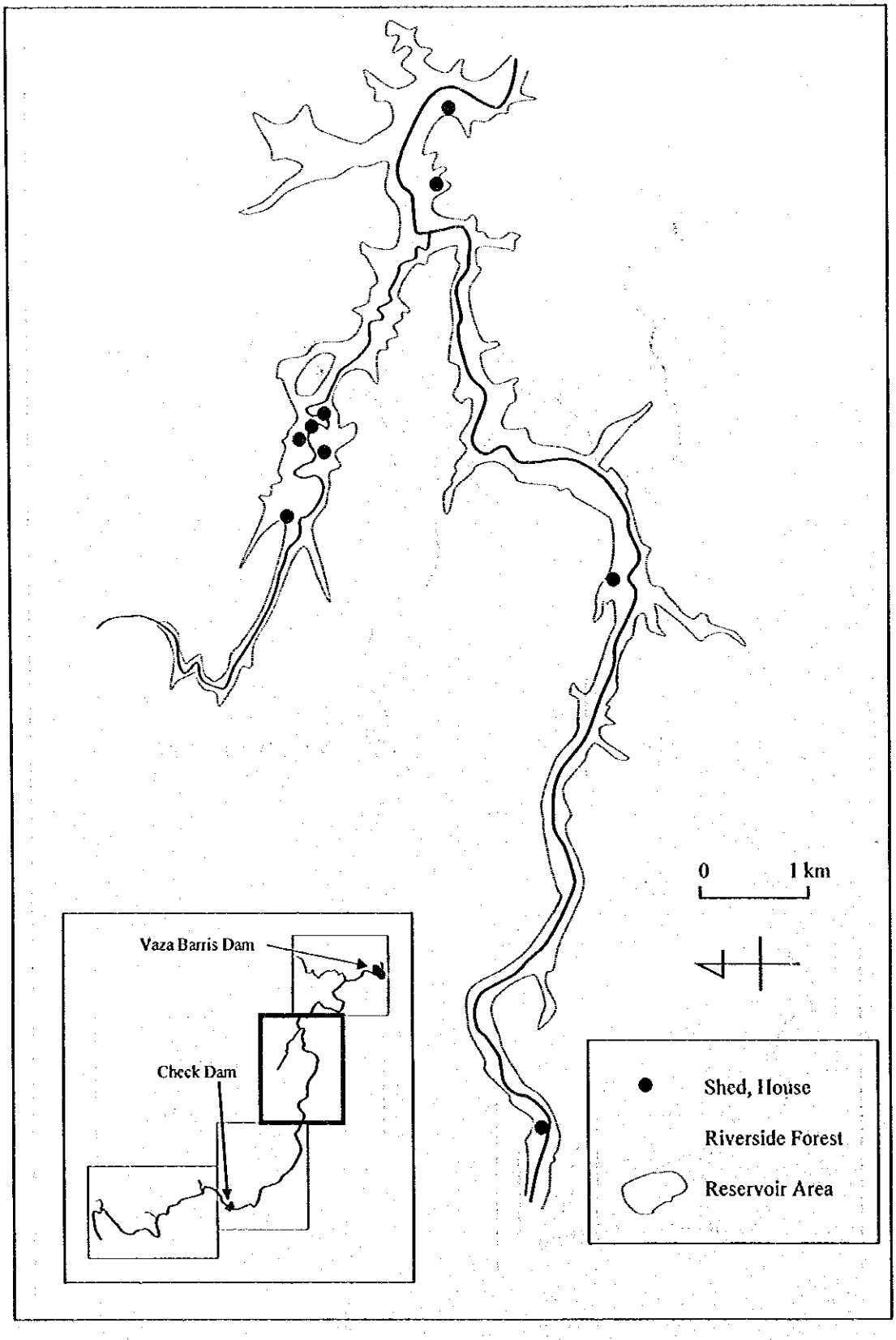

Figure-2.1 (2/4) Reservoir Area

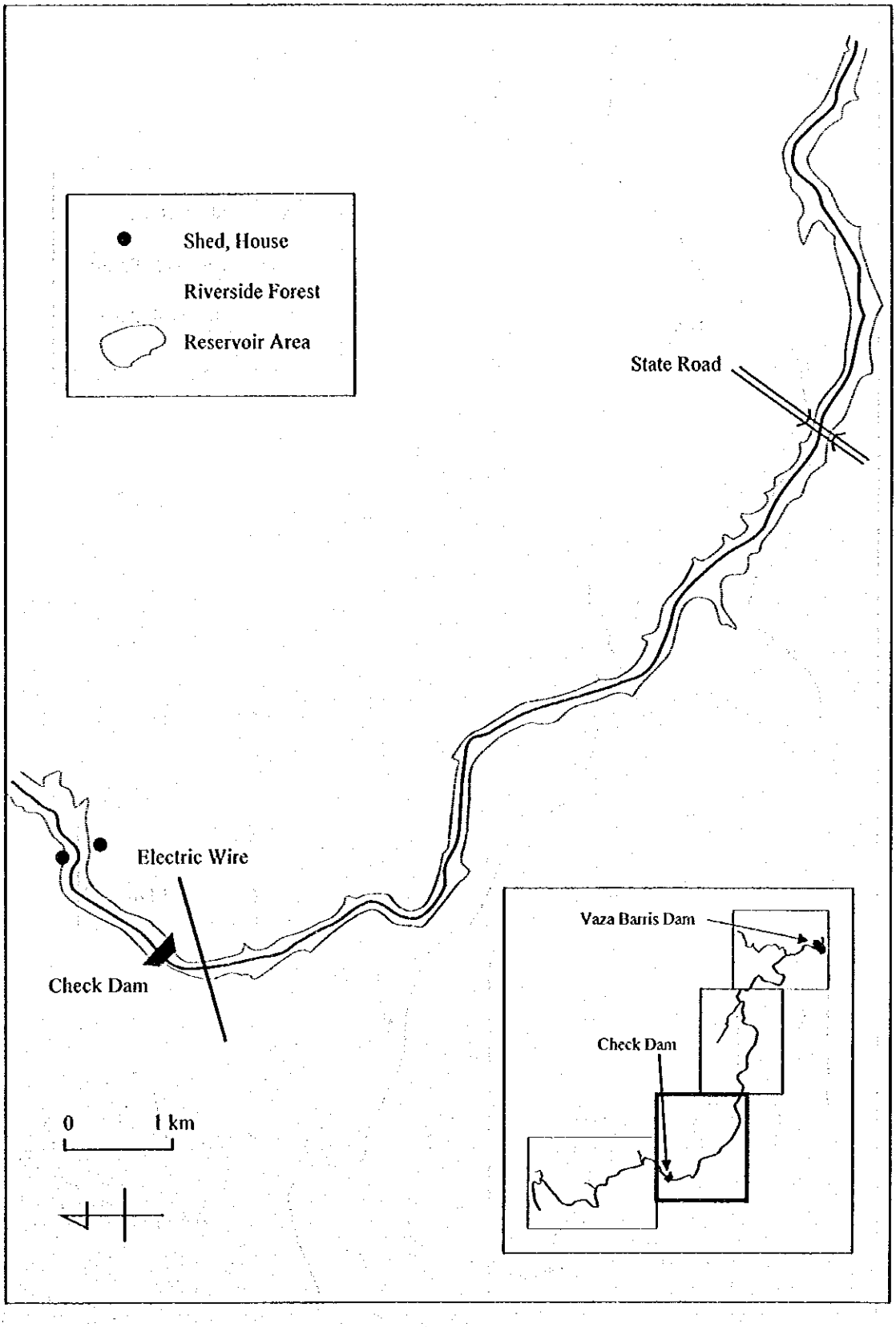

Figure-2.1 (3/4) Reservoir Area

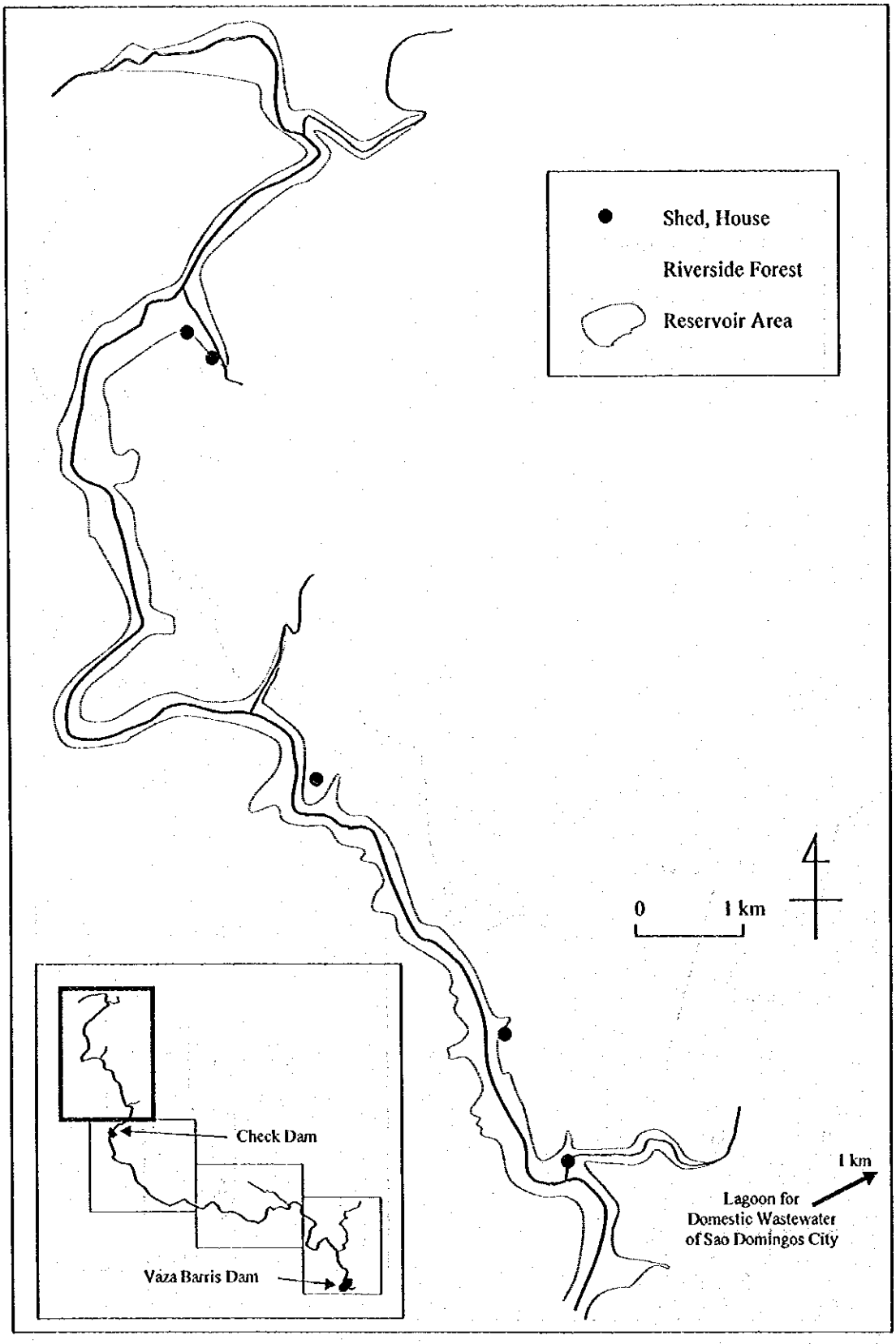

Figure-2.1 (4/4) Reservoir Area

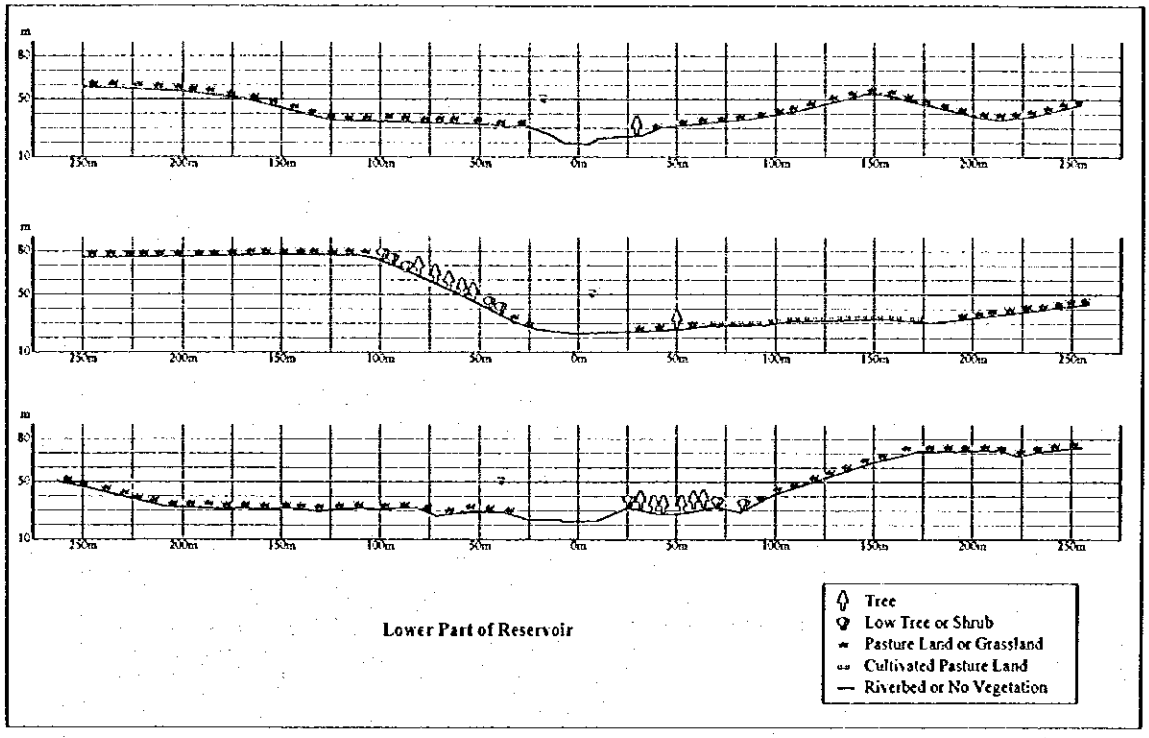

Figure-2.2 (1/3) Typical Land Use Pattern of the Reservoir Area

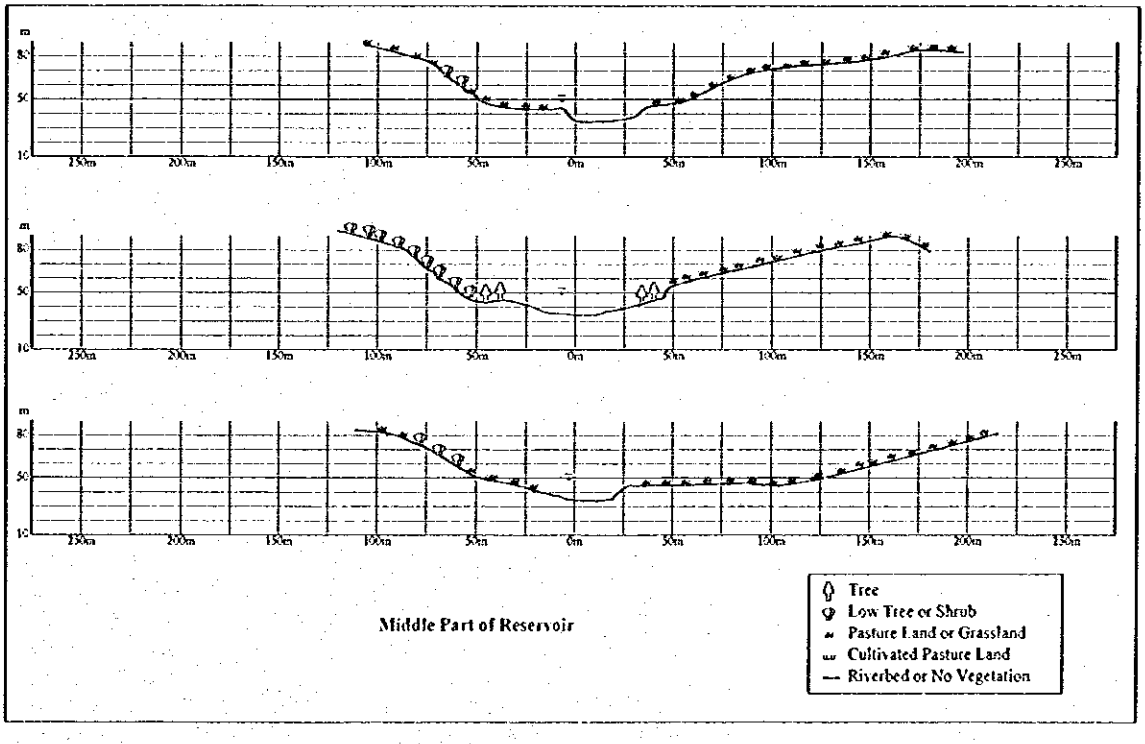

Figure-2.2 (2/3) Typical Land Use Pattern of the Reservoir Area

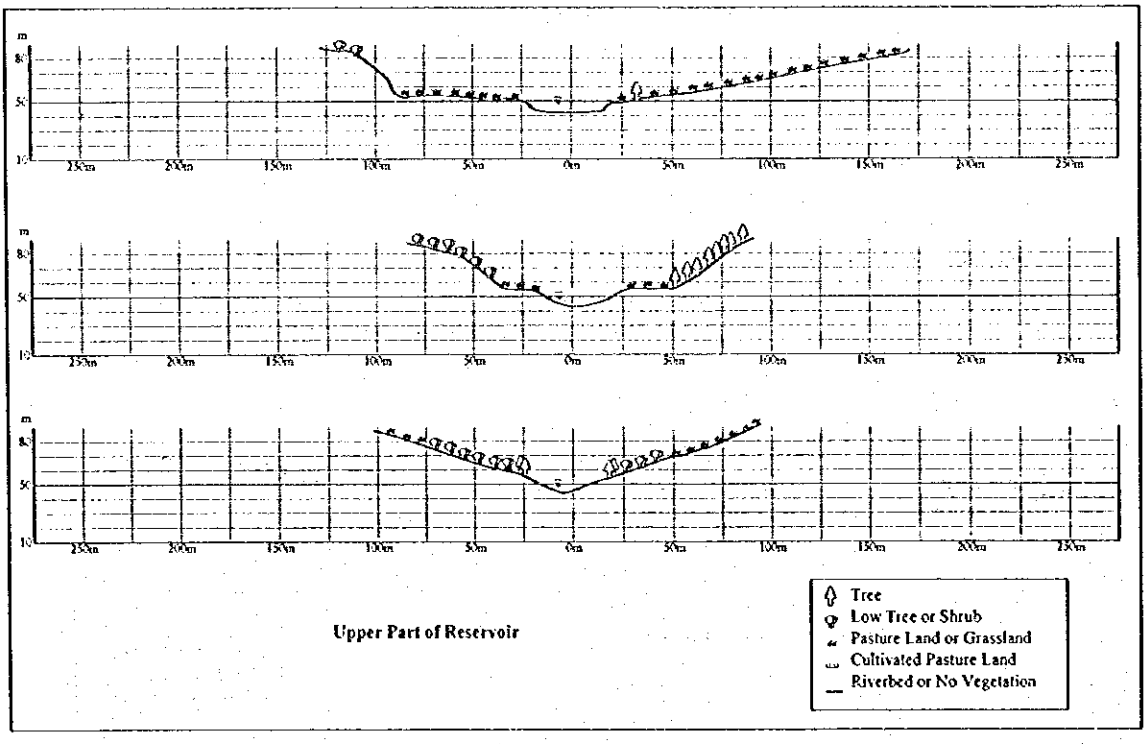

Figure-2.2 (3/3) Typical Land Use Pattern of the Reservoir Area

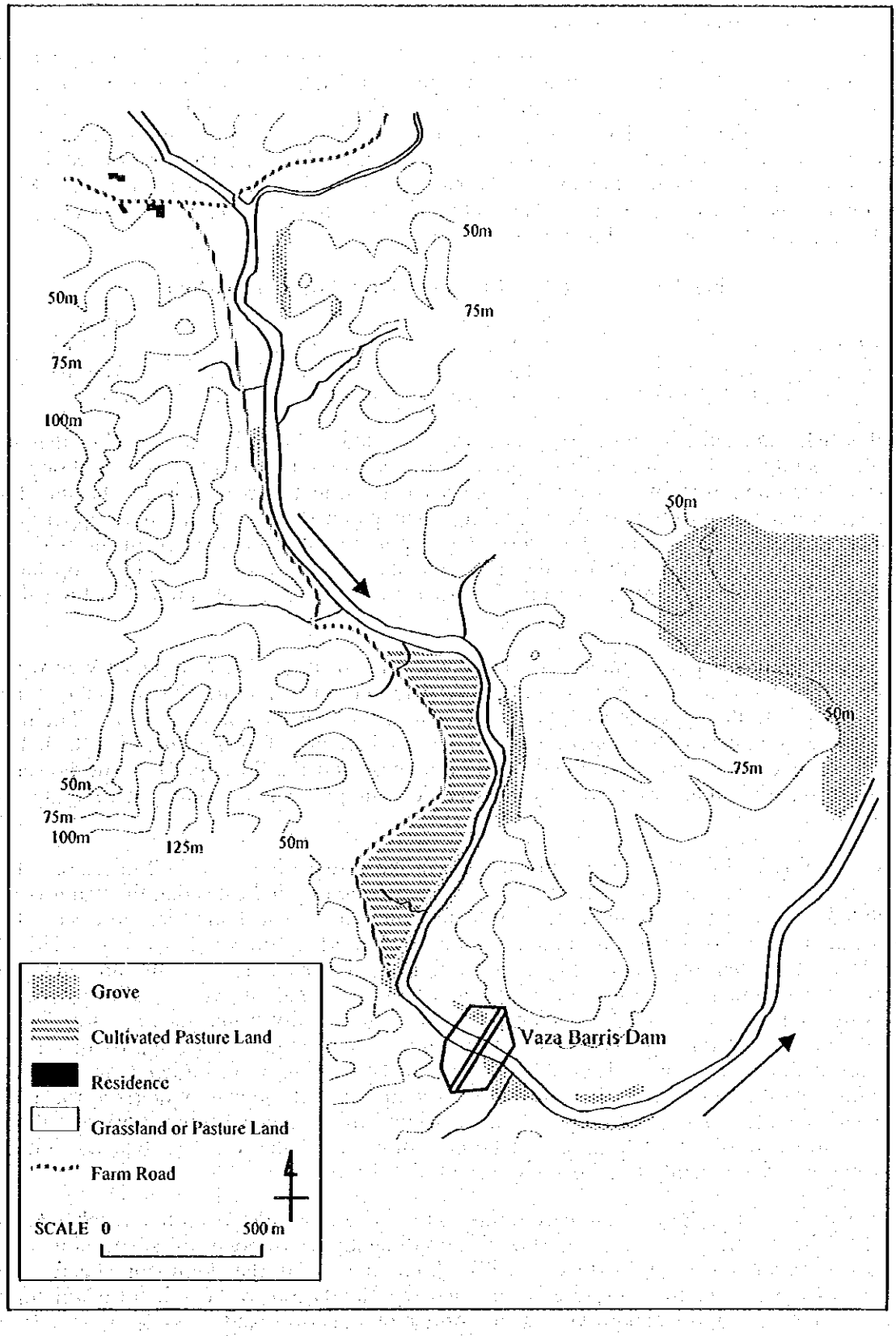

Figure-2.3 Land Use of Vaza Barris Dam Site

2.3 Vaza Barris River Estuary

In the estuary, fishery has been flourishing. In Sao Cristovao, registered fisher persons were 1,401 in 1998. The total including unregistered reaches approximately 6,000 people in a season. Most of the fishery activities use canoes with oar or sail, and a day trip in according with the tide. The shrimp group has a high economical value in the estuary. In recent years, however, the catch has been decreasing. Annual catch for 1987-88 in Sao Cristovao was more than 400 ton, but the catch in 1998 has dropped by 13 ton. Main reason for the decease is over fishing including the catch of juveniles. The catch for 1996-98 in Sao Cristovao is shown in Table-2.5.

Table-2.5 Catch of Fish for 1996-98 in Sao Cristovao

	1996	1997	1998
Sao Cristovao	229.1 t	176.8 t	13.0 t
Total of Sergipe State	3,401.5 t	3,193.8 t	3,692.6 t

Source: Preliminary Ecological Evaluation of Vaza Barris River Estuary by the Federal University of Sergipe

In this fish and shellfish study, 80 species are identified. According to the other fish and shellfish study, the fish and shellfish species sampled in the two rainy seasons and one dry season was composed by at least 133 species belonging to 46 families. Oceanic fish species dominate up to the confluence with Paramopama River. In the more upper area, demersal species dominate. The shrimp group dominates in number of individuals. Pink shrimp (Penaeus subtilis) is the most abundant in the estuary. This group has a complex life cycle and migrates from the estuary to the sea as sub-adult, finishing their growth and reproducing.

The mean grain sizes of sediments in the estuary range from 0.87 to 7.96 phi as Wentworth scale. The river mouth presents sand dominance that has a marine characteristic. The sand extends to the upper area of the estuary where the oceanic energy is low. The ratio of silt rises gradually in the upper area. The mean diameter of the sediment is affected by supply sources of the material, the deposition process and the flow speed. The presence of fine material indicates lower hydrodynamics energy, where make possible the silt deposition.

Water quality in July 1999 (the rainy season) in the estuary is shown in Table-2.6. The sampling points are shown in Figure-2.4. The water quality indicates that the water is not polluted, and has the strong marine influence and the vertical mixture process. The suspended solid (SS) levels are high, more than 160 mg/l, in the whole estuary. The SS levels of the river mouth are higher than the upper area. This result indicates that significant sediments are transported into the estuary by tidal currents. Salinity level of the estuary ranges from 1.78 % to 3.69%. The high salinity water goes up close to the confluence with Paramopama River. The saltwater intrusion reaches approximately 20 km up at the spring tide. The BOD5 levels in the section 3 are higher than the other sections on the ebb tide. This result shows inflows of organic materials form the tributaries in section 3. With regard to the nutrients, the phosphate concentrations suffer a large influence of the lateral channels that drain into the estuary, but the nitrate concentrations are mainly influenced by Vaza Barris River.

The estuary is a developed mangrove forest zone. The total mangrove area reaches 60.56 km^2. The mangrove areas trap the fine sediments transported in suspension, and progressively colonize the estuary. Rhizophora mangle is the dominant species and grows in the estuary margins, the islands and the shoals, up to the salt intrusion limit. About 70 percent of the mangrove area are formed on the coral sand.

According to the plankton study, the dominant phytoplankton species are Odontella regia, Chaetoceros peruvianus, C. compressus and Rhizosolenia styliformis. Odontella regia is the most frequent. 83 percent of identified 65 species are diatoms that generally exist in clean water. Biomass numbers of the phytoplankton in the section 4 are almost ten times greater than the ones in the section 1. The abundant zooplankton species are zoea of

Brachyuran, Acartia lilljeborgi, nauplius of Cirripede, Paracalanus crassirostris, Temora turbinata, Bouganville ramosa and Liriope tetraphylla. The zoea of Brachyuran is the most abundant in all sections. Biomass numbers of the seston during the ebb tide are much greater than the ones during the flood tide in all sections. The densities of zooplankton are high in the section 3 during the ebb tide, and in the section 1 during the flood tide.

Table-2.6 Water Quality in Vaza Barris River Estuary

Sampling Point	Depth (m)	Temp. (℃)	pH	Cl (mg/l)	Sal. (%)	Turb. (NTU)	SS (mg/l)	DO (mg/l)	BOD5 (mg/l)
Ebb Tide									
1:S	0.0	26.8	8.2	19,600	3.59	4.6	160	7.04	0.88
1:M	6.5	26.5	8.3	19,984	3.66	4.2	301	6.96	1.17
1:B	13.0	26.5	8.3	20,147	3.69	4.6	304	6.93	0.59
2:S	0.0	27.0	8.1	16,325	2.99	5.0	232	6.38	2.19
2:M	5.5	26.8	8.1	17,745	3.25	5.4	259	6.01	1.76
2:B	11.0	26.8	8.2	18,073	3.31	6.2	203	6.16	1.87
3:S	0.0	26.8	8.0	13,595	2.49	5.4	186	5.94	6.60
3:M	5.0	26.8	8.0	13,705	2.51	5.8	250	5.86	4.46
3:B	10.0	27.0	8.0	14,851	2.72	6.9	196	5.79	4.29
4:S	0.0	27.0	8.0	9,719	1.78	8.5	161	6.01	-
4:B	4.5	27.0	8.0	11,794	2.16	9.3	210	5.72	3.96
Flood Tide									
1:S	0.0	27.2	8.4	16,817	3.08	7.7	211	6.52	-
1:M	6.5	27.0	8.5	17,636	3.23	8.5	347	6.23	1.10
1:B	13.0	26.5	8.5	17,690	3.24	8.5	325	6.74	-
2:S	0.0	27.0	8.4	15,998	2.93	10.0	229	6.3	1.66
2:M	3.5	27.0	8.4	16,435	3.01	10.0	216	6.01	1.54
2:B	7.0	27.0	8.4	17,144	3.14	10.4	222	6.16	1.39
3:S	0.0	27.0	8.5	14,087	2.58	9.6	258	7.26	-
3:M	5.5	27.0	8.5	15,179	2.63	10.0	234	6.38	-
3:B	11.0	26.8	8.5	14,360	2.78	10.8	206	6.45	3.08
4:S	0.0	27.2	8.4	14,360	2.63	12.3	242	7.18	-
4:B	5.5	27.0	8.3	14,414	2.64	12.3	232	6.52	2.86
5:S	0.0	25.5	8.0	328	0.60	18.1	183	6.67	6.60
5:B	3.7	25.5	8.0	328	0.60	18.5	201	7.11	6.22

(2)

Sampling Point	N-NH4 (mg/l)	N-NO2 (mg/l)	N-NO3 (mg/l)	P-PO4 (mg/l)	P-Total (mg/l)	Si-SiO4 (mg/l)
Ebb Tide						
1:S	0.003	0.001	0.013	< 0.0009	0.029	3.11
1:M	0.007	0.002	0.007	0.009	0.037	0.59
1:B	0.005	0.004	0.005	< 0.0009	0.070	0.96
2:S	0.006	0.001	0.013	0.003	0.037	2.75
2:M	0.01	0.002	0.008	0.006	0.078	4.06
2:B	0.008	0.003	0.012	0.020	0.122	4.24
3:S	0.006	< 0.0001	0.011	0.004	0.057	1.45
3:M	0.004	< 0.0001	0.005	0.004	0.022	1.39
3:B	0.004	< 0.0001	0.003	< 0.0009	0.093	1.11
4:S	0.004	0.001	0.040	0.016	0.099	3.72
4:B	0.004	0.001	0.042	0.009	0.086	2.25
Flood Tide						
1:S	0.008	< 0.0001	0.010	< 0.0009	0.045	0.52
1:M	0.006	0.001	0.008	< 0.0009	0.081	0.40
1:B	0.007	0.001	0.008	< 0.0009	0.091	0.39
2:S	0.003	0.002	< 0.001	< 0.0009	0.040	2.67
2:M	0.004	0.002	0.002	< 0.0009	0.011	2.13
2:B	0.007	0.002	0.005	< 0.0009	0.093	1.45
3:S	0.003	0.0005	0.020	0.003	0.150	1.27
3:M	0.004	< 0.0001	0.015	0.012	0.057	1.02
3:B	0.006	< 0.0001	0.018	0.004	0.050	1.55
4:S	0.005	0.0008	0.042	0.012	0.045	3.21
4:B	0.004	< 0.0001	0.025	< 0.0009	0.052	1.98
5:S	0.011	0.005	0.255	0.015	0.063	4.34
5:B	0.008	0.004	0.221	0.015	0.091	4.77

S: Surface, M: Middle Depth, B: Bottom
Original Data: from Federal University of Sergipe

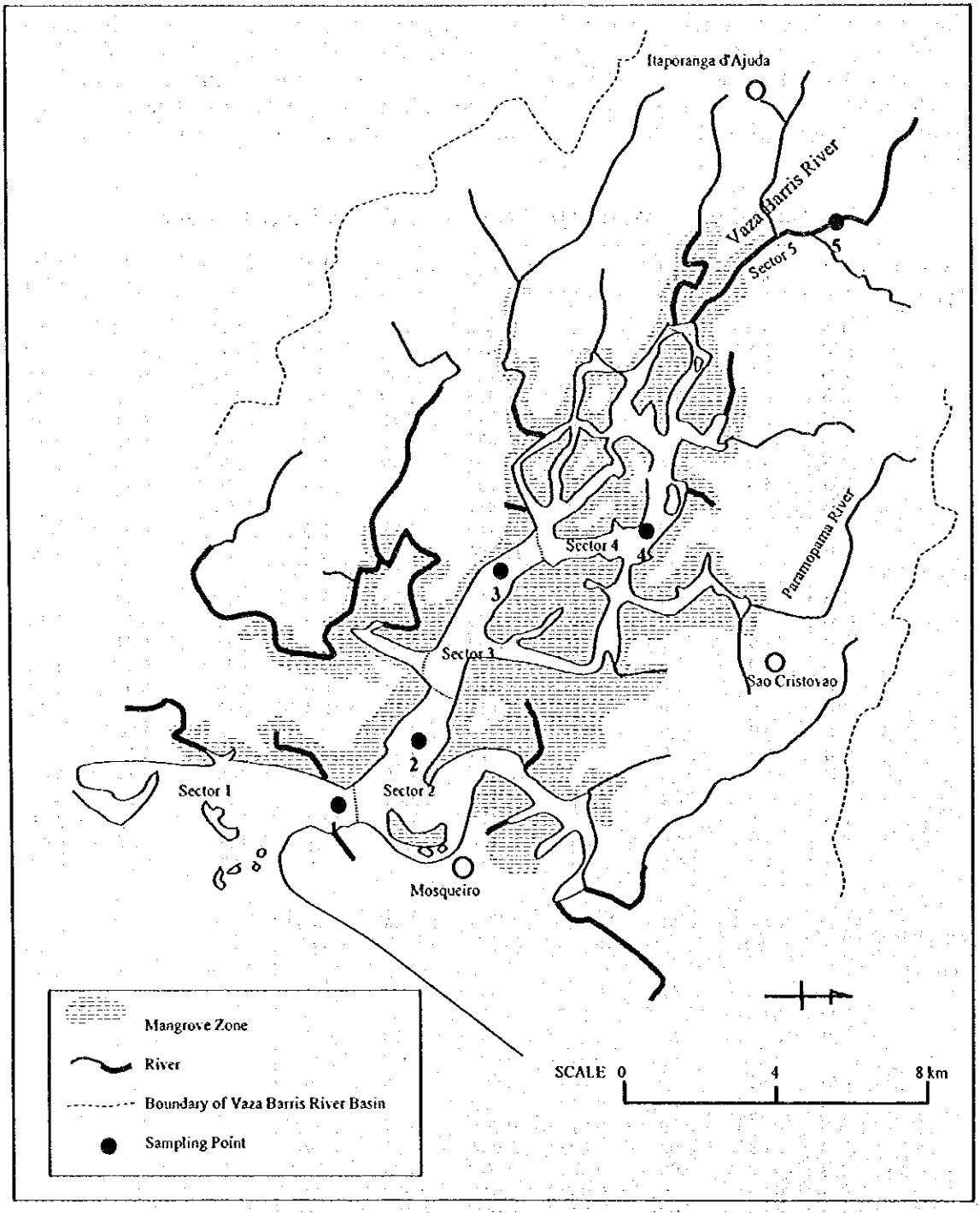

Figure-2.4 Sampling Area of Water, Plankton and Fish

There is a state protected-area in the estuary. This protected-area consists of Paraiso Island located at the river mouth and Paz Island located in front of Mosqueiro Village. However, Paraiso Island is a momentary island and has no biological importance. Paz Island is covered with old growth mangroves. All of mangrove areas in Sergipe State are objects of State Mangrove Protection Law.

The downstream area of Vaza Barris River Basin is shown in Figure-2.5. The more detailed information on the estuary is given in "Preliminary Ecological Evaluation of Vaza Barris River Estuary by the Federal University of Sergipe - September 1999 -".

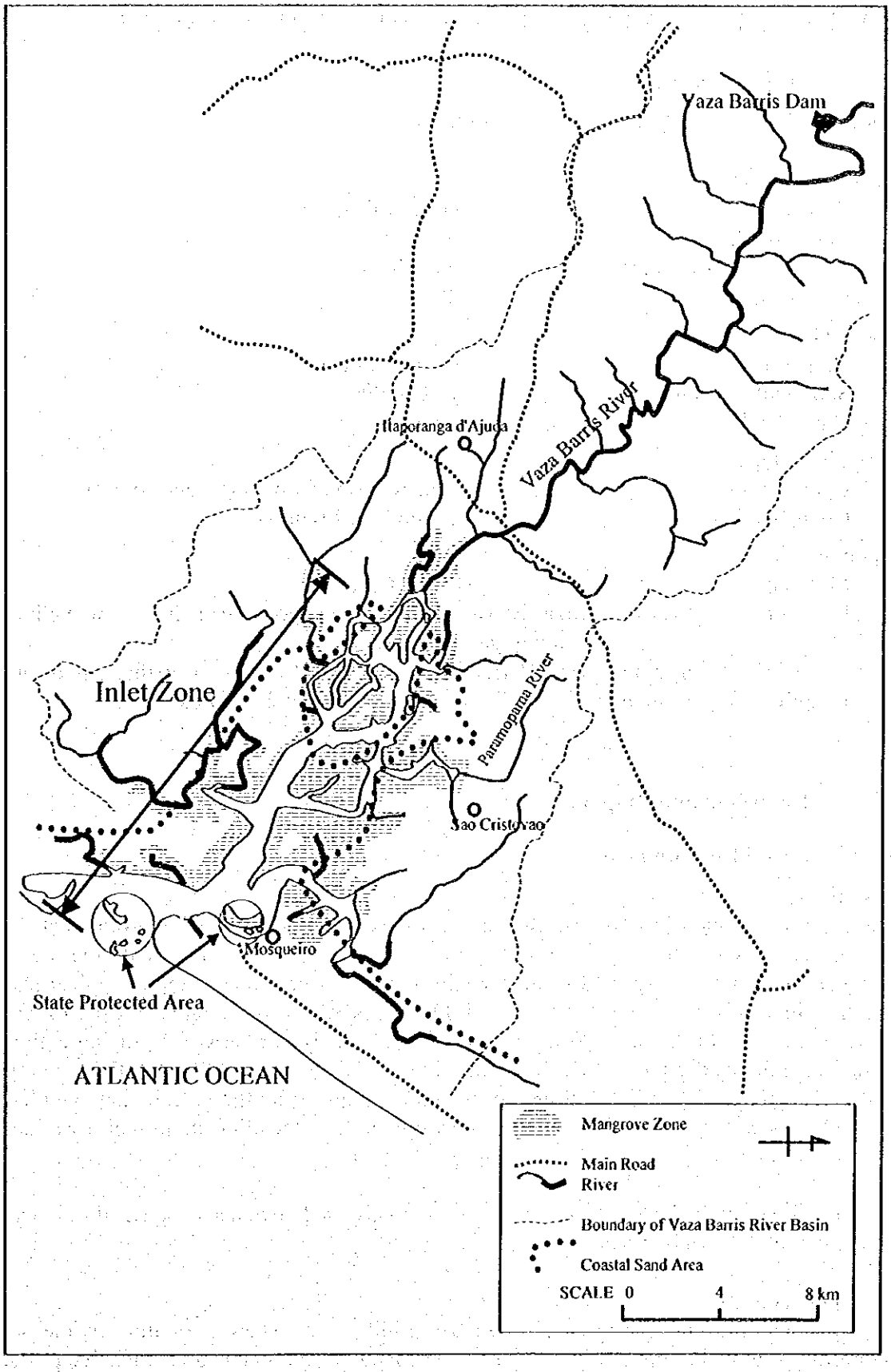

Figure-2.5 Lower Part of Vaza Barris River