ANNEX 22.3

A22.3 Sewage Treatment System in Dispersed Community Area

22.3.1 Outline

Various sewage treatment systems have been developed and used to deal with the needs and problems. Each system has its characteristics in terms of required area for construction, treatment performance and cost. Choice of a system is essential as it influences total economical aspect and maintenance easiness. Sewage treatment system for Riacho Grande STP (QDM=8700m3/d) and Santa cruz STP (QDM=1000m3/d) were examined to meet the requirement. As a result, Oxidation ditch method (+ Phosphorus removal by coagulant feeding) was employed for both STPs in view of economics, maintenance easiness and treated water quality. Dewatering machine shall be installed to treat produced sludge by sewage treatment in 2 STPs. Sludge of Santa cruz STP will be transported to Riacho Grande STP by vehicles for sludge treatment. Sludge treatment machine in Riacho Grande STP shall be multi disc type which needs no thickening process. Dewatered sludge will be transported to disposal site by truck.

22.3.2 Fundamentals

Table 22.3.1 Unit rate of sewage and pollution

	2005	2015	2025	Remarks
1.Sewage Unit Rate				(L/capita/day)
Daily Average	128	144	160	
Daily Maximum	153.6	172.8	192	
Hourly Maximum	230.4	259.2	288	
2.Pollution Load Unit Rate				(g/capita/day)
BOD	54	54	54	
SS	60	60	60	
TN	10	10	10	
TP	1.2	1.2	1.2	

Table22.3.2 General Condition of Riacho Grande STP

	2005	2015	2025	Remarks
1.Sewage Service Population	7,700	34,690	37,159	
2.Sewer Length planned (m)	6,300	37,200	37,200	
3.Projected future sewage				
Daily Average	986	4,995	5,945	(m3/day)
Daily Maximum	1,183	5,994	7,135	(m3/day)
Hourly Maximum	1,774	8,992	10,702	(m3/day)
Infiltration	272	1,607	1,607	43.2 m3/km

Table 22.3.3 General Condition of Santa cruz STP

	2005	2015	2025	Remarks
1.Sewage Service Population	3,239	3,773	4,041	
2.Sewer Length planned (m)	4,674	4,674	4,674	
3.Projected future sewage				(m3/day)
Daily Average	415	543	647	
Daily Maximum	498	652	776	
Hourly Maximum	746	978	1,164	
Infiltration	202	202	202	43.2 m3/km

(1) Water Quality of influent and effluent

Influent water quality is determined by unit sewage rate, unit pollution lode rate and so on. Its concentration is higher than that of in developed countries due to smaller sewage unit rate. Effluent water quality is determined by the indices and values based on guidance by CETESB. Target value for nitrogen was added in consideration of necessity for nitrogen removal. Nitrogen removal rate of 70% is adopted since the oxidation ditch system will be employed.

1) Riacho Grande STP

Table22.3.4 Riacho Grande STP Design Water Quality

Indices	2015			2025		
	Influent (mg/L)	Removal rate	Effluent (mg/L)	Influent (mg/L)	Removal rate	Effluent (mg/L)
BOD_5	292	93.1%	20	265	92.5%	20
COD	583	93.1%	40	530	92.5%	40
TSS	324	93.8%	20	295	93.2%	20
TP	6.5	84.6%	1.0	5.9	83.0%	1.0
TN	54	70.0%	16	49	70.0%	15

2) Santa cruz STP

Table22.3.5 Santa cruz STP Design Water Quality

Indices	2015			2025		
	Influent (mg/L)	Removal rate	Effluent (mg/L)	Influent (mg/L)	Removal rate	Effluent (mg/L)
BOD5	239	91.6%	20	223	91.0%	20
COD	477	91.6%	40	446	91.0%	40
TSS	265	92.5%	20	248	91.9%	20
TP	5.3	81.1%	1.0	5.0	79.8%	1.0
TN	44	70.0%	13	41	70.0%	12

(2) Conditions of examination

1) Riacho Grande Sewage Treatment Plant

- Capacity of STP : 8,700m3/day (≒7,135 m3/day +1,607 m3/day)
- Special requirement : Need of advanced treatment for phosphorus and nitrogen removal
- Current Status : Existing plant. Suspension of treatment not admitted.
- Discharge point : Lake Billings. Recreational use of water surface around.
- Sludge treatment : Transportation of slurry of sludge economically not feasible. Location of ABC STP approximately 20km away from Riacho Grande STP.

2)Santa Cruz STP

- Capacity of STP : 1,000m3/day (≒776 m3/day +202 m3/day)
- Special requirement : Need of advanced treatment for phosphorus and nitrogen removal
- Status : New construction
- Effluent Discharge point: Swamp area already polluted by raw sewage and sludge.
- Sludge treatment: Riacho Grande STP located nearby with 8km distance.

22.3.3 Study on Sewage Treatment System

(1) Comparison of sewage treatment system

Sewage treatment systems that suit these conditions are compared in terms of treatment capacity, effluent water quality and capability of removing nutrient matters as follows;

Table22.3.6 Preliminary choice of sewage treatment system

	Riacho Grande STP		Santa cruz STP	
	suitability	notes	suitability	notes
Conventional activated sludge	NG	Expensive, require lager lot, no Nitrogen removal	NG	Expensive, require lager lot, no Nitrogen removal
Extended aeration	Fare		Fare	
OD	Fare		Fare	
SBR	NG	No nitrogen removal	NG	No nitrogen removal
A2O	Fare		NG	Not suitable for smaller scale
UASB	NG	Inadequate removal rates, no nitrogen removal	NG	Inadequate removal rates, no nitrogen removal
MBR	NG	Expensive	NG	Expensive

Remarks 1) OD : Oxidation ditch, SBR : Sequential batch reactor, A2O : Anaerobic anoxic oxic

method, UASB : Up-flow anaerobic sludge blanket, MBR : Membrane bio reactor

Remarks 2) Phosphorus removal can be attained by using coagulant feeding.

Remarks 3) Approximately 70%removal rate of nitrogen can be expected for method of OD, Extended aeration and A2O. However, operating condition of current Riacho Grande STP (OD) is not suitable for nitrogen removal due to short detention teime.

(2) Suitability and preliminary choice

Extended aeration, Oxidation ditch and A2O are subject systems for examination of Riacho Grande STP based on above mentioned comparison. Extended aeration and Oxidation ditch are chosen for examination of Santa cruz STP.

22.3.4 Sludge treatment system

(1) Collection system

Since Santa cruz STP is located close to Riacho Grande STP with a distance of 8km, intensive sludge treatment is suited economically for this purpose. Sludge treatment shall be dealt in Riacho Grande STP. Sludge treatment facility will be installed as superstructure on the slab of oxidation ditch to make the most of the site area.

(2) Sludge disposal

Dewatered sludge shall be dumped in the dumping site. Dewatered sludge shall be transported and collected to ABC STP once before transportation to dumping site.

(3) Sludge treatment system

Since construction of sludge thickener and digester with the necessary various pipelines in Riacho Grande STP is difficult due to the limited area. Multi disc dewatering machine which needs no sludge thickener shall be constructed on the floor on the oxidation ditch. This method is good for energy conservation, maintenance easiness and odor control.

22.3.4 Evaluation of Treatment System

(1) Riacho Grande STP

1) Required performance and condition of installation

In addition to treatment performance and maintenance easiness, limited lot site and step construction need to be considered. In light of these conditions, oxidation ditch with coagulant feeding for phosphorus removal is advantageous.

UASB is employed as a substitute of primary sedimentation tank in A2O system in this examinationn. Independent use of UASB is not suited from its low ability of removal efficiency.

Table 22.3.7 Examination of treatment system in Riacho Grande STP

	Performance	Maintenance	Required Area/Step construction	Evaluation
UASB	0	3	3	—
OD+P removal	3	3	3	9
Extended aeration +P removal	3	1	3	7
UASB+A2O	3	0	0	3

Not applicable : 0, Problematic but applicable:1, Applicable with some problems : 2, Advantageous : 3

2) Construction cost

Construction cost of OD system is most economical in Riacho Grande STP. Chemical feeding for phosphorus removal shall be installed because of requirement for effluent water quality. UASB is disadvantageous as it needs oxic treatment system in the latter part of the system for this condition.

Riacho Grande QDM= 8,700m3/day Unit: R$

		Civil	Mechanical	Electrical	Total	Remarks
1	Oxidation Ditch + Coagulation	4,288,973	3,067,921	950,625	8,307,519	
2	Extended Aeration + Coagulation	5,747,615	3,052,005	1,373,125	10,172,745	
3	Anaerobic-Anoxic-Oxic(A2O)	8,621,423	6,104,009	2,746,250	17,471,682	
4	UASB+A2O	9,483,565	4,883,207	2,471,625	16,838,398	

3) Maintenance cost

Maintenance cost for OD system is also most economical.

Riacho Grande QDM= 8,700m3/day Unit: R$/yr

		Electricity	Chemical	Transpotation	Equipment	Total
1	Oxidation Ditch + Coagulation	162,966	97,988	122,199	120,556	503,710
2	Extended Aeration + Coagulation	162,966	97,988	122,199	132,754	515,908
3	Anaerobic-Anoxic-Oxic(A2O)	211,856	76,970	171,079	265,508	725,413
4	UASB+A2O	190,671	76,970	122,199	220,645	610,485

4) Total Evaluation

Oxidation ditch system + chemical feeding for P removal is most advantageous and recommendable from the result of Table 22.3.8.

Table 22.3.8 Examination of sewage treatment system in Riacho Grande STP

	Performance	Construction cost	Maintenance cost	Total Score
UASB	0	—	—	0
OD + Chemical Feeding	3	3	3	9
Extended aeration + Chemical Feeding	2	2	1	5
UASB+A2O	1	1	1	3

Not applicable : 0, Problematic but applicable:1, Applicable with some problems : 2, Advantageous : 3

Multi disc dewatering machine shall be adopted for sludge treatment system. Multi disc type de-watering machine has feature of capable of continuous operation, small size and low weight, low energy consumption, low noise, low odor emission and easy maintenance, which is suitable for the sewage treatment plant.

(2) Santa cruz Sewage Treatment Plant

1) Required performance and condition of installation

Treatment performance and maintenance easiness should be regarded as important in this case. As regards the condition of lot area and step construction, there are not serious restrictions. Choice of treatment system depends on things other than treatment performance and maintenance easiness as shown Table 22.3.9. Independent use of UASB is not suited from its low removal efficiency for BOD and nutrient matter.

Table 22.3.9 Examination of treatment system in Santa cruz STP

	Performance	Maintenance	Required Area/Step construction	Evaluation
OD+P removal	3	3	3	9
Extended aeration +P removal	3	2	3	8
UASB＋A2O	3	1	3	7

Not applicable : 0, Problematic but applicable:1, Applicable with some problems : 2, Advantageous : 3

2) Construction cost

Construction cost of OD system is most economical in Santa cruz STP as well as Riacho Grande STP. Chemical feeding for P removal shall be installed because of requirement for effluent. UASB is disadvantageous as it needs oxic treatment system in the latter part of the system for this condition.

Santa Cruz QDM= 1,000m3/day Unit: R$

		Civil	Mechanical	Electrical	Total	Remarks
1	Oxidation Ditch + Coagulation	924,973	2,122,126	327,860	3,374,959	
2	Extended Aeration + Coagulation	1,231,390	2,014,363	750,360	3,996,113	
3	Anaerobic-Anoxic-Oxic(A2O)	1,847,085	4,028,726	1,500,720	7,376,531	
4	UASB+A2O	2,154,933	3,222,981	1,350,648	6,728,562	

3) Maintenance cost

Maintenance cost for OD system is also most economical.

Santa Cruz QDM= 1,000m3/day Unit: R$/yr

		Electricity	Chemical	Transpotation	Equipment	Total
1	Oxidation Ditch + Coagulation	35,800	5,300	40,900	73,500	155,500
2	Extended Aeration + Coagulation	35,800	5,300	40,900	82,942	164,942
3	Anaerobic-Anoxic-Oxic(A2O)	46,540	500	57,260	165,883	270,183
4	UASB+A2O	41,886	500	40,900	137,209	220,495

4) Total Evaluation

Oxidation ditch system + chemical feeding for phosphorus removal is most advantageous and recommendable from the result of Table 22.3.10.

Table 22.3.10 Examination of sewage treatment system in Santa cruz STP

	Performance	Construction cost	Maintenance cost	Total Score
OD + Chemical Feeding	3	3	3	9
Extended aeration + Chemical Feeding	2	2	2	6
UASB+A2O	2	1	1	4

Not applicable : 0, Problematic but applicable:1, Applicable with some problems : 2, Advantageous : 3

Oxidation ditch system + chemical feeding for phosphorus removal is most advantageous and recommendable from the result of Table 22.3.8. Adoption of the same treatment system for both STP is desirable in terms of maintenance. Sludge shall be transported as thickened sludge to the Riacho Grande STP by vacuum car for sludge treatment.

22.3.5 Outline of treatment system in the STP

Name	Item	Description
Riacho Grande Sewage Treatment Plant	Sewage Treatment Plant	QDM=8,700m3/day Oxidation Ditch + Chemical Feeding for Phosphorus Removal Ditch : ^{L}212.6m x ^{B}4m x ^{H}4m x 2 Detention time : 20hrs (2025) BOD-SSloading : 0.079 kgBOD/kgSS (2025) Aerator : carousel type x 6 Final Sedimentation Tank : Center Feed Circular type x 2, D=15m, h=3m
	Advanced Treatment	Nitrogen : 70% removal, concentration in effluent<below 15mg/l Phosphorus : Approximately 80% removal by chemical feeding, concentration in effluent<below 1mg/l
	Sludge Treatment	Treatment : Dewatering with sludge from Santa cruzSTP Sludge thickening process : - Dewatering machine : Multi disc type Storage : Container
	Sludge Disposal	Disposal after transportation to ABCsewage treatment plant 分
Santa Cruz Sewage Treatment Plant	Sewage Treatment Plant	QDM=1,000m3/day Oxidation Ditch + Chemical Feeding for Phosphorus Removal Ditch : ^{L}58.7m x ^{B}5.7m x ^{H}3m x 1 Detention Time : 25hrs (2025) BOD-SS loading : 0.062 kgBOD/kgSS (2025) Aerator : screw type x 3 Final Sedimentation Tank : Center Feed Circular type x 1, D=12.7m, h=3m
	Advanced Treatment	Nitrogen : 70% removal, concentration in effluent<below 15mg/l Phosphorus : Approximately 80% removal by chemical feeding, concentration in effluent<below 1mg/l
	Sludge Treatment	Gravity thickener : ^{L}2.5m x ^{B}2.5m x ^{H}3m x 1 Dewatering after transportation to Riacho Grande STP

ANNEX 23.5.1

Annex A23.5.1 Unit Prices of Permeable Pavement (R$)

No.	Item	Unit Price (R$) : Habitual		Unit Price (R$) : for Study		Notes
		Unidade	Preço	Unidade	Preço	
1.	Preparatory Works					
1.1	Demolition, Loading & Freight of Existing Materials	m3	35.20	m2	7.70	Distance of transport: 16km, Price of reclaimed land:
1.2	Scraping, Demolition, Loading & Freight of Existing Ruble	m3	22.00	m2	1.65	Distance of transport: 5km
2	Works of Road Bed					
2.1	Opening, Grading & Compacting of					
2.1.1	Depth: 25-27cm	m2	8.25	m2	8.25	
2.1.2	Depth: 35-40cm	m2	10.45	m2	10.45	
2.2	Loading & Freight of Soil	m3	17.60			Distance of transport: 10km
2.2.1	Depth: 25-27cm	m3	17.60	m2	4.60	
2.2.2	Depth: 35-40cm	m3	17.60	m2	7.15	
2.3	Works of Lower Subbase					
2.3.1	Broken Stone (t=40cm)	m3	59.13	m2	23.65	Sub total of 2.3.1-2.3.4
2.3.2	Mixed Gravel & Rubble (t=10cm)	m3	49.50	m2	4.95	Mix ratio: 20%
2.3.3	Mixed Gravel (t=10cm)	m3	55.00	m2	5.50	
2.3.4	Mixed Gravel (t=15cm)	m3	60.50	m2	8.25	
3.	Works of Edge Stone & Side Ditch				46.20	Sub total of 3.1-3.3
3.1	Edge Stone Placing	ml	22.00	ml	22.00	Especification: Public work
3.2	Removal & Replacing of Edge Stone	ml	11.00	ml	11.00	
3.3	Conctruction of Side Ditch	m3	231.00	ml	24.20	Width: 45cm, t=10-15cm
4.	Works of Permeable Pavement			m2	67.45	Sub total of 4.1-4.5
4.1	Upper Subbase/Size Controlled Gravel	m3	66.00	m2	12.10	t=15cm
4.2	Layer of asphalt emulsion (waterproof)	m2	3.08	m2	3.10	
4.3	BaseLayer/Normal Asphalt(PMQ)	m3	341.00	m2	26.40	t=7cm
4.4	Layer of asphalt emulsion (adheisive)	m2	1.65	m2	1.65	
4.5	Sueface Layer/Pervious Asphalt(CPA)	m3	435.60	m2	24.20	t=5cm
B	Works of Drainage					
1.1	Pervious Trench (50cm x 50cm)				58.85	Sub total of 1.1.1-1.1.3
1.1.1	Mechanical Escavation	m3	6.60	ml	1.65	
1.1.2	Loading & Freight of Soil	m3	17.60	ml	4.40	Distance of transport: 10km
1.1.3	Grading & Compacting of Bottom	m2	1.10	ml	0.55	
1.1.4	Placing of Perforated Drain Pipe	ml	24.20	ml	24.20	PVC Φ=150mm
1.1.5	Filling up of Gravel	ml	28.05	ml	28.05	No. 3 Gravel
1.1.6	Placing of Rainwater Drain Pipe for Connection inaside of Housing Lot	Unit	110.00	Unit	110.00	PVC Φ=10cm
1.2	Pervious Well (Φ=70cm)				50.60	Sub total of 1.2.1-1.2.3
1.2.1	Mechanical Escavation	ml	26.40	ml	26.40	
1.2.2	Loading & Freight of Soil	m3	17.60	ml	4.40	Distance of transport: 10km
1.2.3	Filling up of Gravel & Broken Stone	m3	55.00	ml	19.80	Broken stone + Gravel No. 3
C	Works of Stormwater Drainage					
1.1	Drain Hole & Drain Box	Unit	715.00	Unit	715.00	
1.2	Placing of PC Drain Pipe					
1.2.1	PC Pipe (Φ=500mm)	ml	418.00	ml	418.00	
1.2.2	PC Pipe (Φ=800mm)	ml	693.00	ml	693.00	
1.3	Drain Manhole					
1.3.1	Manhole: 1,4m x 1,4m x1,4m	Unit	#######	Unit	#######	
1.3.2	Manhole: 1,6m x 1,6m x1,6m	Unit	#######	Unit	#######	
D	Works of Walkway				33.90	Sub total of 1.1-1.3
1.	Demolition, Loading & Freight of Existing Materials	m3	35.20	m2	5.85	
1.1	Grading & Compacting	m2	1.65	m2	1.65	
1.2	Concrete Pavement	m2	30.80	m2	18.70	Uniform finishing, T=7cm
1.3	Walkway Turf	m2	7.70	m2	7.70	Esmeralda species

Notes Unit Price (R$): Habitual ; habitual use unit in Brazil

Unit Price (R$): for Study; unit for JICA Study

ANNEX 23.5.2

Annex A23.5.2 Detailed Dimensions & Components of Actual Streets & Proposed Streets at Work Lot-1

No.	Name of Residential Area & Street	Actual Dimensions					Proposed Dimensions													
		Road Width (m)					Transversal Section (m)			Pavement					Sidewalk (m)		Stormwater Drainage			
		Road	Walk-way	Total Width	Extention (m)	Notes	Width of Bed	Width of Side Ditch	Total Width	Width of Side Ditch (m)	Width of Paving (m)	Exten. of Lower Sub-base(m)	No. of Lateral Ditch	No. of Inclin-ation	Width of Concr-ete (m)	Width of Turf (m)	Drain hole & Box (unit)	PC Drain Pipe (m)	Manh-ole (unit)	Pipe/ PVC (unit)
1	Núcleo Santa Cruz																			
1.1	Rua 5 (Total)				710.00	Sit. Variavel Lar.Variavel														
1.1.1	Rua 5 (começo.)	9.80	0.00	9.80	650.00	S. Pavimento	8.00	1.80	9.80	1.20	6.80	300.00	2	2	1.20	0.60	6	30.00	0	
1.1.2	Rua 5 (término)	8.00	3.50	11.50	60.00	C. Pavimento C. Guia e Sar.	8.00	3.50	11.50	1.20	6.80	0.00	2	2	1.20	2.30	4	50.00	0	
1.2	Rua 1 (Total)				1,085.00	Sit. Variavel Lar.Variavel														
1.2.1	Rua 1 (Dir./começo)	7.00	3.50	10.50	200.00	C. Pavimento	7.00	3.50	10.50	1.20	5.80	0.00	1	1	1.20	2.30	2	20.00	1	
1.2.2	Rua 1 (Dir./meio)	6.10	3.50	9.60	115.00	C. Pavimento	6.10	3.50	9.60	1.20	4.90	0.00	1	1	1.20	2.30	2	160.00	2	
1.2.3	Rua 1 (Dir./término)	8.60	0.00	8.60	185.00	C. Pavimento	6.10	2.50	8.60	1.20	4.90	0.00	1	1	1.20	1.30	0	0.00	0	
1.2.4	Rua 1 (Esq./começo)	7.00	4.20	11.20	130.00	C. Pavimento	7.00	4.20	11.20	1.20	5.80	0.00	2	2	1.20	3.00	2	17.00	1	
1.2.5	Rua 1 (Esq./meio)	6.00	3.70	9.70	190.00	Lar. Variavel S. Pavimento	6.10	3.60	9.70	1.20	4.90	0.00	1	1	1.20	2.40	3	180.00	1	
1.2.6	Rua 1 (Esq./meio)	8.80	0.00	8.80	35.00	Lar. Variavel S. Pavimento	6.10	2.70	8.80	1.20	4.90	0.00	1	1	1.20	1.50	1	9.00	0	
1.2.7	Rua 1 (Esq./meio)	6.30	0.00	6.30	170.00	Lar. Estreito S. Pavimento	4.80	1.50	6.30	1.20	3.60	0.00	1	1	1.20	0.30	1	7.00	0	
1.2.8	Rua 1 (Esq./término)	6.30	0.00	6.30	60.00	Lar. Estreito S. Pavimento	4.80	1.50	6.30	1.20	3.60	0.00	1	1	1.20	0.30	1	9.00	0	
1.3	Rua 2 (Total)	7.10	4.10	11.20	70.00	C. B. de Lôbo C. Pavimento	7.00	4.20	11.20	1.20	5.80	0.00	2	2	1.20	3.00	2	15.00	0	
1.4	Rua 4 (Total)	7.00	4.10	11.10	65.00	C. B. de Lôbo S. Pavimento	7.00	4.10	11.10	1.20	5.80	0.00	2	2	1.20	2.90	2	15.00	0	
1.5	Rua 3 (Total)				580.00	Sit. Variavel														
1.5.1	Rua 3 (Dir./começo)	7.00	3.60	10.60	200.00	Lar. Variavel S. Pavimento	7.00	3.60	10.60	1.20	5.80	0.00	2	2	1.20	2.40	0	0.00	0	
1.5.2	Rua 3 (Dir./término)	9.20	0.00	9.20	280.00	S. Pavimento	7.00	2.20	9.20	1.20	5.80	0.00	2	2	1.20	1.00	0	120.00	1	
1.5.3	Rua 3 (Esq./término)	8.00	0.00	8.00	100.00	S. Pavimento	6.10	1.90	8.00	1.20	4.90	0.00	1	1	1.20	0.70	1	15.00	0	

(Obs) ; (a) P. de Visita: Poço de Visita, (b) Dir.: Lado direita, (c) Esq.: Lado esquerda, (d) C.: Com, (e) S.: Sem, (f) Sit.: Situação, (g) Lar.: Largura, (h) Av.: Avenida, (i) R.: Rua, (j) V.: Viela

No.	Name of Residential Area & Street	Actual Dimensions: Road Width (m): Road	Actual Dimensions: Road Width (m): Walk-way	Actual Dimensions: Road Width (m): Total Width	Actual Dimensions: Extention (m)	Actual Dimensions: Notes	Proposed Dimensions: Transversal Section (m): Width of Bed	Proposed Dimensions: Transversal Section (m): Width of Side Ditch	Proposed Dimensions: Transversal Section (m): Total Width	Proposed Dimensions: Pavement: Width of Side Ditch (m)	Proposed Dimensions: Pavement: Width of Paving (m)	Proposed Dimensions: Pavement: Exten. of Lower Sub-base(m)	Proposed Dimensions: Pavement: No. of Lateral Ditch	Proposed Dimensions: Pavement: No. of Inclin-ation	Proposed Dimensions: Sidewalk (m): Width of Concr-ete (m)	Proposed Dimensions: Sidewalk (m): Width of Turf (m)	Proposed Dimensions: Stormwater Drainage: Drain hole & Box (unit)	Proposed Dimensions: Stormwater Drainage: PC Drain Pipe (m)	Proposed Dimensions: Stormwater Drainage: Manh-ole (unit)	Proposed Dimensions: Stormwater Drainage: Pipe/ PVC (unit)
1.6	Rua 6 (Total)	9.60	0.00	9.60	560.00	S. Pavimento	7.00	2.60	9.60	1.20	5.80	0.00	1	1	1.20	1.40	0	60.00	1	
1.7	Rua 7 (Total)	7.00	3.10	10.10	85.00	S. Pavimento	7.00	3.10	10.10	1.20	5.80	0.00	2	2	1.20	1.90	0	0.00	0	
1.8	Viela 3 (Total)	8.00	0.00	8.00	65.00	S. Pavimento	5.00	3.00	8.00	1.20	3.80	0.00	1	1	1.20	1.80	2	40.00	1	
1.9	Rua s. Saida	6.80	0.00	6.80	45.00	S. Pavimento	5.00	1.80	6.80	1.20	3.80	0.00	1	1	1.20	0.60	1	30.00	0	
1.10	Est. Rio Acima (Total)				1,060.00	Sit. Variavel Lar.Variavel														
1.10.1	Est. R. Acima (término)	10.50	0.00	10.50	100.00	S. Pavimento	8.00	2.50	10.50	1.20	6.90	0.00	2	2	1.20	1.30	2	11.00	0	
1.10.2	Est. R. Acima (meio)	13.00	0.00	13.00	420.00	S. Pavimento	8.00	5.00	13.00	1.20	6.90	0.00	2	2	1.20	3.80	2	13.00	0	
1.10.3	Est. R. Acima (começo)	12.00	0.00	12.00	540.00	S. Pavimento	8.00	4.00	12.00	1.20	6.90	100.00	2	2	1.20	2.80	2	12.00	0	
	Sub Total				4,325.00												36	813.00	8	1,207
2	Sub-Latera II (Núcleo João de Barro Parte)																			
2.1	Av. João de Barro (Total)				440.00	Sit. Variavel Lar.Variavel														
2.1.1	Av. João de Barro (começo)	8.30	4.20	12.50	75.00	C. Pavimento C. Guia e Sar.	8.30	4.20	12.50	1.20	7.20	90.00	2	2	1.20	3.00	4	100.00	1	
2.1.2	Av. João de Barro (meio)	10.60	0.00	10.60	305.00	S. Pavimento	8.00	2.60	10.60	1.20	6.90	0.00	2	2	1.20	1.40	20	310.00	6	
2.1.3	Av. João de Barro (término)	8.40	0.00	8.40	60.00	S. Pavimento.	7.00	1.40	8.40	1.20	5.90	65.00	2	2	1.20	0.20	2	30.00	1	
2.2	R. dos Tang-aras (Total)				250.00	Lar.Variavel														
2.2.1	R. dos Tang-aras (Dir.)	10.50	0.00	10.50	85.00		7.00	3.50	10.50	1.20	5.90	0.00	2	2	1.20	2.30	0	0.00	0	
2.2.2	R. dos Tang-aras (Esq.)	10.50	0.00	10.50	115.00		7.00	3.50	10.50	1.20	5.90	0.00	2	2	1.20	2.30	0	0.00	0	
2.2.3	R. dos Tang-aras (Esq./ter.)	9.80	0.00	9.80	50.00	Lar. Estreito	7.00	2.80	9.80	1.20	5.90	0.00	2	2	1.20	1.60	0	0.00	0	
2.4	R. Siriema (Total)	9.80	0.00	9.80	57.00	Lar. Estreito	7.00	2.80	9.80	1.20	5.90	0.00	2	2	1.20	1.60	0	0.00	0	
2.3	Rua 2 (Total)	9.80	0.00	9.80	36.00	Lar. Estreito	7.00	2.80	9.80	1.20	5.90	0.00	2	2	1.20	1.60	0	0.00	0	

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No.	Name of Residential Area & Street	Actual Dimensions					Proposed Dimensions													
		Road Width (m)			Extention (m)	Notes	Transversal Section (m)			Pavement					Sidewalk (m)		Stormwater Drainage			
		Road	Walk-way	Total Width			Width of Bed	Width of Side Ditch	Total Width	Width of Side Ditch (m)	Width of Paving (m)	Exten. of Lower Sub-base(m)	No. of Lateral Ditch	No. of Inclin-ation	Width of Concr-ete (m)	Width of Turf (m)	Drain hole & Box (unit)	PC Drain Pipe (m)	Manh-ole (unit)	Pipe/ PVC (unit)
2.5	R. Tucano (Total)	8.80	0.00	8.80	44.00	Lar. Estreito	7.00	1.80	8.80	1.20	5.90	0.00	2	2	1.20	0.60	0	0.00	0	
2.6	R. Albaroz (Total)	9.80	0.00	9.80	107.00	Lar. Estreito	7.00	2.80	9.80	1.20	5.90	0.00	2	2	1.20	1.60	0	0.00	0	
2.7	R. Andorinhas (Total.)				296.00	Lar. Estreito														
2.7.1	R. Andorinhas (Dir.)	9.60	0.00	9.60	94.00	Lar. Estreito	7.00	2.60	9.60	1.20	5.90	0.00	2	2	1.20	1.40	0	0.00	0	
2.7.2	R. Andorinhas (Esq.)	8.40	0.00	8.40	202.00	Lar. Estreito	7.00	1.40	8.40	1.20	5.90	0.00	2	2	1.20	0.20	0	0.00	0	
2.8	R. Flamingo (Total)	8.40	0.00	8.40	85.00	Lar. Estreito	7.00	1.40	8.40	1.20	5.90	0.00	2	2	1.20	0.20	0	0.00	0	
2.9	R. Beija-Flor (Total)				84.00	Lar. Estreito														
2.9.1	R. Beija-Flor (começo)	10.40	0.00	10.40	50.00		7.00	3.40	10.40	1.20	5.90	0.00	2	2	1.20	2.20	2	11.00	0	
2.9.2	R. Beija-Flor (término)	8.40	0.00	8.40	34.00	Lar. Estreito	7.00	1.40	8.40	1.20	5.90	0.00	2	2	1.20	0.20	0	0.00	0	
2.10	R. Canarios (Total.)				436.00	Lar. Estreito														
2.10.1	R. Canarios (Dir.)	9.10	0.00	9.10	94.00	Lar. Estreito	7.00	2.10	9.10	1.20	5.90	0.00	2	2	1.20	0.90	0	0.00	0	
2.10.2	R. Canarios (Esq.)	9.10	0.00	9.10	342.00	Lar. Estreito	7.00	2.10	9.10	1.20	5.90	0.00	2	2	1.20	0.90	2	9.00	0	
2.11	R. Cardeal (Total.)				422.00	Lar. Estreito														
2.11.1	R. Cardeal (Dir.)	9.60	0.00	9.60	94.00	Lar. Estreito	7.00	2.60	9.60	1.20	5.90	0.00	2	2	1.20	1.40	0	0.00	0	
2.11.2	R. Cardeal (Esq.)	9.60	0.00	9.60	328.00	Lar. Estreito	7.00	2.60	9.60	1.20	5.90	0.00	2	2	1.20	1.40	0	0.00	0	
2.12	R. Bem-Te-Vi (Total.)	8.50	0.00	8.50	255.00	Lar. Estreito	8.00	0.50	8.50	1.20	6.90	0.00	2	2	0.50	0.00	2	9.00	0	
2.12.1	R. Bem-Te-Vi (Dir.)	8.50	0.00	8.50	94.00	C. Retrno de Onibus	8.00	0.50	8.50	1.20	6.90	0.00	2	2	0.50	0.00	2	9.00	0	
2.12.2	R. Bem-Te-Vi (Esq.)	8.50	0.00	8.50	161.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
2.13	R. Ave do Paraiso (Tot.)				248.00	Lar. Estreito														

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No.	Name of Residential Area & Street	Actual Dimensions: Road Width (m): Road	Walk-way	Total Width	Extention (m)	Notes	Proposed Dimensions: Transversal Section (m): Width of Bed	Width of Side Ditch	Total Width	Pavement: Width of Side Ditch (m)	Width of Paving (m)	Exten. of Lower Sub-base(m)	No. of Lateral Ditch	No. of Inclin-ation	Sidewalk (m): Width of Concr-ete (m)	Width of Turf (m)	Stormwater Drainage: Drain hole & Box (unit)	PC Drain Pipe (m)	Manh-ole (unit)	Pipe/ PVC (unit)
2.13.1	R. Ave do Paraiso (Dir.)	9.20	0.00	9.20	92.00	Lar. Estreito	7.00	2.20	9.20	1.20	5.90	0.00	2	2	1.20	1.00	0	0.00	0	
2.13.2	R. Ave do Paraiso (Esq.)	8.50	0.00	8.50	156.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
2.14	R. Garças (Total)	6.30	0.00	6.30	304.00	Lar. Estreito	4.80	1.50	6.30	1.20	3.60	0.00	1	1	0.60	0.90	3	15.00	0	
2.15	R. Ema (Total)	8.50	0.00	8.50	206.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
2.16	R. Falcão (Total)	8.50	0.00	8.50	118.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
2.17	R. Aguia (Total)	8.50	0.00	8.50	206.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
2.18	R. Pavão (Total)	8.50	0.00	8.50	88.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
2.19	R. Planalto (Total)	9.20	0.00	9.20	123.00	Lar. Estreito	7.00	2.20	9.20	1.20	5.90	0.00	2	2	1.20	1.00	0	0.00	0	
	Sub Total				3,805.00												35	484.00	8	3,086
3	Pq. Ideal																			
3.1	R. das Paineiras (Total)	7.10	2.80	9.90	425.00	S. Pavimento	7.00	2.90	9.90	1.20	5.90	0.00	2	2	1.20	1.70	4	220.00	2	
3.2	R. dos Cedros (Total)	7.10	2.80	9.90	470.00	S. Pavimento	7.00	2.90	9.90	1.20	5.90	0.00	2	2	1.20	1.70	4	290.00	2	
3.3	R. Dois (Total)	7.20	3.00	10.20	55.00	S. Pavimento	7.00	3.20	10.20	1.20	5.90	0.00	2	2	1.20	2.00	0	0.00	0	
3.4	R. Três (Total)	8.50	0.00	8.50	70.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
3.5	R. Quatro (Total)	8.50	0.00	8.50	70.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
3.6	Est. dos Alvarengas	8.00	6.00	14.00	500.00	Re-Pavimento	8.00	6.00	14.00	1.20	6.90	400.00	2	2	3.00	3.00	6	42.00	2	
	Sub Total				1,590.00												14	552.00	6	706
4	Jd. Serro Azul																			
4.1	R. Um (Total)	8.50	0.00	8.50	194.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
4.2	R. Dois (Total)	8.50	0.00	8.50	194.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
4.3	R. Três (Total)	8.50	0.00	8.50	84.00	Lar. Estreito	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
4.4	R. Serro Azul (Parte)	12.00	0.00	12.00	152.00	S. Pavimento	7.00	5.00	12.00	1.20	5.90	0.00	2	2	1.20	3.80	2	12.00	0	
	Sub Total				624.00												2	12.00	0	278
5	Capelinha																			
5.1	R. Um (Total)	8.50	0.00	8.50	490.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	6	27.00	0	
5.2	R. Dois (Total)	8.50	0.00	8.50	420.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	2	96.00	0	
5.3	R. Três (Total)	8.50	0.00	8.50	250.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	2	30.00	0	
5.4	R. Quatro (Total)	8.50	0.00	8.50	155.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
5.5	R. Cinco (Total)	8.50	0.00	8.50	170.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	2	10.00	0	
5.6	R. Seis (Total)	8.50	0.00	8.50	455.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	2	10.00	0	

(Obs) : (a) P. de Visita: Poço de Visita, (b) Dir.: Lado direita, (c) Esq.: Lado esquerda, (d) C.: Com, (e) S.: Sem, (f) Sit.: Situação, (g) Lar.: Largura, (h) Av.: Avenida, (i) R.: Rua, (j) V.: Viela

No.	Name of Residential Area & Street	Actual Dimensions					Proposed Dimensions													
		Road Width (m)			Extention (m)	Notes	Transversal Section (m)			Pavement					Sidewalk (m)		Stormwater Drainage			
		Road	Walk-way	Total Width			Width of Bed	Width of Side Ditch	Total Width	Width of Side Ditch (m)	Width of Paving (m)	Exten. of Lower Sub-base(m)	No. of Lateral Ditch	No. of Inclin-ation	Width of Concr-ete (m)	Width of Turf (m)	Drain hole & Box (unit)	PC Drain Pipe (m)	Manh-ole (unit)	Pipe/ PVC (unit)
5.7	R. Sete (Total)	8.50	0.00	8.50	80.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
5.8	R. Oito (Total)	8.50	0.00	8.50	40.00	S. Pavimento	7.00	1.50	8.50	1.20	5.90	0.00	2	2	1.20	0.30	0	0.00	0	
5.9	V. Um (Total)	4.00	0.00	4.00	100.00	S. Pavimento	0.00	4.00	4.00	0.00	0.00	0.00	1	1	2.00	2.00	0	0.00	0	
5.10	V. Dois (Total)	4.00	0.00	4.00	75.00	S. Pavimento	0.00	4.00	4.00	0.00	0.00	0.00	1	1	2.00	2.00	0	0.00	0	
5.11	V. Três (Total)	4.00	0.00	4.00	150.00	S. Pavimento	0.00	4.00	4.00	0.00	0.00	0.00	1	1	2.00	2.00	0	0.00	0	
	Sub Total				2,385.00												14	173.00	0	916
	Total de Lot 4				12,739.90												101	2,034.00	22	6,250

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ANNEX 24.5.1

Material Anexo A24.5.1 Parque Linear Custo (A)

	Servico		Unid	Quant.	Custo Uni	Custo Total
1.Servicos preliminares e gerais			Vb	0		0
2.Infra estrutura	2.1Terabalhos em terra	2.1.1Demolicoes	m^3			
		2.1.2Limpeza remocao cobert. Vegetal	m^2	1,000	0.9	900
		2.1.3Escavacoes carga e movimentacao	m^3	1,500	10.78	16,170
		2.1.4Nivelamento geometrico	m^2	1,000	3.00	3,000
		2.1.5Compactacao de de terra movimentada	m^3	900	5.00	4,500
		2.1.6Regul. E compactacao de rua	m^2	540	1.35	729
		2.1.7Ref. De sub-base melhor. c/10% brita	m^3	108	8.5	918
		2.1.8Terra preparada p/plantio e=0,15m	m^3	69	75.00	5,175
						0
	2.2Fundacoes e outros servicos	2.2.1Escoramento do terreno vizinho				0
		2.2.2Reb. Lencol freatico/drenagem				0
		2.2.3Fundacoes profundas				0
		2.2.4Fundacoes superificiais	Vb	1	1,500.00	1,500
		2.2.5Enrococamento de pedras em talude				0
		2.2.6Gabiao, fornecimento e colocacao				0
		Custo total do item				32,892
3.Supraetru	3.1Concreto armado		m^3	0		0
	3.2Pre-moldados		m^2	0		0
4.Paredes e paineis				0		0
5.Coberturas e protecoes				0		0
6.Revestimentos				0		0
7.Pavimentacao	7.1Madeira		m^2	0		0
	7.2Ceramica		m^2	0		0
	7.3Carpete		m^2	0		0
	7.4Cimentado	Guia, fornecimento e assentamento	m^2		23.00	0
	7.5Rodapes soleiras e peitoris		m^2	0		0
	7.6Pavimentad	Piso estampado	m^2		25.00	0
		Custo total do item				0
8.Eletricas e Telefonicas			Vb		900.00	0
9.Compleme	Outros	Jardins grama Sao carlos	m^2	400	6.00	2,400
		Arvores / arbusto	unid		150.00	0
		Bancos para jardim	unid		350.00	0
		Custo total do item				2,400
Custo Total da Construcao						35,292

35.29 R$/m2
45.88 R$/m2(税込み)

Material Anexo A24.5.1 Parque Linear Custo (A&B)

	Servico		Unid	Quant.	Custo Uni	Custo Total
1.Servicos preliminares e gerais			Vb	0		0
2.Infra estrutura	2.1Terabalhos em terra	2.1.1Demolicoes	m³			
		2.1.2Limpeza remocao cobert. Vegetal	m²	1,000	0.9	900
		2.1.3Escavacoes carga e movimentacao	m³	1,500	10.78	16,170
		2.1.4Nivelamento geometrico	m²	1,000	3.00	3,000
		2.1.5Compactacao de de terra movimentada	m³	900	5.00	4,500
		2.1.6Regul. E compactacao de rua	m²	540	1.35	729
		2.1.7Ref. De sub-base melhor. c/10% brita	m³	108	8.5	918
		2.1.8Terra preparada p/plantio e=0,15m	m³	69	75.00	5,175
						0
	2.2Fundacoes e outros servicos	2.2.1Escoramento do terreno vizinho				0
		2.2.2Reb. Lencol freatico/drenagem				0
		2.2.3Fundacoes profundas				0
		2.2.4Fundacoes superificiais	Vb	1	1,500.00	1,500
		2.2.5Enrococamento de pedras em talude				0
		2.2.6Gabiao, fornecimento e colocacao				0
		Custo total do item				32,892
3.Supraetru	3.1Concreto armado		m³	0		0
	3.2Pre-moldados		m²	0		0
4.Paredes e paineis				0		0
5.Coberturas e protecoes				0		0
6.Revestimentos				0		0
7.Pavimentacao	7.1Madeira		m²	0		0
	7.2Ceramica		m²	0		0
	7.3Carpete		m²	0		0
	7.4Cimentado	Guia, fornecimento e assentamento	m²	200	23.00	4,600
	7.5Rodapes soleiras e peitoris		m²	0		0
	7.6Pavimentac	Piso estampado	m²	540	25.00	13,500
		Custo total do item				18,100
8.Eletricas e Telefonicas			Vb	5	900.00	4,500
9.Compleme	Outros	Jardins grama Sao carlos	m²	400	6.00	2,400
		Arvores / arbusto	unid	7	150.00	1,050
		Bancos para jardim	unid	5	350.00	1,750
		Custo total do item				5,200
Custo Total da Construcao						60,692

60.69 R$/m2
78.90 R$/m2(税込み)

ANNEX 29.1.1

Annex A 29. 1.1

Investment cost for the Environmental Centre

(R$)

	Building	Vehicle, ship, etc.	Lab. equipment	Lab. glass instrument	Lab. Reagents	Consulting fee	Total
Local portion	5,658,058	2,083,500	12,000	0	0	0	7,753,558
Foreign portion	0	0	410,420	5,624	22,574	573,452	1,012,070
Total	5,658,058	2,083,500	422,420	5,624	22,574	573,452	8,765,628
Percentage	65%	24%	5%	0%	0%	7%	100%

	Yeay	Investment cost						
		Building	Vehicle, ship, etc.	Lab. equipment	Lab. glass instrument	Lab. Reagents	Consulting fee	Total
		5,658,058	2,083,500	422,420	5,624	22,574	573,452	8,765,628
1	2006							
2	2007							
3	2008						143,363	143,363
4	2009						143,363	143,363
5	2010	2,829,029					143,363	2,972,392
6	2011	2,829,029	2,083,500	422,420	5,624	22,574	143,363	5,506,510

Annex A 29. 1.2

Investment cost for permeable pavement

(R$)

	Year	Investment cost					
		Lot 1	Lot 2	Lot 3	Total of construction cost	Consulting fee	Total
		12,311,619	5,196,928	8,370,770	25,879,317	1,811,552	27,690,869
1	2006						
2	2007						
3	2008						
4	2009						
5	2010					362,310	362,310
6	2011					362,310	362,310
7	2012	4,103,873	1,732,309	2,790,257	8,626,439	362,310	8,988,750
8	2013	4,103,873	1,732,309	2,790,257	8,626,439	362,310	8,988,750
9	2014	4,103,873	1,732,309	2,790,257	8,626,439	362,310	8,988,750
10	2015						
11	2016						
12	2017						
13	2018						
14	2019						
15	2020						
16	2021						
17	2022						
18	2023						
19	2024						
20	2025						
21	2026						
22	2027						
23	2028						
24	2029						
25	2030						
26	2031						
27	2032						
28	2033						

Annex A 29. 1.3

Investment cost for remediation of the former Alvarenga solid waste dumping site

(R$)

	Year	Investment cost				
		Preparatory works	Civil works	Total Of construction cost	Consulting fee	Total
		3,574,635	8,390,340	11,964,975	837,548	12,802,523
		28%	66%	93%	7%	100%
1	2006					
2	2007					
3	2008				167,510	167,510
4	2009				167,510	167,510
5	2010	893,659	2,097,585	2,991,244	167,510	3,158,754
6	2011	1,787,318	4,195,170	5,982,488	167,510	6,149,998
7	2012	893,659	2,097,585	2,991,244	167,510	3,158,754
8	2013					
9	2014					
10	2015					
11	2016					
12	2017					
13	2018					
14	2019					
15	2020					
16	2021					
17	2022					
18	2023					
19	2024					
20	2025					
21	2026					
22	2027					
23	2028					
24	2029					
25	2030					
26	2031					
27	2032					
28	2033					

Annex A 29. 1.4

Investment cost for installation of a pilot plant for lake purification using aquatic plants

(R$)

	Year	Investment cost		
		Construction cost	Consulting fee	Total
		665,000	46,550	711,550
		93%	7%	100%
1	2006			
2	2007			
3	2008		15,517	15,517
4	2009		15,517	15,517
5	2010	665,000	15,517	680,517
6	2011			
7	2012			
8	2013			
9	2014			
10	2015			
11	2016			
12	2017			
13	2018			
14	2019			
15	2020			
16	2021			
17	2022			
18	2023			
19	2024			
20	2025			
21	2026			
22	2027			
23	2028			
24	2029			
25	2030			
26	2031			
27	2032			
28	2033			

Annex A 29. 1.5

Investment cost for construction of the Alvarenga Park

(R$)

	Year	Investment cost			
		construction cost	Consulting fee	Land acquisition cost	Total
		1,168,454	81,792	1,691,792	2,942,038
		40%	3%	58%	100%
1	2006				
2	2007				
3	2008				
4	2009				
5	2010			1,691,792	1,691,792
6	2011		40,896		40,896
7	2012	1,168,454	40,896		40,896
8	2013				
9	2014				
10	2015				
11	2016				
12	2017				
13	2018				
14	2019				
15	2020				
16	2021				
17	2022				
18	2023				
19	2024				
20	2025				
21	2026				
22	2027				
23	2028				
24	2029				
25	2030				
26	2031				
27	2032				
28	2033				

Annex A 29. 1.6

Annual O&M cost for the Environmental Centre

(R$)

	Year	O&M cost							
		Basic charge for power	Demand charge for power	Fuel	Personnel	Lab. Maintenance	Water charge	Wastewater charge	Total
1	2006								
2	2007								
3	2008								
4	2009								
5	2010								
6	2011								
7	2012	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
8	2013	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
9	2014	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
10	2015	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
11	2016	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
12	2017	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
13	2018	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
14	2019	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
15	2020	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
16	2021	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
17	2022	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
18	2023	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
19	2024	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
20	2025	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
21	2026	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
22	2027	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
23	2028	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
24	2029	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
25	2030	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
26	2031	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
27	2032	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374
28	2033	5,970	14,520	109,500	1,242,000	1,410	3,942	2,032	1,379,374

Annex A 29. 1.7

Annual O&M cost for permeable pavement

(R$)

	Year	O&M cost			
		Lot 1	Lot 2	Lot 3	Total
1	2006				
2	2007				
3	2008				
4	2009				
5	2010				
6	2011				
7	2012				
8	2013				
9	2014				
10	2015	1,180	428	690	2,298
11	2016	1,180	428	690	2,298
12	2017	1,180	428	690	2,298
13	2018	1,180	428	690	2,298
14	2019	1,180	428	690	2,298
15	2020	1,180	428	690	2,298
16	2021	1,180	428	690	2,298
17	2022	1,180	428	690	2,298
18	2023	1,180	428	690	2,298
19	2024	1,180	428	690	2,298
20	2025	1,180	428	690	2,298
21	2026	1,180	428	690	2,298
22	2027	1,180	428	690	2,298
23	2028	1,180	428	690	2,298
24	2029	1,180	428	690	2,298
25	2030	1,180	428	690	2,298
26	2031	1,180	428	690	2,298
27	2032	1,180	428	690	2,298
28	2033	1,180	428	690	2,298

Annex A 29. 1.8

Annual O&M cost for remediation of the former Alvarenga solid waste dumping site

(R$)

	Year	O&M cost						
		Basi charge for power	Demand charge for power	Fuel	Personnel	Transportation	Expense for leachate	Total
		597	1,452	10,950	82,800	19,467	12,614	127,880
		0.5%	1.1%	8.6%	64.7%	15.2%	9.9%	100.0%
1	2006							
2	2007							
3	2008							
4	2009							
5	2010							
6	2011							
7	2012							
8	2013	597	1,452	10,950	82,800	19,467	12,614	127,880
9	2014	597	1,452	10,950	82,800	19,467	12,614	127,880
10	2015	597	1,452	10,950	82,800	19,467	12,614	127,880
11	2016	597	1,452	10,950	82,800	19,467	12,614	127,880
12	2017	597	1,452	10,950	82,800	19,467	12,614	127,880
13	2018	597	1,452	10,950	82,800	19,467	12,614	127,880
14	2019	597	1,452	10,950	82,800	19,467	12,614	127,880
15	2020	597	1,452	10,950	82,800	19,467	12,614	127,880
16	2021	597	1,452	10,950	82,800	19,467	12,614	127,880
17	2022	597	1,452	10,950	82,800	19,467	12,614	127,880
18	2023	597	1,452	10,950	82,800	19,467	12,614	127,880
19	2024	597	1,452	10,950	82,800	19,467	12,614	127,880
20	2025	597	1,452	10,950	82,800	19,467	12,614	127,880
21	2026	597	1,452	10,950	82,800	19,467	12,614	127,880
22	2027	597	1,452	10,950	82,800	19,467	12,614	127,880
23	2028	597	1,452	10,950	82,800	19,467	12,614	127,880
24	2029	597	1,452	10,950	82,800	19,467	12,614	127,880
25	2030	597	1,452	10,950	82,800	19,467	12,614	127,880
26	2031	597	1,452	10,950	82,800	19,467	12,614	127,880
27	2032	597	1,452	10,950	82,800	19,467	12,614	127,880
28	2033	597	1,452	10,950	82,800	19,467	12,614	127,880

Annex A 29. 1.9

Annual O&M cost for installation of a pilot plant for lake purification using aquatic plants

(R$)

	Year	O&M cost			
		Fuel	Personnel	Tranportation	Total
		10,950	82,800	4,160	93,750
		12%	88%	4%	100%
1	2006				
2	2007				
3	2008				
4	2009				
5	2010				
6	2011	10,950	82,800	4,160	97,910
7	2012	10,950	82,800	4,160	97,910
8	2013	10,950	82,800	4,160	97,910
9	2014	10,950	82,800	4,160	97,910
10	2015	10,950	82,800	4,160	97,910
11	2016	10,950	82,800	4,160	97,910
12	2017	10,950	82,800	4,160	97,910
13	2018	10,950	82,800	4,160	97,910
14	2019	10,950	82,800	4,160	97,910
15	2020	10,950	82,800	4,160	97,910
16	2021	10,950	82,800	4,160	97,910
17	2022	10,950	82,800	4,160	97,910
18	2023	10,950	82,800	4,160	97,910
19	2024	10,950	82,800	4,160	97,910
20	2025	10,950	82,800	4,160	97,910
21	2026	10,950	82,800	4,160	97,910
22	2027	10,950	82,800	4,160	97,910
23	2028	10,950	82,800	4,160	97,910
24	2029	10,950	82,800	4,160	97,910
25	2030	10,950	82,800	4,160	97,910
26	2031	10,950	82,800	4,160	97,910
27	2032	10,950	82,800	4,160	97,910
28	2033	10,950	82,800	4,160	97,910

Annex A 29. 1.10

Annual O&M cost for construction of the Alvarenga Park

(R$)

	Year	O&M cost	
		Personnel	Total
		11,040	11,040
1	2006		
2	2007		
3	2008		
4	2009		
5	2010		
6	2011		
7	2012		
8	2013	11,040	11,040
9	2014	11,040	11,040
10	2015	11,040	11,040
11	2016	11,040	11,040
12	2017	11,040	11,040
13	2018	11,040	11,040
14	2019	11,040	11,040
15	2020	11,040	11,040
16	2021	11,040	11,040
17	2022	11,040	11,040
18	2023	11,040	11,040
19	2024	11,040	11,040
20	2025	11,040	11,040
21	2026	11,040	11,040
22	2027	11,040	11,040
23	2028	11,040	11,040
24	2029	11,040	11,040
25	2030	11,040	11,040
26	2031	11,040	11,040
27	2032	11,040	11,040
28	2033	11,040	11,040

Annex A 29. 1.11

Financial Analysis of income alternative E for the Environmental Centre

		A	B	C=AxB	D	E	F=DxE	G	G=C+F+G	C+F	H
	Year	Entrance Visitors	Entrance Admission	Entrance Receipt	Seminar Participants	Seminar Admission	Seminar Receipt	Others Receipt	Total	Case B	Case C
		(人)	(R$)	(R$)	(人)	(R$)	(R$)	(R$)	(R$)	(R$)	(R$)
1	2006										
2	2007										
3	2008										
4	2009										
5	2010										
6	2011										
7	2012	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
8	2013	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
9	2014	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
10	2015	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
11	2016	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
12	2017	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
13	2018	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
14	2019	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
15	2020	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
16	2021	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
17	2022	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
18	2023	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
19	2024	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
20	2025	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
21	2026	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
22	2027	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
23	2028	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
24	2029	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
25	2030	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
26	2031	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
27	2032	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000
28	2033	33,800	5	169,000	2,500	30	75,000	1,300,000	1,544,000	244,000	1,544,000

Annex A 29. 2.1

Investment cost for sewerage construction in the urban areas

(1000R$)

	Year	Investment cost					
		Total	Lote 1	Lote 2	Lote 3	Land acquisition	Consuting fee
		124,625	54,571	21,660	37,215	1,272	9,907
		100%	44%	17%	30%	1%	8%
1	2006	0					
2	2007	0					
3	2008	0					
4	2009	3,706				1,272	2,434
5	2010	12,327	10,742				1,585
6	2011	26,198	21,484	3,610			1,104
7	2012	44,178	22,345	7,220	12,405		2,208
8	2013	21,097		7,220	12,405		1,472
9	2014	17,119		3,610	12,405		1,104
10	2015	0					
11	2016	0					
12	2017	0					
13	2018	0					
14	2019	0					
15	2020	0					
16	2021	0					
17	2022	0					
18	2023	0					
19	2024	0					-
20	2025	0					
		124,625	54,571	21,660	37,215	1,272	9,907
			113,446				

Annex A 29. 2.2

Investment cost for sewerage construction in the isolated communities

(R$)

	Investment cost										
	Total	Santa Cruz					Riacho Grande				
		Sub-total	Consulting fee	STP	Pipeline	Land acquisition	Sub-total	Consulting fee	STP	Pipeline	Land acquisition
Local portion	15,871,244	3,392,511	0	2,146,867	1,029,644	216,000	12,478,733	0	8,536,674	3,942,059	0
Foreign portion	6,880,910	1,563,086	310,067	1,253,019	0	0	5,317,824	1,164,261	4,153,563	0	0
Total	22,752,154	4,955,597	310,067	3,399,886	1,029,644	216,000	17,796,557	1,164,261	12,690,236	3,942,059	0
	100%	22%	1%	15%	5%	1%	78%	5%	56%	17%	0%

(R$)

		Total	Santa Cruz					Riacho Grande				
			Sub-total	Consulting fee	STP	Pipeline	Land acquisition	Sub-total	Consulting fee	STP	Pipeline	Land acquisition
	Year											
1	2006											
2	2007											
3	2008	294,866	62,013	62,013				232,852	232,852			
4	2009	294,866	62,013	62,013				232,852	232,852			
5	2010	7,248,151	1,471,200	62,013	849,972	343,215	216,000	5,776,950	232,852	4,230,079	1,314,020	
6	2011	7,882,122	2,105,171	62,013	1,699,943	343,215		5,776,950	232,852	4,230,079	1,314,020	
7	2012	7,032,151	1,255,200	62,013	849,972	343,215		5,776,950	232,852	4,230,079	1,314,020	

Annex A 29. 2.3

Annual O&M cost for sewerage construction in the urban areas

O&M cost						
Total	Power	O&M expenses	No. of households	No. of households connected to a system	Parcentage of Corrected	O&M expenses
(1000R$)	(1000R$)	(1000R$)	(household)	(household)	(%)	(1000R$)
1,009	369	640	19,948	13,929	70%	304
1,015	375	640	20,135	13,929	69%	313
2,813	1,067	1,746	34,300	13,929	41%	1,671
2,827	1,081	1,746	34,539	13,929	40%	1,687
2,842	1,096	1,746	34,778	13,929	40%	1,704
2,857	1,111	1,746	35,017	13,929	40%	1,721
2,872	1,126	1,746	35,256	13,929	40%	1,737
2,886	1,140	1,746	35,494	13,929	39%	1,753
2,901	1,155	1,746	35,691	13,929	39%	1,769
2,916	1,170	1,746	35,887	13,929	39%	1,784
2,930	1,184	1,746	36,084	13,929	39%	1,799
2,945	1,199	1,746	36,281	13,929	38%	1,814
2,960	1,214	1,746	36,477	13,929	38%	1,830

Annex A 29. 2.4

Annual O&M cost for sewerage construction in the isolated communities

	Year	O&M cost																	
			Santa cruz								Riacho Grande								
		Total	Sub-total	Basic charge for power	Demand charge for power	Chemicals	Chlorine	Transportation	Equipment	Personnel	Sub-total	Basic charge for power	Demand charge for power	Chemicals	Chemicals	Chlorine	Transportation	Personnel	Equipment
1	2006																		
2	2007																		
3	2008																		
4	2009																		
5	2010																		
6	2011																		
7	2012																		
8	2013	821,677	223,701	5,266	24,735	3,954	350	33,097	73,500	82,800	597,976	19,737	115,115	16,892	58,653	3,209	98,213	165,600	120,556
9	2014	830,370	225,057	5,266	25,274	4,040	358	33,820	73,500	82,800	605,313	19,737	118,007	17,316	60,126	3,290	100,680	165,600	120,556
10	2015	837,128	225,920	5,266	25,618	4,095	363	34,279	73,500	82,800	611,208	19,737	120,330	17,657	61,310	3,355	102,662	165,600	120,556
11	2016	845,625	227,276	5,266	26,158	4,181	370	35,002	73,500	82,800	618,348	19,737	123,144	18,070	62,744	3,433	105,063	165,600	120,556
12	2017	853,728	228,633	5,266	26,698	4,268	378	35,724	73,500	82,800	625,095	19,737	125,803	18,460	64,099	3,507	107,332	165,600	120,556
13	2018	859,234	229,619	5,266	27,090	4,330	384	36,249	73,500	82,800	629,615	19,737	127,585	18,722	65,006	3,557	108,852	165,600	120,556
14	2019	866,944	230,975	5,266	27,630	4,417	391	36,972	73,500	82,800	635,969	19,737	130,089	19,089	66,282	3,627	110,988	165,600	120,556
15	2020	872,057	231,961	5,266	28,023	4,479	397	37,497	73,500	82,800	640,096	19,737	131,715	19,328	67,111	3,672	112,376	165,600	120,556
16	2021	879,832	233,317	5,266	28,563	4,566	404	38,220	73,500	82,800	646,515	19,737	134,245	19,699	68,400	3,743	114,534	165,600	120,556
17	2022	887,797	234,797	5,266	29,151	4,660	413	39,008	73,500	82,800	653,000	19,737	136,801	20,074	69,702	3,814	116,715	165,600	120,556
18	2023	895,703	236,153	5,266	29,691	4,746	420	39,730	73,500	82,800	659,550	19,737	139,383	20,453	71,017	3,886	118,918	165,600	120,556
19	2024	903,733	237,632	5,266	30,280	4,840	429	40,518	73,500	82,800	666,101	19,737	141,965	20,832	72,333	3,958	121,120	165,600	120,556
20	2025	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
21	2026	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
22	2027	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
23	2028	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
24	2029	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
25	2030	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
26	2031	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
27	2032	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556
28	2033	907,559	238,249	5,266	30,526	4,880	432	40,846	73,500	82,800	669,310	19,737	143,230	21,018	72,977	3,993	122,199	165,600	120,556

Annex A 29. 2.5

Benefit analysis for sewerage construction in the urban areas

	Year	A	B	C	D	E	F	F*	G	H	I	J	K	L
		Basin population	Design population	Per capita wastewater flow	Wastewater flow	Per HH personnel	Degn no. of HH	Degn no. of HH connected to	Per HH wastewater flow	Tariff class applied	Per HH wastewater charge	Annual billing ammount	Collection rate	Income
		(prs.)	(prs.)	(m3/capita/day)	(million m3/yr)	(prs./HH)	(HH)	(HH)	(m3/month)	(R$/month)	(R$/month)	(1000R$/yr)	(%)	(1000R$/yr)
0	**2005**	156,222	-	0.128										
1	2006	158,327	-	0.130										
2	2007	160,432	-	0.131										
3	2008	162,537	-	0.133										
4	2009	164,642	-	0.134										
5	**2010**	166,749	-	0.136										
6	2011	168,385	-	0.138										
7	2012	170,021	-	0.139										
8	2013	171,657	101,737	0.141	14,348.79	5.1	19,948	6,019	21.58	Rank 21to50	25.0	5,992	65	3,895
9	2014	173,293	102,689	0.143	14,659.73	5.1	20,135	6,206	21.84	Rank 21to50	25.7	6,220	65	4,043
10	**2015**	174,932	174,932	0.144	25,190.21	5.1	34,300	20,371	22.03	Rank 21to50	26.3	10,807	70	7,565
11	2016	176,150	176,150	0.146	25,675.03	5.1	34,539	20,610	22.30	Rank 21to50	27.0	11,183	70	7,828
12	2017	177,368	177,368	0.148	26,167.93	5.1	34,778	20,849	22.57	Rank 21to50	27.7	11,567	70	8,097
13	2018	178,586	178,586	0.149	26,669.03	5.1	35,017	21,088	22.85	Rank 21to50	28.5	11,959	70	8,371
14	2019	179,804	179,804	0.151	27,178.47	5.1	35,256	21,327	23.13	Rank 21to50	29.2	12,359	70	8,651
15	**2020**	181,020	181,020	0.152	27,515.04	5.1	35,494	21,565	23.26	Rank 21to50	29.6	12,591	75	9,443
16	2021	182,023	182,023	0.154	28,005.00	5.1	35,691	21,762	23.54	Rank 21to50	30.3	12,989	75	9,742
17	2022	183,026	183,026	0.156	28,502.83	5.1	35,887	21,958	23.83	Rank 21to50	31.1	13,394	75	10,046
18	2023	184,029	184,029	0.158	29,008.63	5.1	36,084	22,155	24.12	Rank 21to50	31.9	13,807	75	10,356
19	2024	185,032	185,032	0.160	29,522.53	5.1	36,281	22,352	24.41	Rank 21to50	32.7	14,229	75	10,671
20	**2025**	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
21	2026	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
22	2027	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
23	2028	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
24	2029	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
25	2030	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
26	2031	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
27	2032	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790
28	2033	186,031	186,031	0.160	29,764.96	5.1	36,477	22,548	24.48	Rank 21to50	32.9	14,386	75	10,790

Annex A 29. 2.6

Benefit analysis for sewerage construction in the isolated communities

		A	B	C	D	E	F	F*	G	H	I	J	K	L
	Year	Basin population	Design population	Per capita wastewater flow	Wastewater flow	Per HH personnel	Degn no. of HH	Degn no. of HH connected to	Per HH wastewater flow	Tariff class applied	Per HH wastewater charge	Annual billing ammount	Collection rate	Income
		(prs.)	(prs.)	(m3/capita/day)	(million m3/yr)	(prs./HH)	(HH)	(HH)	(m3/month)	(R$/month)	(R$/month)	(1000R$/yr)	(%)	(1000R$/yr)
0	2005	3,239	28,902	32,141	0.128									
1	2006	3,289	29,242	32,531	0.130									
2	2007	3,339	29,582	32,921	0.131									
3	2008	3,389	29,922	33,311	0.133									
4	2009	3,439	30,262	33,701	0.134									
5	2010	3,498	30,602	34,100	0.136									
6	2011	3,523	30,942	34,465	0.138									
7	2012	3,548	31,282	34,830	0.139									
8	2013	3,573	31,622	35,195	0.141	4,964	5.1	6,901	21.58	Rank 21to50	25.0	2,073	65	1,347
9	2014	3,598	31,962	35,560	0.143	5,076	5.1	6,973	21.84	Rank 21to50	25.7	2,154	65	1,400
10	2015	3,628	32,369	35,997	0.144	5,184	5.1	7,058	22.03	Rank 21to50	26.3	2,224	70	1,557
11	2016	3,653	32,669	36,322	0.146	5,294	5.1	7,122	22.30	Rank 21to50	27.0	2,306	70	1,614
12	2017	3,678	32,929	36,607	0.148	5,401	5.1	7,178	22.57	Rank 21to50	27.7	2,387	70	1,671
13	2018	3,703	33,169	36,872	0.149	5,506	5.1	7,230	22.85	Rank 21to50	28.5	2,469	70	1,728
14	2019	3,728	33,369	37,097	0.151	5,607	5.1	7,274	23.13	Rank 21to50	29.2	2,550	70	1,785
15	2020	3,757	33,569	37,326	0.152	5,674	5.1	7,319	23.26	Rank 21to50	29.6	2,596	75	1,947
16	2021	3,782	33,769	37,551	0.154	5,777	5.1	7,363	23.54	Rank 21to50	30.3	2,680	75	2,010
17	2022	3,807	33,969	37,776	0.156	5,883	5.1	7,407	23.83	Rank 21to50	31.1	2,765	75	2,073
18	2023	3,832	34,169	38,001	0.158	5,990	5.1	7,451	24.12	Rank 21to50	31.9	2,851	75	2,138
19	2024	3,857	34,369	38,226	0.160	6,099	5.1	7,495	24.41	Rank 21to50	32.7	2,939	75	2,205
20	2025	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
21	2026	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
22	2027	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
23	2028	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
24	2029	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
25	2030	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
26	2031	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
27	2032	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236
28	2033	3,886	34,673	38,559	0.160	6,169	5.1	7,561	24.48	Rank 21to50	32.9	2,982	75	2,236

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