APPENDIX H: SEWERAGE / DRAINAGE PLANNING

APPENDIX H.1 PLANNING POPULATION

H.1 PLANNING POPULATION

Population in Adminisration Area

CU	ID	ADM_QRT	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Residential Type
1	0	Green Belt	108.7	0	0	0	0	
1	1	Plateau I	221.5	6,281	6,516	6,461	6,470	Modern Quartiers
1	2	Ambassades	121.0	1,467	1,424	1,412	1,414	Modern Quartiers
1	3	IFAN	47.3	0	0	0	0	Public Domain
1	4	Poste	10.4	0	0	0	0	Public Domain
1	5	National Hospital	39.1	0	0	0	0	Public Domain
1	6	Kombo	4.0	1,554	1,481	1,353	1,161	Peripherial Quartiers 2
1	7	Casernes	23.2	0	0	0	0	Public Domain
1	8	Zongo	19.9	3,661	3,905	4,454	4,848	Traditional Quartiers
1	9	Maourey	15.2	3,581	3,721	3,838	3,991	Traditional Quartiers
1	10	Gandacthe	13.2	5,252	4,933	4,506	3,867	Traditional Quartiers
1	11	Deizebon	19.1	7,406	7,104	6,489	5,569	Traditional Quartiers
1	12	Gounrty Yena	60.5	0	0	0	0	Public Domain
1	13	Ecole Aviation Civile	30.3	0	0	0	0	Public Domain
1	14	Lycee Kasai	33.9	0	0	0	0	Public Domain
1	15	Boukoki I	40.9	7,141	8,021	7,954	7,965	Peripherial Quartiers 1
1	16	Boukoki II	46.7	9,497	9,149	9,073	9,085	Peripherial Quartiers 1
1	17	Boukoki III	34.5	6,710	6,771	6,714	6,723	Peripherial Quartiers 1
1	18	Boukoki IV	98.9	17,585	19,405	19,243	19,269	Peripherial Quartiers 1
1	19	Stadium	41.3	0	0	0	0	Public Domain
1	20	Plateau II	302.7	26,725	26,711	26,488	26,523	Modern Quartiers
1	21	Yantala	59.0	22,478	21,396	20,644	20,098	Urban Villages
1	22	SNE	28.7	0	0	0	0	Public Domain
1	23	Goudel	83.5	14,116	14,733	16,235	16,256	Urban Villages
1	24	Kouara Kano	167.5	3,128	3,284	3,256	3,261	Modern Quartiers
1	25	Ext. Kouara Kano	89.1	4,656	4,370	4,334	4,340	Modern Quartiers
1	26	Courronne Nord	58.4	7,332	8,584	10,214	11,364	Peripherial Quartiers 2
1	27	Kouara Me	147.2	15,912	20,203	21,466	25,793	Peripherial Quartiers 2
1	28	Dar Es Salam	286.0	23,395	33,648	38,929	50,118	Peripherial Quartiers 2
1	29	ORTN	68.4	0	0	0	0	Public Domain
1	30	Yantala Haut	170.0	21,208	20,831	20,658	20,685	Modern Quartiers
1	31	Bani Fandou I	104.4	17,152	20,474	20,304	20,331	Peripherial Quartiers 2
1	32	Cite CNSS	18.5	2,166	2,720	2,697	2,701	Peripherial Quartiers 2
1	33	Bani Fandou II	121.2	16,871	19,011	21,209	23,598	Peripherial Quartiers 2
1	34	Hopital Lazaret	37.5	0	0	0	0	Public Domain
1	35	Lazaret	153.3	29,911	30,071	29,821	29,860	Peripherial Quartiers 1
1	36	Banizoumbou II	119.6	6,809	11,724	13,952	20,955	Peripherial Quartiers 2
1	37	Baghdad	164.0	8,812	16,079	22,324	28,740	Peripherial Quartiers 2
1	38	Cimetiere	55.2	0	0	0	0	Public Domain
1	39	OPVN	25.5	0	0	0	0	Public Domain
1	40	Faisceau	17.4	0	0	0	0	Public Domain
1	41	Kouara Tegui	155.2	19,948	19,780	21,125	22,664	Spontaneous Quartiers
1	42	Nord Lazaret	140.0	3,389	8,235	10,889	16,356	New Quartiers
1	43	Taiwan	87.2	1,242	4,276	6,784	8,492	New Quartiers
1	44	Bobiel	90.5	1,289	4,439	7,043	9,697	New Quartiers
1	45	Ouest Faisceau 1	76.6	1,091	3,753	5,212	8,200	New Quartiers
1	46	Ouest Faisceau 2	156.4	2,227	7,667	10,645	15,227	New Quartiers
1	47	Nord Faisceau	104.6	1,489	5,127	8,136	10,184	New Quartiers
1	48	SONUCI	60.6	863	2,973	4,717	5,904	New Quartiers
1	49	Koura Kano Nord	81.9	1,166	4,015	6,371	8,773	New Quartiers
1	50	Ext. Kouara Kano Nord	132.8	1,891	6,510	9,038	11,635	New Quartiers
1	51	Ext. Kouara Tegui	153.7	2,188	7,534	11,954	14,962	New Quartiers
1	52	ZAC	435.0	1,239	4,265	8,460	21,177	Planned Area
1	101	Outlying Villages	0.0	4,870	0	0	0	
1	104	Koubia	0.0	1,107	0	0	0	
Sub-total (Commune 1)			4,981.2	334,805	404,843	454,402	528,256	

Population in Adminisration Area

CU	ID	ADM_QRT	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Residential Type
2	0	Green Belt	341.6	0	0	0	0	
2	0	Green Belt	217.1	0	0	0	0	
2	0	Green Belt	86.9	0	0	0	0	
2	0	Green Belt	228.7	0	0	0	0	
2	0	Green Belt	244.4	0	0	0	0	
2	53	Terminus	75.4	3,941	3,916	3,884	3,889	Modern Quartiers
2	54	Niamey Bas	61.8	1,176	1,212	1,202	1,203	Modern Quartiers
2	55	Grand Marche	6.9	0	0	0	0	Public Domain
2	56	Kalley Centre	8.2	1,561	1,604	1,591	1,593	Traditional Quartiers
2	57	Kalley Est	49.2	10,881	11,096	11,482	11,976	Traditional Quartiers
2	58	Kalley Sud	34.7	6,725	6,813	7,432	8,118	Traditional Quartiers
2	59	Lacouroussou	16.4	4,125	4,171	4,136	4,142	Traditional Quartiers
2	60	Banizoumbou I	23.9	4,988	5,157	5,346	5,820	Traditional Quartiers
2	61	Abidjan	36.9	7,026	7,237	7,896	8,625	Traditional Quartiers
2	62	Sabongari	63.6	10,974	12,467	14,218	15,475	Traditional Quartiers
2	63	Nouveau Marche	48.8	8,355	9,575	10,920	11,885	Traditional Quartiers
2	64	Cimetiere Musulman	22.7	0	0	0	0	Public Domain
2	65	SMB	30.3	0	0	0	0	Public Domain
2	66	Caserne Bagagiya	34.6	0	0	0	0	Public Domain
2	67	Ecole de Police	46.9	0	0	0	0	Public Domain
2	68	Caserne Garba Hassane	51.5	0	0	0	0	Public Domain
2	69	Cite Faycal	29.5	1,708	1,738	1,724	1,726	Modern Quartiers
2	70	Poudriere	185.7	13,055	12,745	12,639	12,656	Modern Quartiers
2	71	Mosquee	36.7	0	0	0	0	Public Domain
2	72	Madina	110.4	17,074	19,486	20,397	21,499	Peripherial Quartiers 2
2	73	Route de Filingue	206.9	27,485	30,425	36,206	40,283	Peripherial Quartiers 2
2	74	Ext. Route de Flingue	161.7	19,014	23,782	28,301	31,487	Peripherial Quartiers 2
2	75	Gamkalle Sabanguye	67.2	13,437	13,179	13,070	13,087	Urban Villages
2	76	Gamkalle Golleye	37.9	7,033	7,438	7,376	7,386	Urban Villages
2	77	Hippodrome	60.0	0	0	0	0	Public Domain
2	78	Zone Industriel	304.1	465	0	0	0	Public Domain
2	79	Talladje	164.4	27,826	32,232	31,964	32,006	Peripherial Quartiers 1
2	80	Ext. Talladje	123.9	1,764	6,072	9,636	12,061	New Quartiers
2	81	Saga	145.7	13,711	14,283	15,580	17,020	Urban Villages
2	82	Ext. Saga	103.7	2,251	4,068	5,043	6,059	Peripherial Quartiers 2
2	83	Airport	661.6	0	0	0	0	Public Domain
2	84	Aviation 1	319.6	16,982	18,801	21,752	23,337	Peripherial Quartiers 2
2	85	Aviation 2	309.6	7,947	9,106	12,040	15,070	New Quartiers
2	86	Sari-Koubou	450.0	1,282	4,412	19,690	26,289	Planned Area
2	102	Outlying Villages	0	5,681	0	0	0	
2	105	Pays Bas	0	2,717	0	0	0	
Sub-total (Commune 2)			5,209.1	239,184	261,015	303,525	332,692	
3	87	Lamorde	53.2	5,718	6,263	7,245	8,292	Urban Villages
3	88	Nogare	34.9	4,024	4,109	4,755	5,441	Urban Villages
3	89	Agrhymet	135.1	0	0	0	0	Public Domain
3	90	University	186.6	0	0	0	0	Public Domain
3	91	Karadje	160.4	18,771	23,585	28,066	31,226	Peripherial Quartiers 2
3	92	Pont Kennedy	37.3	5,361	5,481	6,523	7,257	Peripherial Quartiers 2
3	93	Gawaye	44.5	5,646	6,547	7,792	8,668	Peripherial Quartiers 2
3	94	Kirkissoye	25.6	4,612	5,031	4,987	4,999	Urban Villages
3	95	Ext. Kirkissoye	135.3	16,383	19,901	23,683	26,349	Peripherial Quartiers 2
3	96	Banga Bana	208.2	14,866	20,417	30,368	40,544	Peripherial Quartiers 2
3	103	Outlying Villages	0.0	3,031	0	0	0	
Sub-total (Commune 3)			1,021.1	78,412	91,334	113,419	132,776	
Total			11,211.4	652,401	757,192	871,346	993,724	

Population in Sewerage Planning Area

CU	ID	ADM_QRT	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Residential Type
1	1	Plateau I	221.5	6,281	6,516	6,461	6,470	Modern Quartiers
1	2	Ambassades	121.0	1,467	1,424	1,412	1,414	Modern Quartiers
1	3	IFAN	47.3	0	0	0	0	Public Domain
1	4	Poste	10.4	0	0	0	0	Public Domain
1	5	National Hospital	39.1	0	0	0	0	Public Domain
1	6	Kombo	4.0	1,554	1,481	1,353	1,161	Peripherial Quartiers 2
1	7	Casernes	23.2	0	0	0	0	Public Domain
1	8	Zongo	19.9	3,661	3,905	4,454	4,848	Traditional Quartiers
1	9	Maourey	15.2	3,581	3,721	3,838	3,991	Traditional Quartiers
1	10	Gandacthe	13.2	5,252	4,933	4,506	3,867	Traditional Quartiers
1	11	Deizebon	19.1	7,406	7,104	6,489	5,569	Traditional Quartiers
1	12	Gounrty Yena	60.5	0	0	0	0	Public Domain
1	13	Ecole Aviation Civile	30.3	0	0	0	0	Public Domain
1	14	Lycee Kasai	33.9	0	0	0	0	Public Domain
1	15	Boukoki I	40.9	7,141	8,021	7,954	7,965	Peripherial Quartiers 1
1	16	Boukoki II	46.7	9,497	9,149	9,073	9,085	Peripherial Quartiers 1
1	17	Boukoki III	34.5	6,710	6,771	6,714	6,723	Peripherial Quartiers 1
1	18	Boukoki IV	98.9	17,585	19,405	19,243	19,269	Peripherial Quartiers 1
1	19	Stadium	41.3	0	0	0	0	Public Domain
1	20	Plateau II	302.7	26,725	26,711	26,488	26,523	Modern Quartiers
1	21	Yantala	59.0	22,478	21,396	20,644	20,098	Urban Villages
1	22	SNE	28.7	0	0	0	0	Public Domain
1	23	Goudel	83.5	14,116	14,733	16,235	16,256	Urban Villages
1	24	Kouara Kano	167.5	3,128	3,284	3,256	3,261	Modern Quartiers
1	25	Ext. Kouara Kano	89.1	4,656	4,370	4,334	4,340	Modern Quartiers
1	26	Courronne Nord	58.4	7,332	8,584	10,214	11,364	Peripherial Quartiers 2
1	27	Kouara Me	147.2	15,912	20,203	21,466	25,793	Peripherial Quartiers 2
1	28	Dar Es Salam	286.0	23,395	33,648	38,929	50,118	Peripherial Quartiers 2
1	29	ORTN	68.4	0	0	0	0	Public Domain
1	30	Yantala Haut	170.0	21,208	20,831	20,658	20,685	Modern Quartiers
1	31	Bani Fandou I	104.4	17,152	20,474	20,304	20,331	Peripherial Quartiers 2
1	32	Cite CNSS	18.5	2,166	2,720	2,697	2,701	Peripherial Quartiers 2
1	33	Bani Fandou II	121.2	16,871	19,011	21,209	23,598	Peripherial Quartiers 2
1	34	Hopital Lazaret	37.5	0	0	0	0	Public Domain
1	35	Lazaret	153.3	29,911	30,071	29,821	29,860	Peripherial Quartiers 1
1	36	Banizoumbou II	119.6	6,809	11,724	13,952	20,955	Peripherial Quartiers 2
1	37	Baghdad	164.0	8,812	16,079	22,324	28,740	Peripherial Quartiers 2
1	38	Cimetiere	55.2	0	0	0	0	Public Domain
1	39	OPVN	25.5	0	0	0	0	Public Domain
1	40	Faisceau	17.4	0	0	0	0	Public Domain
1	48	SONUCI	60.6	863	2,973	4,717	5,904	New Quartiers
1	49	Koura Kano Nord	81.9	1,166	4,015	6,371	8,773	New Quartiers
Sub-total (Commune 1)			3,340.5	292,835	333,257	355,116	389,662	

Population in Sewerage Planning Area

CU	ID	ADM_QRT	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Residential Type
2	53	Terminus	75.4	3,941	3,916	3,884	3,889	Modern Quartiers
2	54	Niamey Bas	61.8	1,176	1,212	1,202	1,203	Modern Quartiers
2	55	Grand Marche	6.9	0	0	0	0	Public Domain
2	56	Kalley Centre	8.2	1,561	1,604	1,591	1,593	Traditional Quartiers
2	57	Kalley Est	49.2	10,881	11,096	11,482	11,976	Traditional Quartiers
2	58	Kalley Sud	34.7	6,725	6,813	7,432	8,118	Traditional Quartiers
2	59	Lacouroussou	16.4	4,125	4,171	4,136	4,142	Traditional Quartiers
2	60	Banizoumbou I	23.9	4,988	5,157	5,346	5,820	Traditional Quartiers
2	61	Abidjan	36.9	7,026	7,237	7,896	8,625	Traditional Quartiers
2	62	Sabongari	63.6	10,974	12,467	14,218	15,475	Traditional Quartiers
2	63	Nouveau Marche	48.8	8,355	9,575	10,920	11,885	Traditional Quartiers
2	64	Cimetiere Musulman	22.7	0	0	0	0	Public Domain
2	65	SMB	30.3	0	0	0	0	Public Domain
2	66	Caserne Bagagiya	34.6	0	0	0	0	Public Domain
2	67	Ecole de Police	46.9	0	0	0	0	Public Domain
2	68	Caserne Garba Hassane	51.5	0	0	0	0	Public Domain
2	69	Cite Faycal	29.5	1,708	1,738	1,724	1,726	Modern Quartiers
2	70	Poudriere	185.7	13,055	12,745	12,639	12,656	Modern Quartiers
2	71	Mosquee	36.7	0	0	0	0	Public Domain
2	72	Madina	110.4	17,074	19,486	20,397	21,499	Peripherial Quartiers 2
2	73	Route de Filingue	206.9	27,485	30,425	36,206	40,283	Peripherial Quartiers 2
2	74	Ext. Route de Flingue	161.7	19,014	23,782	28,301	31,487	Peripherial Quartiers 2
2	75	Gamkalle Sabanguye	67.2	13,437	13,179	13,070	13,087	Urban Villages
2	76	Gamkalle Golleye	37.9	7,033	7,438	7,376	7,386	Urban Villages
2	77	Hippodrome	60.0	0	0	0	0	Public Domain
2	78	Zone Industriel	304.1	465	0	0	0	Public Domain
2	79	Talladje	164.4	27,826	32,232	31,964	32,006	Peripherial Quartiers 1
2	83	Airport	661.6	0	0	0	0	Public Domain
2	84	Aviation 1	319.6	16,982	18,801	21,752	23,337	Peripherial Quartiers 2
2	85	Aviation 2	309.6	7,947	9,106	12,040	15,070	New Quartiers
Sub-total (Commune 2)			3,267.1	211,778	232,180	253,576	271,263	
3	87	Lamorde	53.2	5,718	6,263	7,245	8,292	Urban Villages
3	88	Nogare	34.9	4,024	4,109	4,755	5,441	Urban Villages
3	89	Agrhymet	135.1	0	0	0	0	Public Domain
3	90	University	186.6	0	0	0	0	Public Domain
3	91	Karadje	160.4	18,771	23,585	28,066	31,226	Peripherial Quartiers 2
3	92	Pont Kennedy	37.3	5,361	5,481	6,523	7,257	Peripherial Quartiers 2
3	93	Gawaye	44.5	5,646	6,547	7,792	8,668	Peripherial Quartiers 2
3	94	Kirkissoye	25.6	4,612	5,031	4,987	4,999	Urban Villages
3	95	Ext. Kirkissoye	135.3	16,383	19,901	23,683	26,349	Peripherial Quartiers 2
3	96	Banga Bana	208.2	14,866	20,417	30,368	40,544	Peripherial Quartiers 2
3	103	Outlying Villages	0.0	3,031	0	0	0	
Sub-total (Commune 3)			1,021.1	78,412	91,334	113,419	132,776	
Total			7,628.7	583,025	656,771	722,111	793,701	

Population in On-site System Area

CU	ID	ADM_QRT	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Residential Type
1	0	Green Belt	108.7	0	0	0	0	
1	41	Kouara Tegui	155.2	19,948	19,780	21,125	22,664	Spontaneous Quartiers
1	42	Nord Lazaret	140.0	3,389	8,235	10,889	16,356	New Quartiers
1	43	Taiwan	87.2	1,242	4,276	6,784	8,492	New Quartiers
1	44	Bobiel	90.5	1,289	4,439	7,043	9,697	New Quartiers
1	45	Ouest Faisceau 1	76.6	1,091	3,753	5,212	8,200	New Quartiers
1	46	Ouest Faisceau 2	156.4	2,227	7,667	10,645	15,227	New Quartiers
1	47	Nord Faisceau	104.6	1,489	5,127	8,136	10,184	New Quartiers
1	50	Ext. Kouara Kano Nord	132.8	1,891	6,510	9,038	11,635	New Quartiers
1	51	Ext. Kouara Tegui	153.7	2,188	7,534	11,954	14,962	New Quartiers
1	52	ZAC	435.0	1,239	4,265	8,460	21,177	Planned Area
1	101	Outlying Villages	0.0	4,870	0	0	0	
1	104	Koubia	0.0	1,107	0	0	0	
Sub-total (Commune 1)			1,640.7	41,970	71,586	99,286	138,594	
2	0	Green Belt	341.6	0	0	0	0	
2	0	Green Belt	217.1	0	0	0	0	
2	0	Green Belt	86.9	0	0	0	0	
2	0	Green Belt	228.7	0	0	0	0	
2	0	Green Belt	244.4	0	0	0	0	
2	80	Ext. Talladje	123.9	1,764	6,072	9,636	12,061	New Quartiers
2	81	Saga	145.7	13,711	14,283	15,580	17,020	Urban Villages
2	82	Ext. Saga	103.7	2,251	4,068	5,043	6,059	Peripherial Quartiers 2
2	86	Sari-Koubou	450.0	1,282	4,412	19,690	26,289	Planned Area
2	102	Outlying Villages	0	5,681	0	0	0	
2	105	Pays Bas	0	2,717	0	0	0	
Sub-total (Commune 2)			1,942.0	27,406	28,835	49,949	61,429	
Total			3,582.7	69,376	100,421	149,235	200,023	

APPENDIX H.2 DESIGN WASTEWATER FLOW

Domestic Wastwater

CU	ID	ADM_QRT	Area (ha)	Residential Type	Population (2000)	Population (2005)	Population (2010)	Population (2015)	lpcd (2000)	lpcd (2005)	lpcd (2010)	lpcd (2015)	Domestic Wastewater Flow(m3) (2000)	Domestic Wastewater Flow(m3)) (2005)	Domestic Wastewater Flow(m3) (2010)	Domestic Wastewater Flow(m3) (2015)
1	1	Plateau I	221.5	Modern Quartiers	6,281	6,516	6,461	6,470	50	50	50	50	314	326	323	324
1	2	Ambassades	121.0	Modern Quartiers	1,467	1,424	1,412	1,414	50	50	50	50	73	71	71	71
1	6	Kombo	4.0	Peripherial Quartiers 2	1,554	1,481	1,353	1,161	50	50	50	50	78	74	68	58
1	8	Zongo	19.9	Traditional Quartiers	3,661	3,905	4,454	4,848	50	50	50	50	183	195	223	242
1	9	Maourey	15.2	Traditional Quartiers	3,581	3,721	3,838	3,991	50	50	50	50	179	186	192	200
1	10	Gandacthe	13.2	Traditional Quartiers	5,252	4,933	4,506	3,867	50	50	50	50	263	247	225	193
1	11	Deizebon	19.1	Traditional Quartiers	7,406	7,104	6,489	5,569	50	50	50	50	370	355	324	278
1	15	Boukoki I	40.9	Peripherial Quartiers 1	7,141	8,021	7,954	7,965	50	50	50	50	357	401	398	398
1	16	Boukoki II	46.7	Peripherial Quartiers 1	9,497	9,149	9,073	9,085	50	50	50	50	475	457	454	454
1	17	Boukoki III	34.5	Peripherial Quartiers 1	6,710	6,771	6,714	6,723	50	50	50	50	336	339	336	336
1	18	Boukoki IV	98.9	Peripherial Quartiers 1	17,585	19,405	19,243	19,269	50	50	50	50	879	970	962	963
1	20	Plateau II	302.7	Modern Quartiers	26,725	26,711	26,488	26,523	50	50	50	50	1,336	1,336	1,324	1,326
1	21	Yantala	59.0	Urban Villages	22,478	21,396	20,644	20,098	50	50	50	50	1,124	1,070	1,032	1,005
1	23	Goudel	83.5	Urban Villages	14,116	14,733	16,235	16,256	50	50	50	50	706	737	812	813
1	24	Kouara Kano	167.5	Modern Quartiers	3,128	3,284	3,256	3,261	50	50	50	50	156	164	163	163
1	25	Ext. Kouara Kano	89.1	Modern Quartiers	4,656	4,370	4,334	4,340	50	50	50	50	233	219	217	217
1	26	Courronne Nord	58.4	Peripherial Quartiers 2	7,332	8,584	10,214	11,364	50	50	50	50	367	429	511	568
1	27	Kouara Me	147.2	Peripherial Quartiers 2	15,912	20,203	21,466	25,793	50	50	50	50	796	1,010	1,073	1,290
1	28	Dar Es Salam	286.0	Peripherial Quartiers 2	23,395	33,648	38,929	50,118	50	50	50	50	1,170	1,682	1,946	2,506
1	30	Yantala Haut	170.0	Modern Quartiers	21,208	20,831	20,658	20,685	50	50	50	50	1,060	1,042	1,033	1,034
1	31	Bani Fandou I	104.4	Peripherial Quartiers 2	17,152	20,474	20,304	20,331	50	50	50	50	858	1,024	1,015	1,017
1	32	Cite CNSS	18.5	Peripherial Quartiers 2	2,166	2,720	2,697	2,701	50	50	50	50	108	136	135	135
1	33	Bani Fandou II	121.2	Peripherial Quartiers 2	16,871	19,011	21,209	23,598	50	50	50	50	844	951	1,060	1,180
1	35	Lazaret	153.3	Peripherial Quartiers 1	29,911	30,071	29,821	29,860	50	50	50	50	1,496	1,504	1,491	1,493
1	36	Banizoumbou II	119.6	Peripherial Quartiers 2	6,809	11,724	13,952	20,955	50	50	50	50	340	586	698	1,048
1	37	Baghdad	164.0	Peripherial Quartiers 2	8,812	16,079	22,324	28,740	50	50	50	50	441	804	1,116	1,437
1	48	SONUCI	60.6	New Quartiers	863	2,973	4,717	5,904	50	50	50	50	43	149	236	295
1	49	Koura Kano Nord	81.9	New Quartiers	1,166	4,015	6,371	8,773	50	50	50	50	58	201	319	439
Sub-total (Commune 1)			2,821.8		292,835	333,257	355,116	389,662					14,643	16,665	17,757	19,483
2	53	Terminus	75.4	Modern Quartiers	3,941	3,916	3,884	3,889	50	50	50	50	197	196	194	194
2	54	Niamey Bas	61.8	Modern Quartiers	1,176	1,212	1,202	1,203	50	50	50	50	59	61	60	60
2	56	Kalley Centre	8.2	Traditional Quartiers	1,561	1,604	1,591	1,593	50	50	50	50	78	80	80	80
2	57	Kalley Est	49.2	Traditional Quartiers	10,881	11,096	11,482	11,976	50	50	50	50	544	555	574	599
2	58	Kalley Sud	34.7	Traditional Quartiers	6,725	6,813	7,432	8,118	50	50	50	50	336	341	372	406
2	59	Lacouroussou	16.4	Traditional Quartiers	4,125	4,171	4,136	4,142	50	50	50	50	206	209	207	207
2	60	Banizoumbou I	23.9	Traditional Quartiers	4,988	5,157	5,346	5,820	50	50	50	50	249	258	267	291
2	61	Abidjan	36.9	Traditional Quartiers	7,026	7,237	7,896	8,625	50	50	50	50	351	362	395	431
2	62	Sabongari	63.6	Traditional Quartiers	10,974	12,467	14,218	15,475	50	50	50	50	549	623	711	774
2	63	Nouveau Marche	48.8	Traditional Quartiers	8,355	9,575	10,920	11,885	50	50	50	50	418	479	546	594
2	69	Cite Faycal	29.5	Modern Quartiers	1,708	1,738	1,724	1,726	50	50	50	50	85	87	86	86
2	70	Poudriere	185.7	Modern Quartiers	13,055	12,745	12,639	12,656	50	50	50	50	653	637	632	633
2	72	Madina	110.4	Peripherial Quartiers 2	17,074	19,486	20,397	21,499	50	50	50	50	854	974	1,020	1,075
2	73	Route de Filingue	206.9	Peripherial Quartiers 2	27,485	30,425	36,206	40,283	50	50	50	50	1,374	1,521	1,810	2,014
2	74	Ext. Route de Flingue	161.7	Peripherial Quartiers 2	19,014	23,782	28,301	31,487	50	50	50	50	951	1,189	1,415	1,574
2	75	Gamkalle Sabanguye	67.2	Urban Villages	13,437	13,179	13,070	13,087	50	50	50	50	672	659	654	654
2	76	Gamkalle Golleye	37.9	Urban Villages	7,033	7,438	7,376	7,386	50	50	50	50	352	372	369	369
2	78	Zone Industriel	304.1	Public Domain	465	0	0	0	50	50	50	50	23	0	0	0
2	79	Talladje	164.4	Peripherial Quartiers 1	27,826	32,232	31,964	32,006	50	50	50	50	1,391	1,612	1,598	1,600
2	84	Aviation 1	319.6	Peripherial Quartiers 2	16,982	18,801	21,752	23,337	50	50	50	50	849	940	1,088	1,167
2	85	Aviation 2	309.6	New Quartiers	7,947	9,106	12,040	15,070	50	50	50	50	397	455	602	754
Sub-total (Commune 2)			2,011.8		211,778	232,180	253,576	271,263					10,588	11,610	12,680	13,562
3	87	Lamorde	53.2	Urban Villages	5,718	6,263	7,245	8,292	50	50	50	50	286	313	362	415
3	88	Nogare	34.9	Urban Villages	4,024	4,109	4,755	5,441	50	50	50	50	201	205	238	272
3	91	Karadje	160.4	Peripherial Quartiers 2	18,771	23,585	28,066	31,226	50	50	50	50	939	1,179	1,403	1,561
3	92	Pont Kennedy	37.3	Peripherial Quartiers 2	5,361	5,481	6,523	7,257	50	50	50	50	268	274	326	363
3	93	Gawaye	44.5	Peripherial Quartiers 2	5,646	6,547	7,792	8,668	50	50	50	50	282	327	390	433
3	94	Kirkissoye	25.6	Urban Villages	4,612	5,031	4,987	4,999	50	50	50	50	231	252	249	250
3	95	Ext. Kirkissoye	135.3	Peripherial Quartiers 2	16,383	19,901	23,683	26,349	50	50	50	50	819	995	1,184	1,317
3	96	Banga Bana	208.2	Peripherial Quartiers 2	14,866	20,417	30,368	40,544	50	50	50	50	743	1,021	1,518	2,027
3	103	Outlying Villages	0.0		3,031	0	0	0	50	50	50	50	152	0	0	0
Sub-total (Commune 3)			699.4		78,412	91,334	113,419	132,776					3,921	4,566	5,670	6,638
Total			5,533.0		583,025	656,771	722,111	793,701					29,152	32,841	36,107	39,683

H.2 DESIGN WASTEWATER FLOW

Industrial, Administration and Commerce Wastewater Flow

Item	2,000	2,005	2,010	2,015	Remarks
Domestic Wastewater Flow(m3/d)	29,152	32,841	36,107	39,683	
Industrial, Administration, Commerce Rate	43%	43%	43%	43%	30%/70%
Industrial,Administration,Commerce Wastewater Flow	12,535	14,122	15,526	17,064	
Annual Industrial Growth Rate	100%	109%	118%	129%	Annual Rate1.7%
Industrial Waste Water Flow	2,113	2,303	2,493	2,726	
Administration & Commerce Wastewater Flow	10,422	11,819	13,033	14,338	

Industrial Wastewater Flow

CU	ID	ADM_QRT	Area (ha)	Area Ratio(%)	Industrial Wastewater (2000)	Industrial Wastewater (2005)	Industrial Wastewater (2010)	Industrial Wastewater (2015)	Residential Type
2	78	Zone Industriel	304.1		2,113	2,303	2,493	2,726	2000.5(SNE)
Total			304.1		2,113	2,303	2,493	2,726	

Adiminstration and Commerce Wastewater Flow

CU	ID	ADM_QRT	Area (ha)	Area Ratio(%)	Administration/Commerce Water (2000)	Administration/Commerce Water (2005)	Administration/Commerce Water (2010)	Administration/Commerce Water (2015)	Residential Type
1	3	IFAN	47.3	3.8%	396	449	495	545	Public Domain
1	4	Poste	10.4	0.8%	83	95	104	115	Public Domain
1	5	National Hospital	39.1	3.1%	323	366	404	444	Public Domain
1	7	Casernes	23.2	1.8%	188	213	235	258	Public Domain
1	12	Gounrty Yena	60.5	4.8%	500	567	626	688	Public Domain
1	13	Ecole Aviation Civile	30.3	2.4%	250	284	313	344	Public Domain
1	14	Lycee Kasai	33.9	2.7%	281	319	352	387	Public Domain
1	19	Stadium	41.3	3.3%	344	390	430	473	Public Domain
1	22	SNE	28.7	2.3%	240	272	300	330	Public Domain
1	29	ORTN	68.4	5.4%	563	638	704	774	Public Domain
1	34	Hopital Lazaret	37.5	3.0%	313	355	391	430	Public Domain
1	38	Cimetiere	55.2	4.4%	459	520	573	631	Public Domain
1	39	OPVN	25.5	2.0%	208	236	261	287	Public Domain
1	40	Faisceau	17.4	1.4%	146	165	182	201	Public Domain
Sub-total (Commune 1)			518.7	41.2%	4,294	4,869	5,370	5,907	
2	55	Grand Marche	6.9	0.5%	52	59	65	72	Public Domain
2	64	Cimetiere Musulman	22.7	1.8%	188	213	235	258	Public Domain
2	65	SMB	30.3	2.4%	250	284	313	344	Public Domain
2	66	Caserne Bagagiya	34.6	2.8%	292	331	365	401	Public Domain
2	67	Ecole de Police	46.9	3.7%	386	437	482	531	Public Domain
2	68	Caserne Garba Hassane	51.5	4.1%	427	485	534	588	Public Domain
2	71	Mosquee	36.7	2.9%	302	343	378	416	Public Domain
2	77	Hippodrome	60.0	4.8%	500	567	626	688	Public Domain
2	83	Airport	126.5	10.1%	1,053	1,194	1,316	1,448	Public Domain
Sub-total (Commune 2)			416.1	33.1%	3,450	3,913	4,314	4,746	
3	89	Agrhymet	135.1	10.8%	1,126	1,276	1,408	1,549	Public Domain
3	90	University	186.6	14.9%	1,552	1,761	1,940	2,136	Public Domain
3	103	Outlying Villages	0.0	0.0%	0	0	0	0	
Sub-total (Commune 3)			321.7	25.7%	2,678	3,037	3,348	3,685	
Total			1,256.5	100.0%	10,422	11,819	13,032	14,338	

H.2 DESIGN WASTEWATER FLOW

Total Wastewater

CU	ID	ADM_QRT	Area (ha)	Wastewater Flow (2000)	Wastewater Flow (2005)	Wastewater Flow (2010)	Wastewater Flow (2015)	Residential Type
1	1	Plateau I	221.5	314	326	323	324	Modern Quartiers
1	2	Ambassades	121.0	73	71	71	71	Modern Quartiers
1	3	IFAN	47.3	396	449	495	545	Public Domain
1	4	Poste	10.4	83	95	104	115	Public Domain
1	5	National Hospital	39.1	323	366	404	444	Public Domain
1	6	Kombo	4.0	78	74	68	58	Peripherial Quartiers 2
1	7	Casernes	23.2	188	213	235	258	Public Domain
1	8	Zongo	19.9	183	195	223	242	Traditional Quartiers
1	9	Maourey	15.2	179	186	192	200	Traditional Quartiers
1	10	Gandacthe	13.2	263	247	225	193	Traditional Quartiers
1	11	Deizebon	19.1	370	355	324	278	Traditional Quartiers
1	12	Gounrty Yena	60.5	500	567	626	688	Public Domain
1	13	Ecole Aviation Civile	30.3	250	284	313	344	Public Domain
1	14	Lycee Kasai	33.9	281	319	352	387	Public Domain
1	15	Boukoki I	40.9	357	401	398	398	Peripherial Quartiers 1
1	16	Boukoki II	46.7	475	457	454	454	Peripherial Quartiers 1
1	17	Boukoki III	34.5	336	339	336	336	Peripherial Quartiers 1
1	18	Boukoki IV	98.9	879	970	962	963	Peripherial Quartiers 1
1	19	Stadium	41.3	344	390	430	473	Public Domain
1	20	Plateau II	302.7	1,336	1,336	1,324	1,326	Modern Quartiers
1	21	Yantala	59.0	1,124	1,070	1,032	1,005	Urban Villages
1	22	SNE	28.7	240	272	300	330	Public Domain
1	23	Goudel	83.5	706	737	812	813	Urban Villages
1	24	Kouara Kano	167.5	156	164	163	163	Modern Quartiers
1	25	Ext. Kouara Kano	89.1	233	219	217	217	Modern Quartiers
1	26	Courronne Nord	58.4	367	429	511	568	Peripherial Quartiers 2
1	27	Kouara Me	147.2	796	1,010	1,073	1,290	Peripherial Quartiers 2
1	28	Dar Es Salam	286.0	1,170	1,682	1,946	2,506	Peripherial Quartiers 2
1	29	ORTN	68.4	563	638	704	774	Public Domain
1	30	Yantala Haut	170.0	1,060	1,042	1,033	1,034	Modern Quartiers
1	31	Bani Fandou I	104.4	858	1,024	1,015	1,017	Peripherial Quartiers 2
1	32	Cite CNSS	18.5	108	136	135	135	Peripherial Quartiers 2
1	33	Bani Fandou II	121.2	844	951	1,060	1,180	Peripherial Quartiers 2
1	34	Hopital Lazaret	37.5	313	355	391	430	Public Domain
1	35	Lazaret	153.3	1,496	1,504	1,491	1,493	Peripherial Quartiers 1
1	36	Banizoumbou II	119.6	340	586	698	1,048	Peripherial Quartiers 2
1	37	Baghdad	164.0	441	804	1,116	1,437	Peripherial Quartiers 2
1	38	Cimetiere	55.2	459	520	573	631	Public Domain
1	39	OPVN	25.5	208	236	261	287	Public Domain
1	40	Faisceau	17.4	146	165	182	201	Public Domain
1	48	SONUCI	60.6	43	149	236	295	New Quartiers
1	49	Koura Kano Nord	81.9	58	201	319	439	New Quartiers
Sub-total (Commune 1)			3,340.5	18,937	21,534	23,127	25,390	

H.2 DESIGN WASTEWATER FLOW

CU	ID	ADM_QRT	Area (ha)	Wastewater Flow (2000)	Wastewater Flow (2005)	Wastewater Flow (2010)	Wastewater Flow (2015)	Residential Type
2	53	Terminus	75.4	197	196	194	194	Modern Quartiers
2	54	Niamey Bas	61.8	59	61	60	60	Modern Quartiers
2	55	Grand Marche	6.9	52	59	65	72	Public Domain
2	56	Kalley Centre	8.2	78	80	80	80	Traditional Quartiers
2	57	Kalley Est	49.2	544	555	574	599	Traditional Quartiers
2	58	Kalley Sud	34.7	336	341	372	406	Traditional Quartiers
2	59	Lacouroussou	16.4	206	209	207	207	Traditional Quartiers
2	60	Banizoumbou I	23.9	249	258	267	291	Traditional Quartiers
2	61	Abidjan	36.9	351	362	395	431	Traditional Quartiers
2	62	Sabongari	63.6	549	623	711	774	Traditional Quartiers
2	63	Nouveau Marche	48.8	418	479	546	594	Traditional Quartiers
2	64	Cimetiere Musulman	22.7	188	213	235	258	Public Domain
2	65	SMB	30.3	250	284	313	344	Public Domain
2	66	Caserne Bagagiya	34.6	292	331	365	401	Public Domain
2	67	Ecole de Police	46.9	386	437	482	531	Public Domain
2	68	Caserne Garba Hass	51.5	427	485	534	588	Public Domain
2	69	Cite Faycal	29.5	85	87	86	86	Modern Quartiers
2	70	Poudriere	185.7	653	637	632	633	Modern Quartiers
2	71	Mosquee	36.7	302	343	378	416	Public Domain
2	72	Madina	110.4	854	974	1,020	1,075	Peripherial Quartiers 2
2	73	Route de Filingue	206.9	1,374	1,521	1,810	2,014	Peripherial Quartiers 2
2	74	Ext. Route de Flingu	161.7	951	1,189	1,415	1,574	Peripherial Quartiers 2
2	75	Gamkalle Sabanguye	67.2	672	659	654	654	Urban Villages
2	76	Gamkalle Golleye	37.9	352	372	369	369	Urban Villages
2	77	Hippodrome	60.0	500	567	626	688	Public Domain
2	78	Zone Industriel	304.1	2,136	2,303	2,493	2,726	Public Domain
2	79	Talladje	164.4	1,391	1,612	1,598	1,600	Peripherial Quartiers 1
2	83	Airport	661.6	1,053	1,194	1,316	1,448	Public Domain
2	84	Aviation 1	319.6	849	940	1,088	1,167	Peripherial Quartiers 2
2	85	Aviation 2	309.6	397	455	602	754	New Quartiers
Sub-total (Commune 2)			3,267.1	16,151	17,826	19,487	21,034	
3	87	Lamorde	53.2	286	313	362	415	Urban Villages
3	88	Nogare	34.9	201	205	238	272	Urban Villages
3	89	Agrhymet	135.1	1,126	1,276	1,408	1,549	Public Domain
3	90	University	186.6	1,552	1,761	1,940	2,136	Public Domain
3	91	Karadje	160.4	939	1,179	1,403	1,561	Peripherial Quartiers 2
3	92	Pont Kennedy	37.3	268	274	326	363	Peripherial Quartiers 2
3	93	Gawaye	44.5	282	327	390	433	Peripherial Quartiers 2
3	94	Kirkissoye	25.6	231	252	249	250	Urban Villages
3	95	Ext. Kirkissoye	135.3	819	995	1,184	1,317	Peripherial Quartiers 2
3	96	Banga Bana	208.2	743	1,021	1,518	2,027	Peripherial Quartiers 2
3	103	Outlying Villages	0.0	152	0	0	0	
Sub-total (Commune 3)			1,021.1	6,599	7,603	9,018	10,323	
Total			7,628.7	41,687	46,963	51,632	56,747	

APPENDIX H.3 POLLUTANT LOAD

H.3 POLLUTANT LOAD

Pollutant Load of Domestic Wastewater

Planning Wastewater Quality COD = 360 (mg/l)
BOD = 150 (mg/l)
SS = 600 (mg/l)

Domestic Pollutant Load for Each Quartiers

CU	ID	ADM_QRT	Area (ha)	Residential Type	Domestic Wastewater Flow(m3/d) (2000)	Domestic Wastewater Flow(m3/d) (2005)	Domestic Wastewater Flow(m3/d) (2010)	Domestic Wastewater Flow(m3) (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
1	1	Plateau I	221.5	Modern Quartiers	314	326	323	324	113	117	116	117	47	49	48	49	188	196	194	194
1	2	Ambassades	121.0	Modern Quartiers	73	71	71	71	26	26	26	26	11	11	11	11	44	43	43	43
1	6	Kombo	4.0	Peripherial Quartiers 2	78	74	68	58	28	27	24	21	12	11	10	9	47	44	41	35
1	8	Zongo	19.9	Traditional Quartiers	183	195	223	242	66	70	80	87	27	29	33	36	110	117	134	145
1	9	Maourey	15.2	Traditional Quartiers	179	186	192	200	64	67	69	72	27	28	29	30	107	112	115	120
1	10	Gandacthe	13.2	Traditional Quartiers	263	247	225	193	95	89	81	69	39	37	34	29	158	148	135	116
1	11	Deizebon	19.1	Traditional Quartiers	370	355	324	278	133	128	117	100	56	53	49	42	222	213	194	167
1	15	Boukoki I	40.9	Peripherial Quartiers 1	357	401	398	398	129	144	143	143	54	60	60	60	214	241	239	239
1	16	Boukoki II	46.7	Peripherial Quartiers 1	475	457	454	454	171	165	163	163	71	69	68	68	285	274	272	272
1	17	Boukoki III	34.5	Peripherial Quartiers 1	336	339	336	336	121	122	121	121	50	51	50	50	202	203	202	202
1	18	Boukoki IV	98.9	Peripherial Quartiers 1	879	970	962	963	316	349	346	347	132	146	144	144	527	582	577	578
1	20	Plateau II	302.7	Modern Quartiers	1,336	1,336	1,324	1,326	481	481	477	477	200	200	199	199	802	802	794	796
1	21	Yantala	59.0	Urban Villages	1,124	1,070	1,032	1,005	405	385	372	362	169	161	155	151	674	642	619	603
1	23	Goudel	83.5	Urban Villages	706	737	812	813	254	265	292	293	106	111	122	122	424	442	487	488
1	24	Kouara Kano	167.5	Modern Quartiers	156	164	163	163	56	59	59	59	23	25	24	24	94	98	98	98
1	25	Ext. Kouara Kano	89.1	Modern Quartiers	233	219	217	217	84	79	78	78	35	33	33	33	140	131	130	130
1	26	Courronne Nord	58.4	Peripherial Quartiers 2	367	429	511	568	132	154	184	204	55	64	77	85	220	257	307	341
1	27	Kouara Me	147.2	Peripherial Quartiers 2	796	1,010	1,073	1,290	287	364	386	464	119	152	161	194	478	606	644	774
1	28	Dar Es Salam	286.0	Peripherial Quartiers 2	1,170	1,682	1,946	2,506	421	606	701	902	176	252	292	376	702	1,009	1,168	1,504
1	30	Yantala Haut	170.0	Modern Quartiers	1,060	1,042	1,033	1,034	382	375	372	372	159	156	155	155	636	625	620	620
1	31	Bani Fandou I	104.4	Peripherial Quartiers 2	858	1,024	1,015	1,017	309	369	365	366	129	154	152	153	515	614	609	610
1	32	Cite CNSS	18.5	Peripherial Quartiers 2	108	136	135	135	39	49	49	49	16	20	20	20	65	82	81	81
1	33	Bani Fandou II	121.2	Peripherial Quartiers 2	844	951	1,060	1,180	304	342	382	425	127	143	159	177	506	571	636	708
1	35	Lazaret	153.3	Peripherial Quartiers 1	1,496	1,504	1,491	1,493	539	541	537	537	224	226	224	224	898	902	895	896
1	36	Banizoumbou II	119.6	Peripherial Quartiers 2	340	586	698	1,048	122	211	251	377	51	88	105	157	204	352	419	629
1	37	Baghdad	164.0	Peripherial Quartiers 2	441	804	1,116	1,437	159	289	402	517	66	121	167	216	265	482	670	862
1	48	SONUCI	60.6	New Quartiers	43	149	236	295	15	54	85	106	6	22	35	44	26	89	142	177
1	49	Koura Kano Nord	81.9	New Quartiers	58	201	319	439	21	72	115	158	9	30	48	66	35	121	191	263
Sub-total (Commune 1)			2,821.8		14,643	16,665	17,757	19,483	5,272	5,999	6,393	7,012	2,196	2,502	2,664	2,924	8,788	9,998	10,656	11,691
2	53	Terminus	75.4	Modern Quartiers	197	196	194	194	71	71	70	70	30	29	29	29	118	118	116	116
2	54	Niamey Bas	61.8	Modern Quartiers	59	61	60	60	21	22	22	22	9	9	9	9	35	37	36	36
2	56	Kalley Centre	8.2	Traditional Quartiers	78	80	80	80	28	29	29	29	12	12	12	12	47	48	48	48
2	57	Kalley Est	49.2	Traditional Quartiers	544	555	574	599	196	200	207	216	82	83	86	90	326	333	344	359
2	58	Kalley Sud	34.7	Traditional Quartiers	336	341	372	406	121	123	134	146	50	51	56	61	202	205	223	244
2	59	Lacouroussou	16.4	Traditional Quartiers	206	209	207	207	74	75	75	75	31	31	31	31	124	125	124	124
2	60	Banizoumbou I	23.9	Traditional Quartiers	249	258	267	291	90	93	96	105	37	39	40	44	149	155	160	175
2	61	Abidjan	36.9	Traditional Quartiers	351	362	395	431	126	130	142	155	53	54	59	65	211	217	237	259
2	62	Sabongari	63.6	Traditional Quartiers	549	623	711	774	198	224	256	279	82	93	107	116	329	374	427	464
2	63	Nouveau Marche	48.8	Traditional Quartiers	418	479	546	594	150	172	197	214	63	72	82	89	251	287	328	356
2	69	Cite Faycal	29.5	Modern Quartiers	85	87	86	86	31	31	31	31	13	13	13	13	51	52	52	52
2	70	Poudriere	185.7	Modern Quartiers	653	637	632	633	235	229	228	228	98	96	95	95	392	382	379	380
2	72	Madina	110.4	Peripherial Quartiers 2	854	974	1,020	1,075	307	351	367	387	128	146	153	161	512	584	612	645
2	73	Route de Filingue	206.9	Peripherial Quartiers 2	1,374	1,521	1,810	2,014	495	548	652	725	206	228	272	302	824	913	1,086	1,208
2	74	Ext. Route de Flingue	161.7	Peripherial Quartiers 2	951	1,189	1,415	1,574	342	428	509	567	143	178	212	236	571	713	849	944
2	75	Gamkalle Sabanguye	67.2	Urban Villages	672	659	654	654	242	237	235	235	101	99	98	98	403	395	392	392
2	76	Gamkalle Golleye	37.9	Urban Villages	352	372	369	369	127	134	133	133	53	56	55	55	211	223	221	221
2	78	Zone Industriel	304.1	Public Domain	23	0	0	0	8	0	0	0	3	0	0	0	14	0	0	0
2	79	Talladje	164.4	Peripherial Quartiers 1	1,391	1,612	1,598	1,600	501	580	575	576	209	242	240	240	835	967	959	960
2	84	Aviation 1	319.6	Peripherial Quartiers 2	849	940	1,088	1,167	306	338	392	420	127	141	163	175	509	564	653	700
2	85	Aviation 2	309.6	New Quartiers	397	455	602	754	143	164	217	271	60	68	90	113	238	273	361	452
Sub-total (Commune 2)			2,011.8		10,588	11,610	12,680	13,562	3,812	4,179	4,567	4,884	1,590	1,740	1,902	2,034	6,352	6,965	7,607	8,135
3	87	Lamorde	53.2	Urban Villages	286	313	362	415	103	113	130	149	43	47	54	62	172	188	217	249
3	88	Nogare	34.9	Urban Villages	201	205	238	272	72	74	86	98	30	31	36	41	121	123	143	163
3	91	Karadje	160.4	Peripherial Quartiers 2	939	1,179	1,403	1,561	338	424	505	562	141	177	210	234	563	707	842	937
3	92	Pont Kennedy	37.3	Peripherial Quartiers 2	268	274	326	363	96	99	117	131	40	41	49	54	161	164	196	218
3	93	Gawaye	44.5	Peripherial Quartiers 2	282	327	390	433	102	118	140	156	42	49	59	65	169	196	234	260
3	94	Kirkissoye	25.6	Urban Villages	231	252	249	250	83	91	90	90	35	38	37	38	139	151	149	150
3	95	Ext. Kirkissoye	135.3	Peripherial Quartiers 2	819	995	1,184	1,317	295	358	426	474	123	149	178	198	491	597	710	790
3	96	Banga Bana	208.2	Peripherial Quartiers 2	743	1,021	1,518	2,027	267	368	546	730	111	153	228	304	446	613	911	1,216
3	103	Outlying Villages	0.0		152	0	0	0	55	0	0	0	23	0	0	0	91	0	0	0
Sub-total (Commune 3)			699.4		3,921	4,566	5,670	6,638	1,411	1,645	2,040	2,390	588	685	851	996	2,353	2,739	3,402	3,983
Total			5,533.0		29,152	32,841	36,107	39,683	10,495	11,823	13,000	14,286	4,374	4,927	5,417	5,954	17,493	19,702	21,665	23,809

H.3 POLLUTANT LOAD

Pollutant Load of Administration/Commerce Wastewater

Planning Wastewater Quality COD = 360 (mg/l)
BOD = 150 (mg/l)
SS = 600 (mg/l)

Pollutant Load of Industrial Wastewater

Planning Wastewater Quality COD = 240 (mg/l)
BOD = 150 (mg/l)
SS = 600 (mg/l)

Don Adiminstration and Commerce Wastewater Flow

CU	ID	ADM_QRT	Area (ha)	Residential Type	Admi/Commerce/Indust Water (m3/d) (2000)	Admi/Commerce/Indust Water (m3/d) (2005)	Admi/Commerce/Indust Water (m3/d) (2010)	Admi/Commerce/Indust Water (m3/d) (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
1	3	IFAN	47.3	Public Domain	396	449	495	545	143	162	178	196	59	67	74	82	238	269	297	327
1	4	Poste	10.4	Public Domain	83	95	104	115	30	34	37	41	12	14	16	17	50	57	62	69
1	5	National Hospital	39.1	Public Domain	323	366	404	444	116	132	145	160	48	55	61	67	194	220	242	266
1	7	Casernes	23.2	Public Domain	188	213	235	258	68	77	85	93	28	32	35	39	113	128	141	155
1	12	Gounrty Yena	60.5	Public Domain	500	567	626	688	180	204	225	248	75	85	94	103	300	340	376	413
1	13	Ecole Aviation Civile	30.3	Public Domain	250	284	313	344	90	102	113	124	38	43	47	52	150	170	188	206
1	14	Lycee Kasai	33.9	Public Domain	281	319	352	387	101	115	127	139	42	48	53	58	169	191	211	232
1	19	Stadium	41.3	Public Domain	344	390	430	473	124	140	155	170	52	59	65	71	206	234	258	284
1	22	SNE	28.7	Public Domain	240	272	300	330	86	98	108	119	36	41	45	50	144	163	180	198
1	29	ORTN	68.4	Public Domain	563	638	704	774	203	230	253	279	84	96	106	116	338	383	422	464
1	34	Hopital Lazaret	37.5	Public Domain	313	355	391	430	113	128	141	155	47	53	59	65	188	213	235	258
1	38	Cimetiere	55.2	Public Domain	459	520	573	631	165	187	206	227	69	78	86	95	275	312	344	379
1	39	OPVN	25.5	Public Domain	208	236	261	287	75	85	94	103	31	35	39	43	125	142	157	172
1	40	Faisceau	17.4	Public Domain	146	165	182	201	53	59	66	72	22	25	27	30	88	99	109	121
Sub-total (Commune 1)			518.7		4,294	4,869	5,370	5,907	1,547	1,753	1,933	2,126	643	731	807	888	2,578	2,921	3,222	3,544
2	55	Grand Marche	6.9	Public Domain	52	59	65	72	19	21	23	26	8	9	10	11	31	35	39	43
2	64	Cimetiere Musulman	22.7	Public Domain	188	213	235	258	68	77	85	93	28	32	35	39	113	128	141	155
2	65	SMB	30.3	Public Domain	250	284	313	344	90	102	113	124	38	43	47	52	150	170	188	206
2	66	Caserne Bagagiya	34.6	Public Domain	292	331	365	401	105	119	131	144	44	50	55	60	175	199	219	241
2	67	Ecole de Police	46.9	Public Domain	386	437	482	531	139	157	174	191	58	66	72	80	232	262	289	319
2	68	Caserne Garba Hassane	51.5	Public Domain	427	485	534	588	154	175	192	212	64	73	80	88	256	291	320	353
2	71	Mosquee	36.7	Public Domain	302	343	378	416	109	123	136	150	45	51	57	62	181	206	227	250
2	77	Hippodrome	60.0	Public Domain	500	567	626	688	180	204	225	248	75	85	94	103	300	340	376	413
2	78	Zone Industriel	304.1	Industrial Zone	2,113	2,303	2,493	2,726	761	829	897	981	317	345	374	409	1,268	1,382	1,496	1,636
2	83	Airport	661.6	Public Domain	1,053	1,194	1,316	1,448	379	430	474	521	158	179	197	217	632	716	790	869
Sub-total (Commune 2)			1,255.3		5,563	6,216	6,807	7,472	2,004	2,237	2,450	2,690	835	933	1,021	1,121	3,338	3,729	4,085	4,485
3	89	Agrhymet	135.1	Public Domain	1,126	1,276	1,408	1,549	405	459	507	558	169	191	211	232	676	766	845	929
3	90	University	186.6	Public Domain	1,552	1,761	1,940	2,136	559	634	698	769	233	264	291	320	931	1,057	1,164	1,282
3	103	Outlying Villages	0.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-total (Commune 3)			321.7		2,678	3,037	3,348	3,685	964	1,093	1,205	1,327	402	455	502	552	1,607	1,823	2,009	2,211
Total			2,095.7		12,535	14,122	15,525	17,064	4,515	5,083	5,588	6,143	1,880	2,119	2,330	2,561	7,523	8,473	9,316	10,240

Non-Point Pollutant Load

Non-Point Pollutant Load Unit

COD =	99	(g/ha/d)
BOD =	66	(g/ha/d)
SS =	288	(g/ha/d)

ID	ADM_QRT	Area (ha)	Residential Type	COD Load (kg)	BOD Load (kg)	SS Load (kg)
1	Plateau I	221.5	Modern Quartiers	22	15	64
2	Ambassades	121.0	Modern Quartiers	12	8	35
3	IFAN	47.3	Public Domain	5	3	14
4	Poste	10.4	Public Domain	1	1	3
5	National Hospital	39.1	Public Domain	4	3	11
6	Kombo	4.0	Peripherial Quartiers 2	0	0	1
7	Casernes	23.2	Public Domain	2	2	7
8	Zongo	19.9	Traditional Quartiers	2	1	6
9	Maourey	15.2	Traditional Quartiers	1	1	4
10	Gandacthe	13.2	Traditional Quartiers	1	1	4
11	Deizebon	19.1	Traditional Quartiers	2	1	5
12	Gounrty Yena	60.5	Public Domain	6	4	17
13	Ecole Aviation Civile	30.3	Public Domain	3	2	9
14	Lycee Kasai	33.9	Public Domain	3	2	10
15	Boukoki I	40.9	Peripherial Quartiers 1	4	3	12
16	Boukoki II	46.7	Peripherial Quartiers 1	5	3	13
17	Boukoki III	34.5	Peripherial Quartiers 1	3	2	10
18	Boukoki IV	98.9	Peripherial Quartiers 1	10	7	28
19	Stadium	41.3	Public Domain	4	3	12
20	Plateau II	302.7	Modern Quartiers	30	20	87
21	Yantala	59.0	Urban Villages	6	4	17
22	SNE	28.7	Public Domain	3	2	8
23	Goudel	83.5	Urban Villages	8	5	24
24	Kouara Kano	167.5	Modern Quartiers	17	11	48
25	Ext. Kouara Kano	89.1	Modern Quartiers	9	6	26
26	Courronne Nord	58.4	Peripherial Quartiers 2	6	4	17
27	Kouara Me	147.2	Peripherial Quartiers 2	15	10	42
28	Dar Es Salam	286.0	Peripherial Quartiers 2	28	19	82
29	ORTN	68.4	Public Domain	7	4	20
30	Yantala Haut	170.0	Modern Quartiers	17	11	49
31	Bani Fandou I	104.4	Peripherial Quartiers 2	10	7	30
32	Cite CNSS	18.5	Peripherial Quartiers 2	2	1	5
33	Bani Fandou II	121.2	Peripherial Quartiers 2	12	8	35
34	Hopital Lazaret	37.5	Public Domain	4	2	11
35	Lazaret	153.3	Peripherial Quartiers 1	15	10	44
36	Banizoumbou II	119.6	Peripherial Quartiers 2	12	8	34
37	Baghdad	164.0	Peripherial Quartiers 2	16	11	47
38	Cimetiere	55.2	Public Domain	5	4	16
39	OPVN	25.5	Public Domain	3	2	7
40	Faisceau	17.4	Public Domain	2	1	5
48	SONUCI	60.6	New Quartiers	6	4	17
49	Koura Kano Nord	81.9	New Quartiers	8	5	24
		3,340.5		331	221	960
53	Terminus	75.4	Modern Quartiers	7	5	22
54	Niamey Bas	61.8	Modern Quartiers	6	4	18
55	Grand Marche	6.9	Public Domain	1	0	2
56	Kalley Centre	8.2	Traditional Quartiers	1	1	2
57	Kalley Est	49.2	Traditional Quartiers	5	3	14
58	Kalley Sud	34.7	Traditional Quartiers	3	2	10
59	Lacouroussou	16.4	Traditional Quartiers	2	1	5
60	Banizoumbou I	23.9	Traditional Quartiers	2	2	7
61	Abidjan	36.9	Traditional Quartiers	4	2	11
62	Sabongari	63.6	Traditional Quartiers	6	4	18
63	Nouveau Marche	48.8	Traditional Quartiers	5	3	14
64	Cimetiere Musulman	22.7	Public Domain	2	1	7
65	SMB	30.3	Public Domain	3	2	9
66	Caserne Bagagiya	34.6	Public Domain	3	2	10
67	Ecole de Police	46.9	Public Domain	5	3	13
68	Caserne Garba Hassane	51.5	Public Domain	5	3	15
69	Cite Faycal	29.5	Modern Quartiers	3	2	8
70	Poudriere	185.7	Modern Quartiers	18	12	53
71	Mosquee	36.7	Public Domain	4	2	11
72	Madina	110.4	Peripherial Quartiers 2	11	7	32
73	Route de Filingue	206.9	Peripherial Quartiers 2	20	14	60
74	Ext. Route de Flingue	161.7	Peripherial Quartiers 2	16	11	47
75	Gamkalle Sabanguye	67.2	Urban Villages	7	4	19
76	Gamkalle Golleye	37.9	Urban Villages	4	2	11
77	Hippodrome	60.0	Public Domain	6	4	17
78	Zone Industriel	304.1	Public Domain	30	20	87
79	Talladje	164.4	Peripherial Quartiers 1	16	11	47
83	Airport	661.6	Public Domain	65	44	190
84	Aviation 1	319.6	Peripherial Quartiers 2	32	21	92
85	Aviation 2	309.6	New Quartiers	31	20	89
		3,267.1		323	212	940
87	Lamorde	53.2	Urban Villages	5	3	15
88	Nogare	34.9	Urban Villages	3	2	10
89	Agrhymet	135.1	Public Domain	13	9	39
90	University	186.6	Public Domain	18	12	54
91	Karadje	160.4	Peripherial Quartiers 2	16	11	46
92	Pont Kennedy	37.3	Peripherial Quartiers 2	4	2	11
93	Gawaye	44.5	Peripherial Quartiers 2	4	3	13
94	Kirkissoye	25.6	Urban Villages	3	2	7
95	Ext. Kirkissoye	135.3	Peripherial Quartiers 2	13	9	39
96	Banga Bana	208.2	Peripherial Quartiers 2	21	14	60
103	Outlying Villages	0.0		0	0	0
103	Outlying Villages	0.0		0	0	0
		1,021.1		100	67	294
		7,628.7		754	500	2,194

H.3 POLLUTANT LOAD

CU	ID	ADM_QRT	Area (ha)	Residential Type	Wastewater Flow(m3/d) (2000)	Wastewater Flow(m3/d) (2005)	Wastewater Flow(m3/d) (2010)	Wastewater Flow(m3) (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
1	1	Plateau I	221.5	Modern Quartiers	314	326	323	324	135	139	138	139	62	64	63	64	252	260	258	258
1	2	Ambassades	121.0	Modern Quartiers	73	71	71	71	38	38	38	38	19	19	19	19	79	78	78	78
1	3	IFAN	47.3	Public Domain	396	449	495	545	148	167	183	201	62	70	77	85	252	283	311	341
1	4	Poste	10.4	Public Domain	83	95	104	115	31	35	38	42	13	15	17	18	53	60	65	72
1	5	National Hospital	39.1	Public Domain	323	366	404	444	120	136	149	164	51	58	64	70	205	231	253	277
1	6	Kombo	4.0	Peripherial Quartiers 2	78	74	68	58	28	27	24	21	12	11	10	9	48	45	42	36
1	7	Casernes	23.2	Public Domain	188	213	235	258	70	79	87	95	30	34	37	41	120	135	148	162
1	8	Zongo	19.9	Traditional Quartiers	183	195	223	242	68	72	82	89	28	30	34	37	116	123	140	151
1	9	Maourey	15.2	Traditional Quartiers	179	186	192	200	65	68	70	73	28	29	30	31	111	116	119	124
1	10	Gandacthe	13.2	Traditional Quartiers	263	247	225	193	96	90	82	70	40	38	35	30	162	152	139	120
1	11	Deizebon	19.1	Traditional Quartiers	370	355	324	278	135	130	119	102	57	54	50	43	227	218	199	172
1	12	Gounrty Yena	60.5	Public Domain	500	567	626	688	186	210	231	254	79	89	98	107	317	357	393	430
1	13	Ecole Aviation Civile	30.3	Public Domain	250	284	313	344	93	105	116	127	40	45	49	54	159	179	197	215
1	14	Lycee Kasai	33.9	Public Domain	281	319	352	387	104	118	130	142	44	50	55	60	179	201	221	242
1	15	Boukoki I	40.9	Peripherial Quartiers 1	357	401	398	398	133	148	147	147	57	63	63	63	226	253	251	251
1	16	Boukoki II	46.7	Peripherial Quartiers 1	475	457	454	454	176	170	168	168	74	72	71	71	298	287	285	285
1	17	Boukoki III	34.5	Peripherial Quartiers 1	336	339	336	336	124	125	124	124	52	53	52	52	212	213	212	212
1	18	Boukoki IV	98.9	Peripherial Quartiers 1	879	970	962	963	326	359	356	357	139	153	151	151	555	610	605	606
1	19	Stadium	41.3	Public Domain	344	390	430	473	128	144	159	174	55	62	68	74	218	246	270	296
1	20	Plateau II	302.7	Modern Quartiers	1,336	1,336	1,324	1,326	511	511	507	507	220	220	219	219	889	889	881	883
1	21	Yantala	59.0	Urban Villages	1,124	1,070	1,032	1,005	411	391	378	368	173	165	159	155	691	659	636	620
1	22	SNE	28.7	Public Domain	240	272	300	330	89	101	111	122	38	43	47	52	152	171	188	206
1	23	Goudel	83.5	Urban Villages	706	737	812	813	262	273	300	301	111	116	127	127	448	466	511	512
1	24	Kouara Kano	167.5	Modern Quartiers	156	164	163	163	73	76	76	76	34	36	35	35	142	146	146	146
1	25	Ext. Kouara Kano	89.1	Modern Quartiers	233	219	217	217	93	88	87	87	41	39	39	39	166	157	156	156
1	26	Courronne Nord	58.4	Peripherial Quartiers 2	367	429	511	568	138	160	190	210	59	68	81	89	237	274	324	358
1	27	Kouara Me	147.2	Peripherial Quartiers 2	796	1,010	1,073	1,290	302	379	401	479	129	162	171	204	520	648	686	816
1	28	Dar Es Salam	286.0	Peripherial Quartiers 2	1,170	1,682	1,946	2,506	449	634	729	930	195	271	311	395	784	1,091	1,250	1,586
1	29	ORTN	68.4	Public Domain	563	638	704	774	210	237	260	286	88	100	110	120	358	403	442	484
1	30	Yantala Haut	170.0	Modern Quartiers	1,060	1,042	1,033	1,034	399	392	389	389	170	167	166	166	685	674	669	669
1	31	Bani Fandou I	104.4	Peripherial Quartiers 2	858	1,024	1,015	1,017	319	379	375	376	136	161	159	160	545	644	639	640
1	32	Cite CNSS	18.5	Peripherial Quartiers 2	108	136	135	135	41	51	51	51	17	21	21	21	70	87	86	86
1	33	Bani Fandou II	121.2	Peripherial Quartiers 2	844	951	1,060	1,180	316	354	394	437	135	151	167	185	541	606	671	743
1	34	Hopital Lazaret	37.5	Public Domain	313	355	391	430	117	132	145	159	49	55	61	67	199	224	246	269
1	35	Lazaret	153.3	Peripherial Quartiers 1	1,496	1,504	1,491	1,493	554	556	552	552	234	236	234	234	942	946	939	940
1	36	Banizoumbou II	119.6	Peripherial Quartiers 2	340	586	698	1,048	134	223	263	389	59	96	113	165	238	386	453	663
1	37	Baghdad	164.0	Peripherial Quartiers 2	441	804	1,116	1,437	175	305	418	533	77	132	178	227	312	529	717	909
1	38	Cimetiere	55.2	Public Domain	459	520	573	631	170	192	211	232	73	82	90	99	291	328	360	395
1	39	OPVN	25.5	Public Domain	208	236	261	287	78	88	97	106	33	37	41	45	132	149	164	179
1	40	Faisceau	17.4	Public Domain	146	165	182	201	55	61	68	74	23	26	28	31	93	104	114	126
1	48	SONUCI	60.6	New Quartiers	43	149	236	295	21	60	91	112	10	26	39	48	43	106	159	194
1	49	Koura Kano Nord	81.9	New Quartiers	58	201	319	439	29	80	123	166	14	35	53	71	59	145	215	287
(Commune 1)			3,340.5		18,937	21,534	23,127	25,390	7,150	8,083	8,657	9,469	3,060	3,454	3,692	4,033	12,326	13,879	14,838	16,195
2	53	Terminus	75.4	Modern Quartiers	197	196	194	194	76	76	75	75	37	36	36	36	140	140	138	138
2	54	Niamey Bas	61.8	Modern Quartiers	59	61	60	60	25	26	26	26	15	15	15	15	53	55	54	54
2	55	Grand Marche	6.9	Public Domain	52	59	65	72	19	21	23	26	9	10	11	12	33	37	41	45
2	56	Kalley Centre	8.2	Traditional Quartiers	78	80	80	80	29	30	30	30	13	13	13	13	49	50	50	50
2	57	Kalley Est	49.2	Traditional Quartiers	544	555	574	599	199	203	210	219	87	88	91	95	340	347	358	373
2	58	Kalley Sud	34.7	Traditional Quartiers	336	341	372	406	123	125	136	148	53	54	59	64	212	215	233	254
2	59	Lacouroussou	16.4	Traditional Quartiers	206	209	207	207	75	76	76	76	33	33	33	33	129	130	129	129
2	60	Banizoumbou I	23.9	Traditional Quartiers	249	258	267	291	92	95	98	107	39	41	42	46	156	162	167	182
2	61	Abidjan	36.9	Traditional Quartiers	351	362	395	431	129	133	145	158	57	58	63	69	222	228	248	270
2	62	Sabongari	63.6	Traditional Quartiers	549	623	711	774	202	228	260	283	88	99	113	122	347	392	445	482
2	63	Nouveau Marche	48.8	Traditional Quartiers	418	479	546	594	153	175	200	217	68	77	87	94	265	301	342	370
2	64	Cimetiere Musulman	22.7	Public Domain	188	213	235	258	70	79	87	95	30	34	37	41	120	135	148	162
2	65	SMB	30.3	Public Domain	250	284	313	344	92	104	115	126	41	46	50	55	159	179	197	215
2	66	Caserne Bagagiya	34.6	Public Domain	292	331	365	401	107	121	133	146	47	53	58	63	185	209	229	251
2	67	Ecole de Police	46.9	Public Domain	386	437	482	531	142	160	177	194	62	70	76	84	245	275	302	332
2	68	Caserne Garba Hassane	51.5	Public Domain	427	485	534	588	158	179	196	216	69	78	85	93	271	306	335	368
2	69	Cite Faycal	29.5	Modern Quartiers	85	87	86	86	33	33	33	33	16	16	16	16	59	60	60	60
2	70	Poudriere	185.7	Modern Quartiers	653	637	632	633	248	242	241	241	116	114	113	113	445	435	432	433
2	71	Mosquee	36.7	Public Domain	302	343	378	416	112	126	139	153	49	55	61	66	192	217	238	261
2	72	Madina	110.4	Peripherial Quartiers 2	854	974	1,020	1,075	315	359	375	395	139	157	164	172	544	616	644	677
2	73	Route de Filingue	206.9	Peripherial Quartiers 2	1,374	1,521	1,810	2,014	509	562	666	739	226	248	292	322	884	973	1,146	1,268
2	74	Ext. Route de Flingue	161.7	Peripherial Quartiers 2	951	1,189	1,415	1,574	353	439	520	578	159	194	228	252	618	760	896	991
2	75	Gamkalle Sabanguye	67.2	Urban Villages	672	659	654	654	247	242	240	240	107	105	104	104	422	414	411	411
2	76	Gamkalle Golleye	37.9	Urban Villages	352	372	369	369	130	137	136	136	57	60	59	59	222	234	232	232
2	77	Hippodrome	60.0	Public Domain	500	567	626	688	184	208	229	252	81	91	100	109	317	357	393	430
2	78	Zone Industriel	304.1	Public Domain	2,136	2,303	2,493	2,726	790	850	918	1,002	349	374	403	438	1,369	1,469	1,583	1,723
2	79	Talladje	164.4	Peripherial Quartiers 1	1,391	1,612	1,598	1,600	512	591	586	587	225	258	256	256	882	1,014	1,006	1,007
2	83	Airport	661.6	Public Domain	1,053	1,194	1,316	1,448	444	495	539	586	202	223	241	261	822	906	980	1,059
2	84	Aviation 1	319.6	Peripherial Quartiers 2	849	940	1,088	1,167	338	370	424	452	148	162	184	196	601	656	745	792
2	85	Aviation 2	309.6	New Quartiers	397	455	602	754	174	195	248	302	80	88	110	133	327	362	450	541
(Commune 2)			3,267.1		16,151	17,826	19,487	21,034	6,080	6,680	7,281	7,838	2,702	2,950	3,200	3,432	10,630	11,634	12,632	13,560
3	87	Lamorde	53.2	Urban Villages	286	313	362	415	107	117	134	153	48	52	59	67	187	203	232	264
3	88	Nogare	34.9	Urban Villages	201	205	238	272	74	76	88	100	33	34	39	44	131	133	153	173
3	89	Agrhymet	135.1	Public Domain	1,126	1,276	1,408	1,549	414	468	516	567	182	204	224	245	715	805	884	968
3	90	University	186.6	Public Domain	1,552	1,761	1,940	2,136	572	647	711	782	251	282	309	338	985	1,111	1,218	1,336
3	91	Karadje	160.4	Peripherial Quartiers 2	939	1,179	1,403	1,561	349	435	516	573	156	192	225	249	609	753	888	983
3	92	Pont Kennedy	37.3	Peripherial Quartiers 2	268	274	326	363	99	102	120	134	44	45	53	58	172	175	207	229
3	93	Gawaye	44.5	Peripherial Quartiers 2	282	327	390	433	105	121	143	159	46	53	63	69	182	209	247	273
3	94	Kirkissoye	25.6	Urban Villages	231	252	249	250	85	93	92	92	37	40	39	40	146	158	156	157
3	95	Ext. Kirkissoye	135.3	Peripherial Quartiers 2	819	995	1,184	1,317	304	367	435	483	136	162	191	211	530	636	749	829
3	96	Banga Bana	208.2	Peripherial Quartiers 2	743	1,021	1,518	2,027	281	382	560	744	131	173	248	324	506	673	971	1,276
3	103	Outlying Villages	0.0		152	0	0	0	55	0	0	0	23	0	0	0	91	0	0	0
(Commune 3)			1,021.1		6,599	7,603	9,018	10,323	2,445	2,808	3,315	3,787	1,087	1,237	1,450	1,645	4,254	4,856	5,705	6,488
Total			7,628.7		41,687	46,963	51,632	56,747	15,675	17,571	19,253	21,094	6,849	7,641	8,342	9,110	27,210	30,369	33,175	36,243

APPENDIX H.4 TREATMENT DISTRICT DATA

Generated Volume

TD	CU	ID	Treatment District	Administration Quartier	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Wastewater Flow (2000)	Wastewater Flow (2005)	Wastewater Flow (2010)	Wastewater Flow (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
C1	1	1	Plateau I	Plateau I	155.1	4,397	4,561	4,523	4,529	220	228	226	227	90	93	92	92	48	49	49	49	177	181	180	181
C1	1	3	Plateau I	IFAN	4.7	0	0	0	0	40	45	50	55	15	17	18	20	6	7	8	9	25	28	31	34
C1	1	4	Plateau I	Poste	10.4	0	0	0	0	83	95	104	115	31	35	38	42	13	15	17	18	53	60	65	72
C1	1	5	Plateau I	National Hospital	39.1	0	0	0	0	323	366	404	444	119	134	148	162	52	59	64	70	205	231	254	278
C1	1	6	Plateau I	Kombo	4.0	1,554	1,481	1,353	1,161	78	74	68	58	28	27	25	21	12	11	11	9	48	46	42	36
C1	1	13	Plateau I	Ecole Aviation Civile	30.3	0	0	0	0	250	284	313	344	92	104	115	126	40	46	50	55	159	179	197	215
C1	1	20	Plateau I	Plateau II	60.5	5,345	5,342	5,298	5,305	267	267	265	265	100	100	100	100	46	46	46	46	178	178	176	176
Sub-Total					304.1	11,296	11,384	11,174	10,995	1,261	1,359	1,430	1,508	475	510	536	563	217	233	245	256	845	903	945	992
C2	1	19	Issa Beri	Stadium	41.3	0	0	0	0	344	390	430	473	127	143	158	173	56	62	68	75	218	246	270	296
C2	1	20	Issa Beri	Plateau II	121.1	10,690	10,684	10,595	10,609	534	534	530	530	200	200	199	199	92	92	91	91	355	355	353	353
Sub-Total					162.4	10,690	10,684	10,595	10,609	878	924	960	1,003	327	343	357	372	148	154	159	166	573	601	623	649
C3	1	14	Deizebon	Lycee Kasai	33.9	0	0	0	0	281	319	352	387	103	117	129	142	45	51	56	61	178	201	221	242
C3	1	15	Deizebon	Boukoki I	40.9	7,141	8,021	7,954	7,965	357	401	398	398	131	147	146	146	57	64	64	64	226	252	251	251
C3	1	16	Deizebon	Boukoki II	46.7	9,497	9,149	9,073	9,085	475	457	454	454	174	168	167	167	76	73	73	73	298	288	286	286
C3	1	17	Deizebon	Boukoki III	34.5	6,710	6,771	6,714	6,723	336	339	336	336	123	124	123	123	54	54	54	54	212	213	212	212
C3	1	18	Deizebon	Boukoki IV	98.9	17,585	19,405	19,243	19,269	879	970	962	963	323	356	353	353	141	155	154	154	556	610	606	606
Sub-Total					254.9	40,933	43,346	42,984	43,042	2,328	2,486	2,502	2,538	854	912	918	931	373	397	401	406	1,470	1,564	1,576	1,597
C4	1	3	Gamkalle	IFAN	42.6	0	0	0	0	356	404	445	490	131	148	163	179	57	65	71	78	226	255	279	306
C4	1	8	Gamkalle	Zongo	19.9	3,661	3,905	4,454	4,848	183	195	223	242	67	72	82	88	29	31	35	38	116	123	140	151
C4	1	9	Gamkalle	Maourey	15.2	3,581	3,721	3,838	3,991	179	186	192	200	65	68	70	73	28	29	30	31	112	116	120	124
C4	1	10	Gamkalle	Gandacthe	13.2	5,252	4,933	4,506	3,867	263	247	225	193	96	90	82	70	41	38	35	30	162	152	139	120
C4	1	11	Gamkalle	Deizebon	19.1	7,406	7,104	6,489	5,569	370	355	324	278	134	129	118	101	57	55	50	44	228	219	200	172
C4	1	12	Gamkalle	Gounrty Yena	60.5	0	0	0	0	500	567	626	688	184	208	229	252	81	91	100	109	317	358	393	430
C4	2	53	Gamkalle	Terminus	75.4	3,941	3,916	3,884	3,889	197	196	194	194	76	76	75	75	37	37	36	36	140	139	138	138
C4	2	54	Gamkalle	Niamey Bas	61.8	1,176	1,212	1,202	1,203	59	61	60	60	25	26	26	26	15	15	15	15	53	54	54	54
C4	2	55	Gamkalle	Grand Marche	6.9	0	0	0	0	52	59	65	72	19	22	24	26	8	10	10	11	33	37	41	45
C4	2		Gamkalle	Kalley Centre	8.2	1,561	1,604	1,591	1,593	78	80	80	80	29	29	29	29	12	13	13	13	49	50	50	50
C4	2	57	Gamkalle	Kalley Est	49.2	10,881	11,096	11,482	11,976	544	555	574	599	199	203	210	219	86	88	91	95	341	347	359	374
C4	2	58	Gamkalle	Kalley Sud	34.7	6,725	6,813	7,432	8,118	336	341	372	406	123	125	136	149	54	54	59	64	212	215	233	254
C4	2	59	Gamkalle	Lacouroussou	16.4	4,125	4,171	4,136	4,142	206	209	207	207	75	76	76	76	32	33	33	33	128	130	129	129
C4	2	60	Gamkalle	Banizoumbou I	23.9	4,988	5,157	5,346	5,820	249	258	267	291	91	95	98	106	40	41	42	46	156	162	167	181
C4	2	61	Gamkalle	Abidjan	36.9	7,026	7,237	7,896	8,625	351	362	395	431	129	133	145	158	56	58	63	68	221	228	248	269
C4	2	62	Gamkalle	Sabongari	25.0	4,390	4,987	5,687	6,190	220	249	284	310	81	91	104	113	35	40	45	49	139	157	178	193
C4	2	63	Gamkalle	Nouveau Marche	48.8	8,355	9,575	10,920	11,885	418	479	546	594	154	176	200	217	67	77	87	94	265	301	342	370
C4	2	64	Gamkalle	Cimetiere Musulman	22.7	0	0	0	0	188	213	235	258	69	78	86	94	30	34	37	41	119	134	148	161
C4	2	65	Gamkalle	SMB	30.3	0	0	0	0	250	284	313	344	92	104	115	126	40	46	50	55	159	179	197	215
C4	2	66	Gamkalle	Caserne Bagagiya	34.6	0	0	0	0	292	331	365	401	107	122	134	147	47	53	58	63	185	209	229	251
C4	2	67	Gamkalle	Ecole de Police	46.9	0	0	0	0	386	437	482	531	142	161	177	194	62	70	77	84	245	276	303	332
C4	2	68	Gamkalle	Caserne Garba Hass	51.5	0	0	0	0	427	485	534	588	157	178	196	215	69	78	85	93	271	306	335	368
C4	2	69	Gamkalle	Cite Faycal	29.5	1,708	1,738	1,724	1,726	85	87	86	86	33	33	33	33	16	16	16	16	59	61	60	60
C4	2	75	Gamkalle	Gamkalle Sabanguyo	67.2	13,437	13,179	13,070	13,087	672	659	654	654	246	242	240	240	107	105	105	105	423	415	412	412
Sub-Total					840.4	88,213	90,348	93,657	96,529	6,861	7,299	7,748	8,197	2,524	2,685	2,848	3,006	1,106	1,177	1,243	1,311	4,359	4,623	4,894	5,159
S1	1	1	Yantala	Plateau I	66.4	1,884	1,955	1,938	1,941	94	98	97	97	38	40	39	39	20	21	21	21	76	78	77	77
S1	1	2	Yantala	Ambassades	121.0	1,467	1,424	1,412	1,414	73	71	71	71	35	34	34	34	23	22	22	22	79	77	77	77
S1	1	7	Yantala	Casernes	23.2	0	0	0	0	188	213	235	258	69	78	86	94	30	34	37	41	119	134	148	161
S1	1	20	Yantala	Plateau II	121.1	10,690	10,685	10,595	10,609	535	535	529	531	201	201	199	199	92	92	91	91	356	356	352	353
S1	1	21	Yantala	Yantala	59.0	22,478	21,396	20,644	20,098	1,124	1,070	1,032	1,005	409	389	376	366	174	166	160	156	691	659	636	620
S1	1	22	Yantala	SNE	28.7	0	0	0	0	240	272	300	330	88	100	110	121	39	44	48	52	152	171	188	206
S1	1	23	Yantala	Goudel	83.5	14,116	14,733	16,235	16,256	706	737	812	813	260	271	298	298	114	119	130	130	448	466	511	512
S1	1	24	Yantala	Kouara Kano	33.5	626	657	651	652	31	33	33	33	13	14	14	14	8	8	8	8	28	29	29	29
S1	1	30	Yantala	Yantala Haut	34.0	4,242	4,166	4,132	4,137	212	208	207	207	79	77	77	77	35	34	34	34	137	135	134	134
Sub-Total					570.4	55,503	55,016	55,607	55,107	3,203	3,237	3,316	3,345	1,192	1,204	1,233	1,242	535	540	551	555	2,086	2,105	2,152	2,169
S2	1	24	Kouara Kano	Kouara Kano	134.0	2,502	2,627	2,605	2,609	125	131	130	130	54	56	56	56	32	33	32	32	114	117	117	117
S2	1	25	Kouara Kano	Ext. Kouara Kano	89.1	4,656	4,370	4,334	4,340	233	219	217	217	90	85	84	84	44	41	41	41	165	157	156	156
S2	1	30	Kouara Kano	Yantala Haut	51.0	6,362	6,249	6,197	6,206	318	313	310	310	118	116	115	115	53	52	51	51	205	202	201	201
S1	1	38	Kouara Kano	Cimetiere	55.2	0	0	0	0	459	520	573	631	169	191	210	231	74	83	91	100	291	328	360	394
S1	1	48	Kouara Kano	SONUCI	60.6	863	2,973	4,717	5,904	43	149	236	295	20	58	89	110	12	28	41	50	43	107	159	194
Sub-Total					389.9	14,383	16,219	17,853	19,059	1,178	1,332	1,466	1,583	451	506	554	596	215	237	256	274	818	911	993	1,062

Generated Volume

TD	CU	ID	Treatment District	Administration Quartier	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Wastewater Flow (2000)	Wastewater Flow (2005)	Wastewater Flow (2010)	Wastewater Flow (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
S3	1	28	Dar Es Salam	Dar Es Salam	286.0	23,395	33,648	38,929	50,118	1,170	1,682	1,946	2,506	441	625	720	922	203	280	319	403	784	1,092	1,250	1,586
S3	1	29	Dar Es Salam	ORTN	68.4	0	0	0	0	563	638	704	774	207	234	258	283	91	102	112	123	357	402	442	484
S3	1	30	Dar Es Salam	Yantala Haut	85.0	10,604	10,416	10,329	10,342	530	521	516	517	197	193	192	192	88	86	86	86	342	337	334	335
S3	1	37	Dar Es Salam	Baghdad	164.0	8,812	16,079	22,324	28,740	441	804	1,116	1,437	170	301	413	528	82	136	183	231	312	530	717	909
S3	1	39	Dar Es Salam	OPVN	25.5	0	0	0	0	208	236	261	287	77	87	96	105	34	38	42	45	132	149	164	180
S3	1	49	Dar Es Salam	Koura Kano Nord	81.9	1,166	4,015	6,371	8,773	58	201	319	439	26	78	120	164	17	38	56	74	58	144	215	287
Sub-Total					710.8	43,977	64,158	77,953	97,973	2,970	4,082	4,862	5,960	1,118	1,518	1,799	2,194	515	680	798	962	1,985	2,654	3,122	3,781
S4	1	26	Kouara Me	Courronne Nord	58.4	7,332	8,584	10,214	11,364	367	429	511	568	136	158	188	208	61	70	82	91	237	274	323	358
S4	1	27	Kouara Me	Kouara Me	147.2	15,912	20,203	21,466	25,793	796	1,010	1,073	1,290	297	374	396	474	134	166	175	208	520	648	686	816
S4	1	31	Kouara Me	Bani Fandou I	104.4	17,152	20,474	20,304	20,331	858	1,024	1,015	1,017	316	376	372	373	139	164	162	163	545	644	639	640
S4	1	32	Kouara Me	Cite CNSS	18.5	2,166	2,720	2,697	2,701	108	136	135	135	40	50	50	50	18	22	22	22	70	87	86	86
S4	1	33	Kouara Me	Bani Fandou II	121.2	16,871	19,011	21,209	23,598	844	951	1,060	1,180	312	351	390	433	138	154	171	189	541	606	671	743
S4	1	34	Kouara Me	Hopital Lazaret	37.5	0	0	0	0	313	355	391	430	115	130	143	157	51	57	62	68	199	224	245	269
S4	1	35	Kouara Me	Lazaret	153.3	29,911	30,071	29,821	29,860	1,496	1,504	1,491	1,493	549	552	547	548	239	240	238	239	942	947	939	940
S4	1	36	Kouara Me	Banizoumbou II	119.6	6,809	11,724	13,952	20,955	340	586	698	1,048	131	219	259	385	62	99	116	169	238	386	453	663
S4	1	40	Kouara Me	Faisceau	17.4	0	0	0	0	146	165	182	201	54	61	67	74	24	26	29	32	93	104	114	126
Sub-Total					777.5	96,153	112,787	119,663	134,602	5,268	6,160	6,556	7,362	1,950	2,271	2,412	2,702	866	998	1,057	1,181	3,385	3,920	4,156	4,641
S5	2	71	Bani Fandou II	Mosquee	36.7	0	0	0	0	302	343	378	416	111	126	139	152	49	55	60	66	192	216	237	260
S5	2	72	Bani Fandou II	Madina	110.4	17,074	19,486	20,397	21,499	854	974	1,020	1,075	315	358	375	395	139	157	164	172	544	616	644	677
S5	2	73	Bani Fandou II	Route de Filingue	206.9	27,485	30,425	36,206	40,283	1,374	1,521	1,810	2,014	509	562	666	739	226	248	291	322	884	972	1,146	1,268
S5	2	74	Bani Fandou II	Ext. Route de Flingu	161.7	19,014	23,782	28,301	31,487	951	1,189	1,415	1,574	353	439	520	578	158	194	228	252	617	760	896	991
Sub-Total					515.7	63,573	73,693	84,904	93,269	3,481	4,027	4,623	5,079	1,288	1,485	1,700	1,864	572	654	743	812	2,237	2,564	2,923	3,196
S6	2	62	Talladje Koado	Sabongari	38.6	6,584	7,480	8,531	9,285	329	374	427	464	121	137	156	170	53	60	68	73	209	236	267	290
S6	2	70	Talladje Koado	Poudriere	185.7	13,055	12,745	12,639	12,656	653	637	632	633	248	242	240	241	116	113	113	113	445	436	433	433
S6	2	77	Talladje Koado	Hippodrome	60.0	0	0	0	0	500	567	626	688	184	208	229	252	81	91	100	109	317	357	393	430
S6	2	79	Talladje Koado	Talladje	164.4	27,826	32,232	31,964	32,006	1,391	1,612	1,598	1,600	512	591	586	587	224	258	255	256	882	1,015	1,006	1,007
Sub-Total					448.7	47,465	52,457	53,134	53,947	2,873	3,190	3,283	3,385	1,065	1,178	1,211	1,250	474	522	536	551	1,853	2,044	2,099	2,160
S7	2	76	Industrielle	Gamkalle Golleye	37.9	7,033	7,438	7,376	7,386	352	372	369	369	129	136	135	135	56	59	59	59	222	234	232	232
S7	2	78	Industrielle	Zone Industriel	304.1	465	0	0	0	2,136	2,303	2,493	2,726	790	850	918	1,002	350	375	403	438	1,369	1,469	1,583	1,723
Sub-Total					342.0	7,498	7,438	7,376	7,386	2,488	2,675	2,862	3,095	919	986	1,053	1,137	406	434	462	497	1,591	1,703	1,815	1,955
S8	3	87	Karadje	Lamorde	53.2	5,718	6,263	7,245	8,292	286	313	362	415	107	116	134	153	48	52	59	67	187	203	233	264
S8	3	88	Karadje	Nogare	34.9	4,024	4,109	4,755	5,441	201	205	238	272	75	76	88	100	34	34	39	44	131	133	153	173
S8	3	90	Karadje	University	186.6	0	0	0	0	1,552	1,761	1,940	2,136	571	647	711	782	251	282	309	338	985	1,110	1,218	1,335
S8	3	91	Karadje	Karadje	160.4	18,771	23,585	28,066	31,226	939	1,179	1,403	1,561	349	435	516	573	156	192	226	250	610	754	888	983
Sub-Total					435.1	28,513	33,957	40,066	44,959	2,978	3,458	3,943	4,384	1,102	1,274	1,449	1,608	489	560	633	699	1,913	2,200	2,492	2,755
S9	3	89	Gaweye	Agrhymet	135.1	0	0	0	0	1,126	1,276	1,408	1,549	415	469	516	567	182	204	224	245	715	805	884	968
Sub-Total					135.1	0	0	0	0	1,126	1,276	1,408	1,549	415	469	516	567	182	204	224	245	715	805	884	968
S10	3	92	Banga Bana	Pont Kennedy	37.3	5,361	5,481	6,523	7,257	268	274	326	363	99	101	120	133	44	45	52	58	172	175	206	229
S10	3	93	Banga Bana	Gawaye	44.5	5,646	6,547	7,792	8,668	282	327	390	433	105	121	143	159	47	53	63	69	182	209	247	273
S10	3	94	Banga Bana	Kirkissoye	25.6	4,612	5,031	4,987	4,999	231	252	249	250	85	92	91	92	37	40	40	40	146	159	157	157
S10	3	95	Banga Bana	Ext. Kirkissoye	135.3	16,383	19,901	23,683	26,349	819	995	1,184	1,317	304	367	435	483	136	162	191	211	530	636	749	829
S10	3	96	Banga Bana	Banga Bana	208.2	14,866	20,417	30,368	40,544	743	1,021	1,518	2,027	282	382	561	744	131	173	248	324	506	673	971	1,276
S10	3	103	Banga Bana	Outlying Villages	0.0	3,031	0	0	0	152	0	0	0	55	0	0	0	23	0	0	0	91	0	0	0
Sub-Total					450.9	49,899	57,377	73,353	87,817	2,495	2,869	3,667	4,390	930	1,063	1,350	1,611	418	473	594	702	1,627	1,852	2,330	2,764
S11	2	83	Aviatiopn	Airport	661.6	0	0	0	0	1,053	1,194	1,316	1,448	424	475	519	566	221	243	261	281	822	907	980	1,059
S11	2	84	Aviatiopn	Aviation 1	319.6	16,982	18,801	21,752	23,337	849	940	1,088	1,167	327	360	413	442	158	172	194	206	601	656	745	792
S11	2	85	Aviatiopn	Aviation 2	309.6	7,947	9,106	12,040	15,070	397	455	602	754	164	185	238	292	89	98	120	143	327	362	450	542
Sub-Total					1,290.8	24,929	27,907	33,792	38,407	2,299	2,589	3,006	3,369	915	1,020	1,170	1,300	468	513	575	630	1,750	1,925	2,175	2,393
Total					7,628.7	583,025	656,771	722,111	793,701	41,687	46,963	51,632	56,747	15,525	17,424	19,106	20,943	6,984	7,776	8,477	9,247	27,207	30,374	33,179	36,241

Inlet Volume

TD	CU	ID	Treatment District	Administration Quartier	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Wastewater Flow (2000)	Wastewater Flow (2005)	Wastewater Flow (2010)	Wastewater Flow (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
C1	1	1	Plateau I	Plateau I	155.1	4,397	4,561	4,523	4,529	165	171	170	170	70	72	72	72	40	41	40	40	144	147	147	147
C1	1	3	Plateau I	IFAN	4.7	0	0	0	0	30	34	38	41	11	13	14	15	5	6	6	7	19	22	24	26
C1	1	4	Plateau I	Poste	10.4	0	0	0	0	62	71	78	86	23	26	29	32	10	12	13	14	40	46	50	55
C1	1	5	Plateau I	National Hospital	39.1	0	0	0	0	242	275	303	333	90	102	112	123	40	45	49	54	156	176	193	211
C1	1	6	Plateau I	Kombo	4.0	1,554	1,481	1,353	1,161	59	56	51	44	22	20	19	16	9	9	8	7	37	35	32	28
C1	1	13	Plateau I	Ecole Aviation Civile	30.3	0	0	0	0	188	213	235	258	70	79	87	95	31	35	38	42	122	137	150	164
C1	1	20	Plateau I	Plateau II	60.5	5,345	5,342	5,298	5,305	200	200	199	199	76	76	76	76	36	36	36	36	137	137	137	137
Sub-Total					304.1	11,296	11,384	11,174	10,995	946	1,020	1,074	1,131	362	388	409	429	171	184	190	200	655	700	733	768
C2	1	19	Issa Beri	Stadium	41.3	0	0	0	0	258	293	323	355	96	108	119	131	43	48	52	57	167	188	206	225
C2	1	20	Issa Beri	Plateau II	121.1	10,690	10,684	10,595	10,609	401	401	398	398	153	153	152	152	72	72	71	71	275	275	274	274
Sub-Total					162.4	10,690	10,684	10,595	10,609	659	694	721	753	249	261	271	283	115	120	123	128	442	463	480	499
C3	1	14	Deizebon	Lycee Kasai	33.9	0	0	0	0	211	239	264	290	78	88	97	107	35	39	43	47	136	153	168	184
C3	1	15	Deizebon	Boukoki I	40.9	7,141	8,021	7,954	7,965	268	301	299	299	99	111	110	110	44	49	49	49	173	192	191	191
C3	1	16	Deizebon	Boukoki II	46.7	9,497	9,149	9,073	9,085	356	343	341	341	131	127	126	126	58	56	56	56	227	219	218	218
C3	1	17	Deizebon	Boukoki III	34.5	6,710	6,771	6,714	6,723	252	254	252	252	93	94	93	93	41	41	41	41	161	162	161	161
C3	1	18	Deizebon	Boukoki IV	98.9	17,585	19,405	19,243	19,269	659	728	722	722	244	269	267	267	108	119	118	118	424	465	462	462
Sub-Total					254.9	40,933	43,346	42,984	43,042	1,746	1,865	1,878	1,904	645	689	693	703	286	304	307	311	1,121	1,191	1,200	1,216
C4	1	3	Gamkalle	IFAN	42.6	0	0	0	0	267	303	334	368	99	112	123	135	44	50	54	59	172	194	213	233
C4	1	8	Gamkalle	Zongo	19.9	3,661	3,905	4,454	4,848	137	146	167	182	51	54	61	67	22	24	27	29	88	93	106	115
C4	1	9	Gamkalle	Maourey	15.2	3,581	3,721	3,838	3,991	134	140	144	150	49	51	53	55	22	22	23	24	85	88	91	94
C4	1	10	Gamkalle	Gandacthe	13.2	5,252	4,933	4,506	3,867	197	185	169	145	72	67	62	53	31	29	27	23	122	115	105	91
C4	1	11	Gamkalle	Deizebon	19.1	7,406	7,104	6,489	5,569	278	266	243	209	101	97	89	77	44	42	38	33	172	165	151	131
C4	1	12	Gamkalle	Gounrty Yena	60.5	0	0	0	0	375	425	470	516	139	157	173	190	62	70	76	83	242	272	299	327
C4	2	53	Gamkalle	Terminus	75.4	3,941	3,916	3,884	3,889	148	147	146	146	58	58	58	58	29	29	29	29	111	110	109	109
C4	2	54	Gamkalle	Niamey Bas	61.8	1,176	1,212	1,202	1,203	44	46	45	45	20	21	20	20	13	13	13	13	44	45	45	45
C4	2	55	Gamkalle	Grand Marche	6.9	0	0	0	0	39	44	49	54	15	16	18	20	7	7	8	9	25	28	31	34
C4	2		Gamkalle	Kalley Centre	8.2	1,561	1,604	1,591	1,593	59	60	60	60	22	22	22	22	10	10	10	10	38	38	38	38
C4	2	57	Gamkalle	Kalley Est	49.2	10,881	11,096	11,482	11,976	408	416	431	449	150	153	159	165	66	67	69	72	259	264	273	284
C4	2	58	Gamkalle	Kalley Sud	34.7	6,725	6,813	7,432	8,118	252	256	279	305	93	95	103	112	41	42	45	49	161	164	177	193
C4	2	59	Gamkalle	Lacouroussou	16.4	4,125	4,171	4,136	4,142	155	157	155	155	57	58	57	57	25	25	25	25	98	99	98	98
C4	2	60	Gamkalle	Banizoumbou I	23.9	4,988	5,157	5,346	5,820	187	194	200	218	69	71	74	80	30	31	32	35	119	123	127	138
C4	2	61	Gamkalle	Abidjan	36.9	7,026	7,237	7,896	8,625	263	272	296	323	97	100	109	119	43	44	48	52	168	174	188	204
C4	2	62	Gamkalle	Sabongari	25.0	4,390	4,987	5,687	6,190	165	187	213	233	61	69	78	86	27	30	34	37	106	119	135	147
C4	2	63	Gamkalle	Nouveau Marche	48.8	8,355	9,575	10,920	11,885	314	359	410	446	116	133	151	164	52	59	66	72	202	229	260	282
C4	2	64	Gamkalle	Cimetiere Musulman	22.7	0	0	0	0	141	160	176	194	52	59	65	71	23	26	29	31	91	103	112	123
C4	2	65	Gamkalle	SMB	30.3	0	0	0	0	188	213	235	258	70	79	87	95	31	35	38	42	122	137	150	164
C4	2	66	Gamkalle	Caserne Bagagiya	34.6	0	0	0	0	219	248	274	301	81	92	101	111	36	41	44	48	141	159	174	191
C4	2	67	Gamkalle	Ecole de Police	46.9	0	0	0	0	290	328	362	398	108	121	134	146	48	54	59	64	188	210	231	252
C4	2	68	Gamkalle	Caserne Garba Hass	51.5	0	0	0	0	320	364	401	441	119	135	148	162	53	60	65	71	207	233	255	279
C4	2	69	Gamkalle	Cite Faycal	29.5	1,708	1,738	1,724	1,726	64	65	65	65	25	25	25	25	12	13	13	13	47	47	47	47
C4	2	75	Gamkalle	Gamkalle Sabanguy	67.2	13,437	13,179	13,070	13,087	504	494	491	491	186	182	181	181	82	81	80	80	322	316	314	314
Sub-Total					840.4	88,213	90,348	93,657	96,529	5,148	5,475	5,815	6,152	1,910	2,027	2,151	2,271	853	904	952	1,003	3,330	3,525	3,729	3,933
S1	1	1	Yantala	Plateau I	66.4	1,884	1,955	1,938	1,941	71	74	73	73	30	31	31	31	17	17	17	17	62	64	63	63
S1	1	2	Yantala	Ambassades	121.0	1,467	1,424	1,412	1,414	55	53	53	53	28	27	27	27	20	20	20	20	68	67	67	67
S1	1	7	Yantala	Casernes	23.2	0	0	0	0	141	160	176	194	52	59	65	71	23	26	29	31	91	103	112	123
S1	1	20	Yantala	Plateau II	121.1	10,690	10,685	10,595	10,609	401	401	397	398	153	153	151	152	72	72	71	71	275	275	273	274
S1	1	21	Yantala	Yantala	59.0	22,478	21,396	20,644	20,098	843	803	774	754	307	293	283	275	132	126	122	119	523	499	481	469
S1	1	22	Yantala	SNE	28.7	0	0	0	0	180	204	225	248	67	75	83	91	30	33	37	40	116	131	143	157
S1	1	23	Yantala	Goudel	83.5	14,116	14,733	16,235	16,256	530	553	609	610	196	205	225	225	88	91	99	100	342	356	389	390
S1	1	24	Yantala	Kouara Kano	33.5	626	657	651	652	23	25	25	25	11	11	11	11	7	7	7	7	23	25	25	25
S1	1	30	Yantala	Yantala Haut	34.0	4,242	4,166	4,132	4,137	159	156	155	155	60	58	58	58	27	27	27	27	105	103	103	103
Sub-Total					570.4	55,503	55,016	55,607	55,107	2,403	2,429	2,487	2,510	904	912	934	941	416	419	429	432	1,605	1,623	1,656	1,671
S2	1	24	Kouara Kano	Kouara Kano	134.0	2,502	2,627	2,605	2,609	94	98	98	98	43	44	44	44	27	28	28	28	95	97	97	97
S2	1	25	Kouara Kano	Ext. Kouara Kano	89.1	4,656	4,370	4,334	4,340	175	164	163	163	69	65	65	65	35	33	33	33	131	124	123	123
S2	1	30	Kouara Kano	Yantala Haut	51.0	6,362	6,249	6,197	6,206	239	235	233	233	90	88	87	87	41	40	40	40	158	156	154	154
S1	1	38	Kouara Kano	Cimetiere	55.2	0	0	0	0	344	390	430	473	128	144	159	174	57	64	70	76	222	250	274	300
S1	1	48	Kouara Kano	SONUCI	60.6	863	2,973	4,717	5,904	32	112	177	221	16	44	68	84	11	23	32	39	37	85	124	150
Sub-Total					389.9	14,383	16,219	17,853	19,059	884	999	1,101	1,188	346	385	423	454	171	188	203	216	643	712	772	824

Inlet Volume

TD	CU	ID	Treatment District	Administration Quartier	Area (ha)	Population (2000)	Population (2005)	Population (2010)	Population (2015)	Wastewater Flow (2000)	Wastewater Flow (2005)	Wastewater Flow (2010)	Wastewater Flow (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
S3	1	28	Dar Es Salam	Dar Es Salam	286.0	23,395	33,648	38,929	50,118	878	1,262	1,460	1,880	336	474	545	696	159	217	246	309	609	840	958	1,210
S3	1	29	Dar Es Salam	ORTN	68.4	0	0	0	0	422	479	528	581	157	177	195	214	70	78	86	94	273	307	336	368
S3	1	30	Dar Es Salam	Yantala Haut	85.0	10,604	10,416	10,329	10,342	398	391	387	388	149	147	145	145	68	67	66	66	263	259	257	257
S3	1	37	Dar Es Salam	Baghdad	164.0	8,812	16,079	22,324	28,740	331	603	837	1,078	130	228	312	399	65	106	141	177	246	409	549	694
S3	1	39	Dar Es Salam	OPVN	25.5	0	0	0	0	156	177	196	215	58	65	72	79	26	29	32	35	101	114	125	136
S3	1	49	Dar Es Salam	Koura Kano Nord	81.9	1,166	4,015	6,371	8,773	44	151	239	329	21	60	92	124	14	31	44	57	50	114	167	221
Sub-Total					710.8	43,977	64,158	77,953	97,973	2,229	3,063	3,647	4,471	851	1,151	1,361	1,657	402	528	615	738	1,542	2,043	2,392	2,886
S4	1	26	Kouara Me	Courronne Nord	58.4	7,332	8,584	10,214	11,364	275	322	383	426	103	120	142	157	47	54	63	70	182	210	247	272
S4	1	27	Kouara Me	Kouara Me	147.2	15,912	20,203	21,466	25,793	597	758	805	968	225	283	300	358	104	128	135	159	401	497	525	623
S4	1	31	Kouara Me	Bani Fandou I	104.4	17,152	20,474	20,304	20,331	644	768	761	763	239	284	281	282	107	125	124	124	416	491	487	488
S4	1	32	Kouara Me	Cite CNSS	18.5	2,166	2,720	2,697	2,701	81	102	101	101	30	38	38	38	14	17	17	17	54	67	66	66
S4	1	33	Kouara Me	Bani Fandou II	121.2	16,871	19,011	21,209	23,598	633	713	795	885	236	265	294	327	107	119	131	144	415	463	512	566
S4	1	34	Kouara Me	Hopital Lazaret	37.5	0	0	0	0	235	266	293	323	87	98	108	119	39	44	48	52	152	170	187	205
S4	1	35	Kouara Me	Lazaret	153.3	29,911	30,071	29,821	29,860	1,122	1,128	1,118	1,120	414	417	413	414	183	184	182	183	717	721	715	716
S4	1	36	Kouara Me	Banizoumbou II	119.6	6,809	11,724	13,952	20,955	255	440	524	786	100	167	197	291	50	77	90	129	187	298	349	506
S4	1	40	Kouara Me	Faisceau	17.4	0	0	0	0	110	124	137	151	41	46	51	56	18	20	22	24	71	79	87	96
Sub-Total					777.5	96,153	112,787	119,663	134,602	3,952	4,621	4,917	5,523	1,475	1,718	1,824	2,042	669	768	812	902	2,595	2,996	3,175	3,538
S5	2	71	Bani Fandou II	Mosquee	36.7	0	0	0	0	227	257	284	312	84	95	105	115	38	42	46	50	147	165	181	198
S5	2	72	Bani Fandou II	Madina	110.4	17,074	19,486	20,397	21,499	641	731	765	806	238	271	283	298	107	120	125	131	416	470	491	515
S5	2	73	Bani Fandou II	Route de Filingue	206.9	27,485	30,425	36,206	40,283	1,031	1,141	1,358	1,511	385	425	503	558	175	191	224	247	678	744	874	966
S5	2	74	Bani Fandou II	Ext. Route de Flingu	161.7	19,014	23,782	28,301	31,487	713	892	1,061	1,181	268	332	393	436	122	149	175	193	474	582	683	755
Sub-Total					515.7	63,573	73,693	84,904	93,269	2,612	3,021	3,468	3,810	975	1,123	1,284	1,407	442	502	570	621	1,715	1,961	2,229	2,434
S6	2	62	Talladje Koado	Sabongari	38.6	6,584	7,480	8,531	9,285	247	281	320	348	92	104	118	128	41	46	52	56	159	180	203	220
S6	2	70	Talladje Koado	Poudriere	185.7	13,055	12,745	12,639	12,656	490	478	474	475	189	185	183	184	91	90	89	89	347	340	338	338
S6	2	77	Talladje Koado	Hippodrome	60.0	0	0	0	0	375	425	470	516	139	157	173	190	62	70	76	83	242	272	299	327
S6	2	79	Talladje Koado	Talladje	164.4	27,826	32,232	31,964	32,006	1,043	1,209	1,199	1,200	387	446	443	443	172	197	196	196	673	773	767	767
Sub-Total					448.7	47,465	52,457	53,134	53,947	2,155	2,393	2,463	2,539	807	892	917	945	366	403	413	424	1,421	1,565	1,607	1,652
S7	2	76	Industrielle	Gamkalle Golleye	37.9	7,033	7,438	7,376	7,386	264	279	277	277	98	103	102	102	43	45	45	45	169	178	177	177
S7	2	78	Industrielle	Zone Industriel	304.1	465	0	0	0	1,602	1,727	1,870	2,045	597	642	694	757	269	288	310	336	1,049	1,124	1,210	1,315
Sub-Total					342.0	7,498	7,438	7,376	7,386	1,866	2,006	2,147	2,322	695	745	796	859	312	333	355	381	1,218	1,302	1,387	1,492
S8	3	87	Karadje	Lamorde	53.2	5,718	6,263	7,245	8,292	215	235	272	311	81	88	102	116	37	40	46	52	144	156	179	202
S8	3	88	Karadje	Nogare	34.9	4,024	4,109	4,755	5,441	151	154	179	204	57	58	67	76	26	26	30	34	101	102	117	132
S8	3	90	Karadje	University	186.6	0	0	0	0	1,164	1,321	1,455	1,602	432	488	536	589	193	216	236	258	752	846	927	1,015
S8	3	91	Karadje	Karadje	160.4	18,771	23,585	28,066	31,226	704	884	1,052	1,171	264	329	390	432	121	148	173	191	469	577	677	749
Sub-Total					435.1	28,513	33,957	40,066	44,959	2,234	2,594	2,958	3,288	834	963	1,095	1,213	377	430	485	535	1,466	1,681	1,900	2,098
S9	3	89	Gaweye	Agrhymet	135.1	0	0	0	0	845	957	1,056	1,162	313	354	389	428	140	157	171	187	546	613	673	736
Sub-Total					135.1	0	0	0	0	845	957	1,056	1,162	313	354	389	428	140	157	171	187	546	613	673	736
S10	3	92	Banga Bana	Pont Kennedy	37.3	5,361	5,481	6,523	7,257	201	206	245	272	75	77	91	100	34	34	40	44	131	134	158	174
S10	3	93	Banga Bana	Gawaye	44.5	5,646	6,547	7,792	8,668	212	245	293	325	79	91	109	120	36	41	48	53	140	160	189	208
S10	3	94	Banga Bana	Kirkissoye	25.6	4,612	5,031	4,987	4,999	173	189	187	188	64	70	69	69	28	31	31	31	111	121	120	120
S10	3	95	Banga Bana	Ext. Kirkissoye	135.3	16,383	19,901	23,683	26,349	614	746	888	988	230	278	329	365	105	125	146	161	407	487	572	632
S10	3	96	Banga Bana	Banga Bana	208.2	14,866	20,417	30,368	40,544	557	766	1,139	1,520	215	290	424	561	104	135	191	248	394	520	743	972
S10	3	103	Banga Bana	Outlying Villages	0.0	3,031	0	0	0	114	0	0	0	41	0	0	0	17	0	0	0	68	0	0	0
Sub-Total					450.9	49,899	57,377	73,353	87,817	1,871	2,152	2,752	3,293	704	806	1,022	1,215	324	366	456	537	1,251	1,422	1,782	2,106
S11	2	83	Aviatiopn	Airport	661.6	0	0	0	0	790	896	987	1,086	329	368	400	436	182	198	212	226	665	728	783	842
S11	2	84	Aviatiopn	Aviation 1	319.6	16,982	18,801	21,752	23,337	637	705	816	875	251	276	315	337	126	136	153	162	474	515	582	617
S11	2	85	Aviatiopn	Aviation 2	309.6	7,947	9,106	12,040	15,070	298	341	452	566	128	144	184	225	74	81	98	115	268	294	360	429
Sub-Total					1,290.8	24,929	27,907	33,792	38,407	1,725	1,942	2,255	2,527	708	788	899	998	382	415	463	503	1,407	1,537	1,725	1,888
Total					7,628.7	583,025	656,771	722,111	793,701	31,275	35,231	38,739	42,573	11,778	13,202	14,468	15,845	5,426	6,021	6,544	7,118	20,957	23,334	25,440	27,741

Average Inlet Wastewater volume of Each Treatment Plant

TD	Treatment District	Area (ha)	Average Daily Flow (m^3/d)(2000)	Average Daily Flow (m^3/d)(2005)	Average Daily Flow (m^3/d)(2010)	Average Daily Flow (m^3/d) (2015)	COD (kg/d) (2000)	COD (kg/d) (2005)	COD (kg/d) (2010)	COD (kg/d) (2015)	BOD (kg/d) (2000)	BOD (kg/d) (2005)	BOD (kg/d) (2010)	BOD (kg/d) (2015)	SS (kg/d) (2000)	SS (kg/d) (2005)	SS (kg/d) (2010)	SS (kg/d) (2015)
C1	Plateau I	304.1	946	1,020	1,074	1,131	362	388	409	429	171	184	190	200	655	700	733	768
C2	Issa Beri	162.4	659	694	721	753	249	261	271	283	115	120	123	128	442	463	480	499
C3	Deizebon	254.9	1,746	1,865	1,878	1,904	645	689	693	703	286	304	307	311	1,121	1,191	1,200	1,216
C4	Gamkalle	840.4	5,148	5,475	5,815	6,152	1,910	2,027	2,151	2,271	853	904	952	1,003	3,330	3,525	3,729	3,933
S1	Yantala	570.4	2,403	2,429	2,487	2,510	904	912	934	941	416	419	429	432	1,605	1,623	1,656	1,671
S2	Kouara Kano	389.9	884	999	1,101	1,188	346	385	423	454	171	188	203	216	643	712	772	824
S3	Dar Es Salam	710.8	2,229	3,063	3,647	4,471	851	1,151	1,361	1,657	402	528	615	738	1,542	2,043	2,392	2,886
S4	Kouara Me	777.5	3,952	4,621	4,917	5,523	1,475	1,718	1,824	2,042	669	768	812	902	2,595	2,996	3,175	3,538
S5	Bani Fandou II	515.7	2,612	3,021	3,468	3,810	975	1,123	1,284	1,407	442	502	570	621	1,715	1,961	2,229	2,434
S6	Talladje Koado	448.7	2,155	2,393	2,463	2,539	807	892	917	945	366	403	413	424	1,421	1,565	1,607	1,652
S7	Industrielle	342.0	1,866	2,006	2,147	2,322	695	745	796	859	312	333	355	381	1,218	1,302	1,387	1,492
S8	Karadje	435.1	2,234	2,594	2,958	3,288	834	963	1,095	1,213	377	430	485	535	1,466	1,681	1,900	2,098
S9	Gaweye	135.1	845	957	1,056	1,162	313	354	389	428	140	157	171	187	546	613	673	736
S10	Banga Bana	450.9	1,871	2,152	2,752	3,293	704	806	1,022	1,215	324	366	456	537	1,251	1,422	1,782	2,106
S11	Aviation	1,290.8	1,725	1,942	2,255	2,527	708	788	899	998	382	415	463	503	1,407	1,537	1,725	1,888
		7,628.7	31,275	35,231	38,739	42,573	11,778	13,202	14,468	15,845	5,426	6,021	6,544	7,118	20,957	23,334	25,440	27,741

Daily Water Supply	1995	1996	1997	1998	1999	Average	Adopted
①Average Daily Water Supply (m^3/d)	44,297	45,191	47,490	48,485	52,652	47,623	
②Maxumum Daily Water Supply (m^3/d)	53,562	61,558	59,322	61,787	67,800	60,806	
②/①	1.21	1.36	1.25	1.27	1.29	1.28	1.30

Table

TD	Treatment District	Area (ha)	Wastewater Flow (m^3/d)(2000)	Wastewater Flow (m^3/d)(2005)	Wastewater Flow (m^3/d)(2010)	Wastewater Flow (m^3/d) (2015)	COD (mg/l) (2000)	COD (mg/l) (2005)	COD (mg/l) (2010)	COD (mg/l) (2015)	BOD (mg/l) (2000)	BOD (mg/l) (2005)	BOD (mg/l) (2010)	BOD (mg/l) (2015)	SS (mg/l) (2000)	SS (mg/l) (2005)	SS (mg/l) (2010)	SS (mg/l) (2015)
C1	Plateau I	304.1	1,230	1,326	1,396	1,470	383	380	381	379	181	180	177	177	692	686	682	679
C2	Issa Beri	162.4	857	902	937	979	378	376	376	376	175	173	171	170	671	667	666	663
C3	Deizebon	254.9	2,270	2,425	2,441	2,475	369	369	369	369	164	163	163	163	642	639	639	639
C4	Gamkalle	840.4	6,692	7,118	7,560	7,998	371	370	370	369	166	165	164	163	647	644	641	639
S1	Yantala	570.4	3,124	3,158	3,233	3,263	376	375	376	375	173	172	172	172	668	668	666	666
S2	Kouara Kano	389.9	1,149	1,299	1,431	1,544	391	385	384	382	193	188	184	182	727	713	701	694
S3	Dar Es Salam	710.8	2,898	3,982	4,741	5,812	382	376	373	371	180	172	169	165	692	667	656	645
S4	Kouara Me	777.5	5,138	6,007	6,392	7,180	373	372	371	370	169	166	165	163	657	648	646	641
S5	Bani Fandou II	515.7	3,396	3,927	4,508	4,953	373	372	370	369	169	166	164	163	657	649	643	639
S6	Talladje Koado	448.7	2,802	3,111	3,202	3,301	374	373	372	372	170	168	168	167	659	654	652	651
S7	Industrielle	342.0	2,426	2,608	2,791	3,019	372	371	371	370	167	166	165	164	653	649	646	643
S8	Karadje	435.1	2,904	3,372	3,845	4,274	373	371	370	369	169	166	164	163	656	648	642	638
S9	Gaweye	135.1	1,099	1,244	1,373	1,511	370	370	368	368	166	164	162	161	646	641	637	633
S10	Banga Bana	450.9	2,432	2,798	3,578	4,281	376	375	371	369	173	170	166	163	669	661	648	640
S11	Aviatiuon	1,290.8	2,243	2,525	2,932	3,285	410	406	399	395	221	214	205	199	816	791	765	747
		7,628.7	40,658	45,800	50,361	55,345	5,671	5,641	5,621	5,603	2,636	2,593	2,559	2,535	10,152	10,025	9,930	9,857

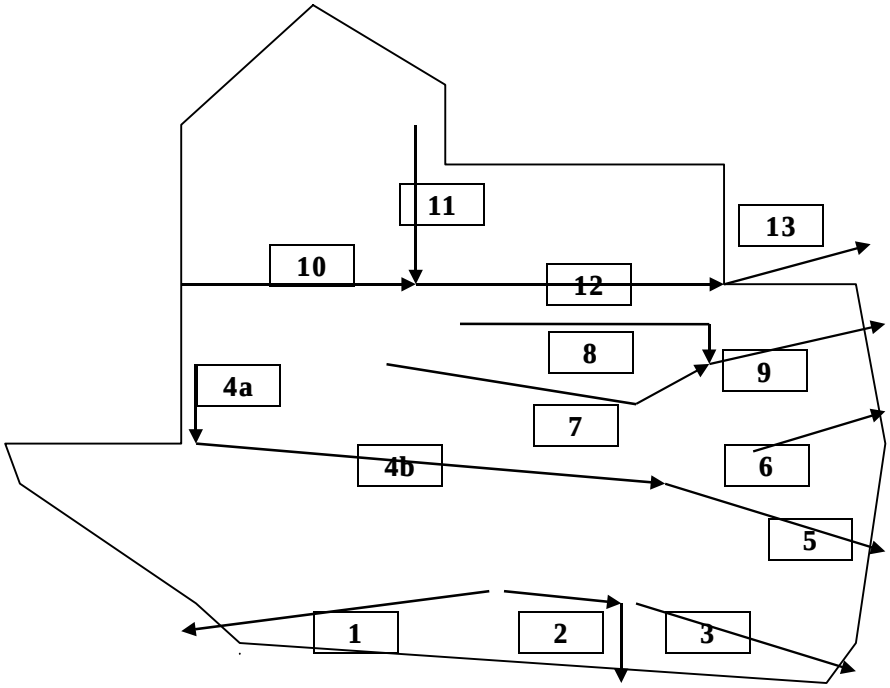
Design Wastewater Flow per Unit Area

TD	Treatment District	Area (ha)	Maximum Daily Flow (m^3/d) (2015)	Design Wastewater Flow per Unit Area (m^3/ha/d) (2015)	Design Wastewater Flow per Unit Area (m^3/ha/min) (2015)	Design Wastewater Flow per Unit Area (m^3/ha/sec) (2015)
C1	Plateau I	304.1	2,036	6.70	0.00465	0.000078
C2	Issa Beri	162.4	1,355	8.34	0.00579	0.000097
C3	Deizebon	254.9	3,427	13.44	0.00933	0.000156
C4	Gamkalle	840.4	11,074	13.18	0.00915	0.000153
S1	Yantala	570.4	4,518	7.92	0.00550	0.000092
S2	Kouara Kano	389.9	2,138	5.48	0.00381	0.000064
S3	Dar Es Salam	710.8	8,048	11.32	0.00786	0.000131
S4	Kouara Me	777.5	9,941	12.79	0.00888	0.000148
S5	Bani Fandou II	515.7	6,858	13.30	0.00924	0.000154
S6	Talladje Koado	448.7	4,570	10.18	0.00707	0.000118
S7	Industrielle	342.0	4,180	12.22	0.00849	0.000142
S8	Karadje	435.1	5,918	13.60	0.00944	0.000157
S9	Gaweye	135.1	2,092	15.48	0.01075	0.000179
S10	Banga Bana	450.9	5,927	13.14	0.00913	0.000152
S11	Aviation	755.7	4,549	6.02	0.00418	0.000070
Total(Average)				10.87	0.00755	0.000126

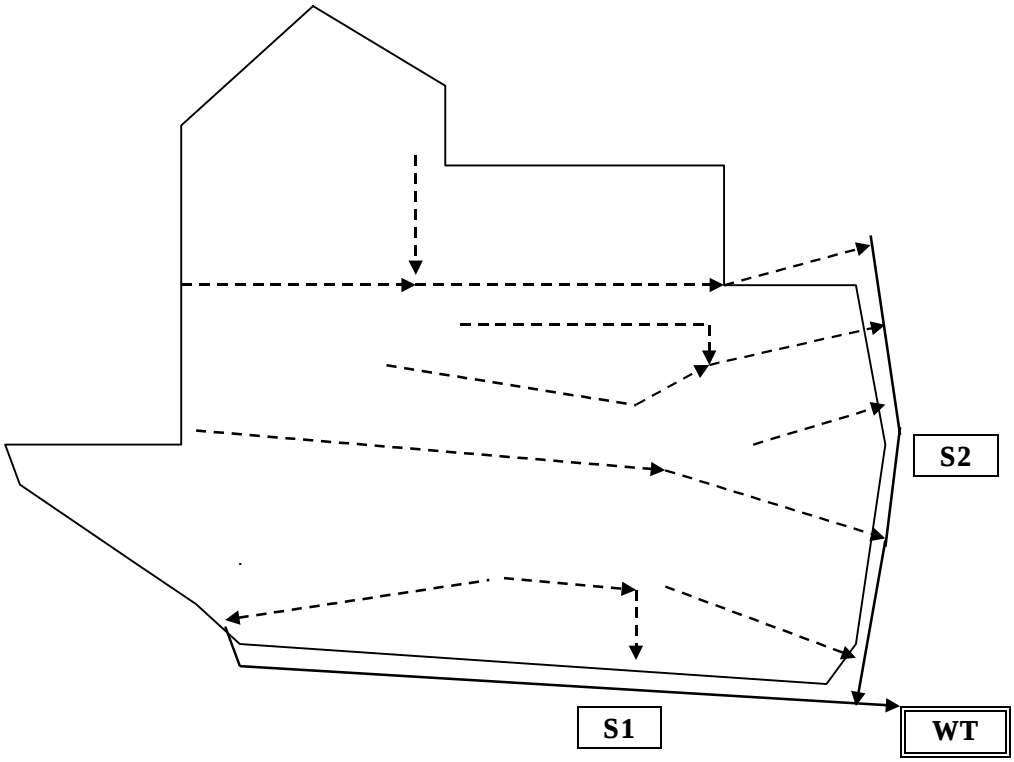
APPENDIX I: SEWERAGE / DRAINAGE FACILITY DESIGN

APPENDIX I.1 DRAINAGE NETWORK DRAWING

DRAINAGE NETWORK DRAWING

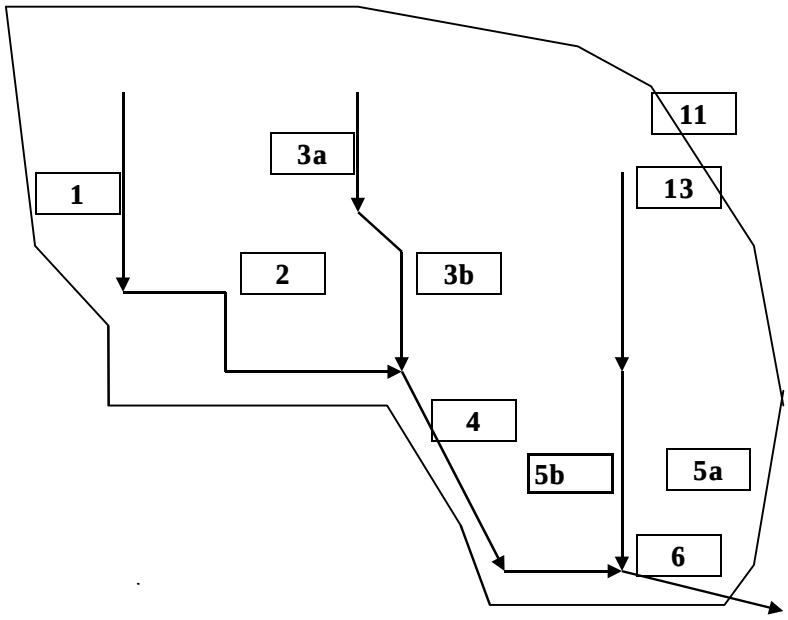


DRAINAGE NETWORK IN C1(PLATEAU Ⅰ) DICTRICT

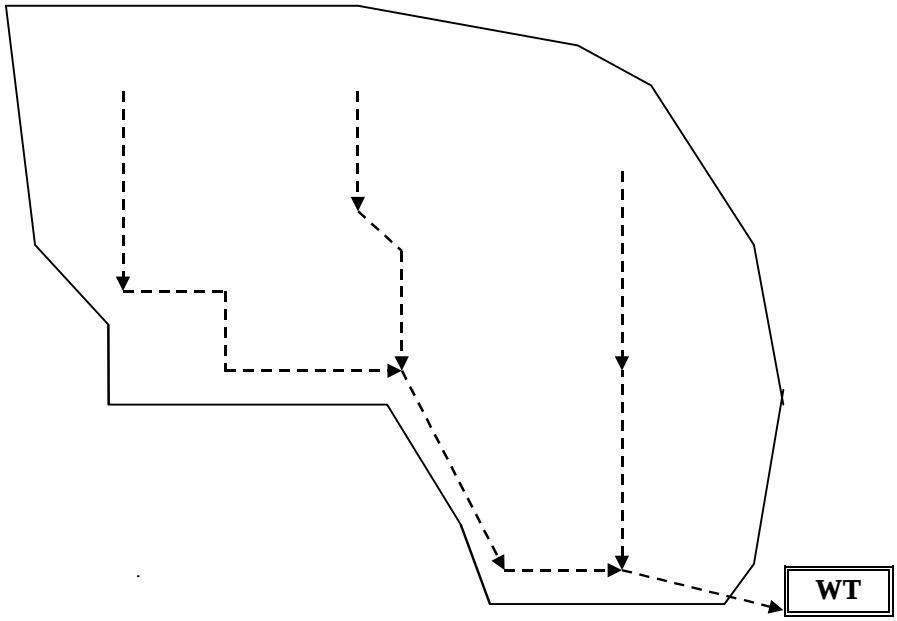


SEWAGE NETWORK IN C1(PLATEAU Ⅰ) DICTRICT

DRAINAGE NETWORK DRAWING

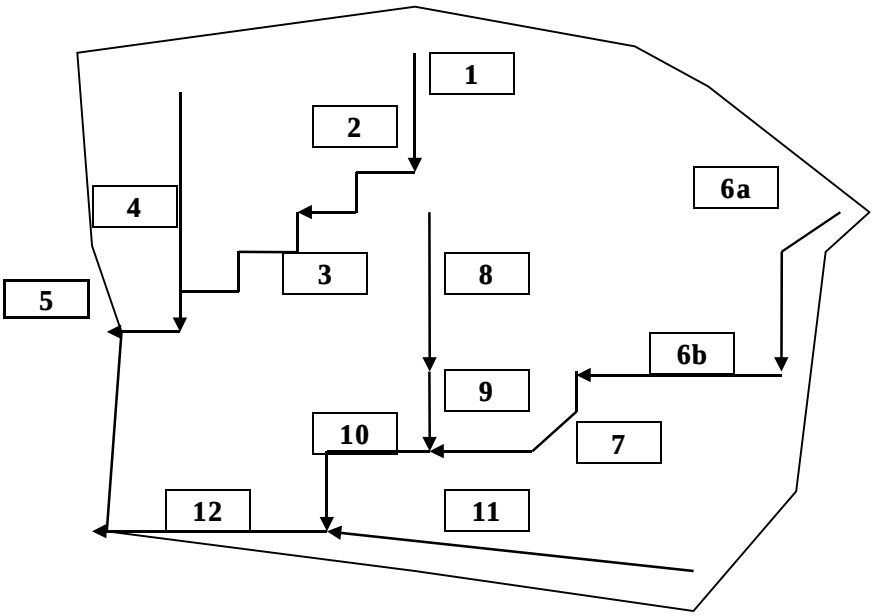


DRAINAGE NETWORK IN C2 (ISSA BERI) DICTRICT

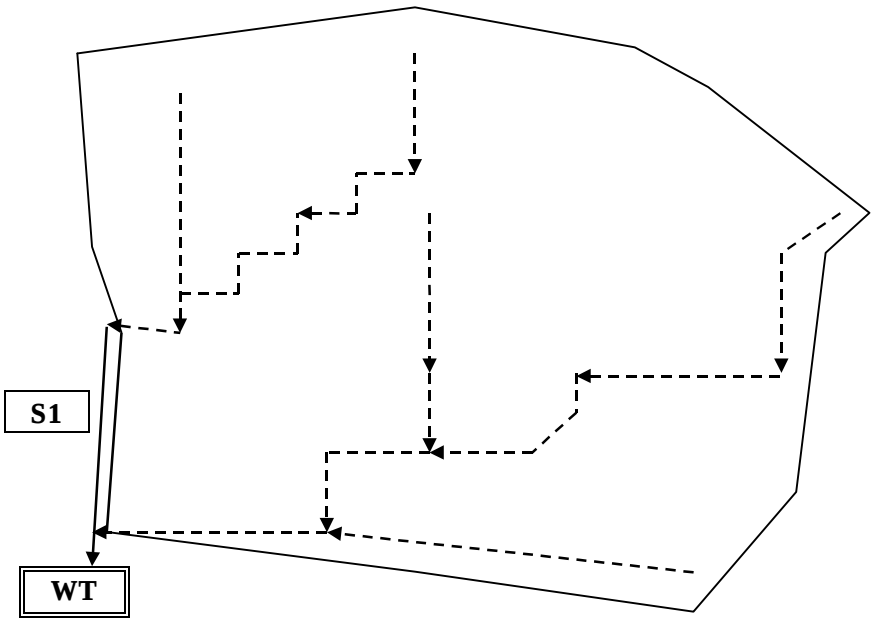


SEWAGE NETWORK IN C2 (ISSA BERI) DICTRICT

DRAINAGE NETWORK DRAWING

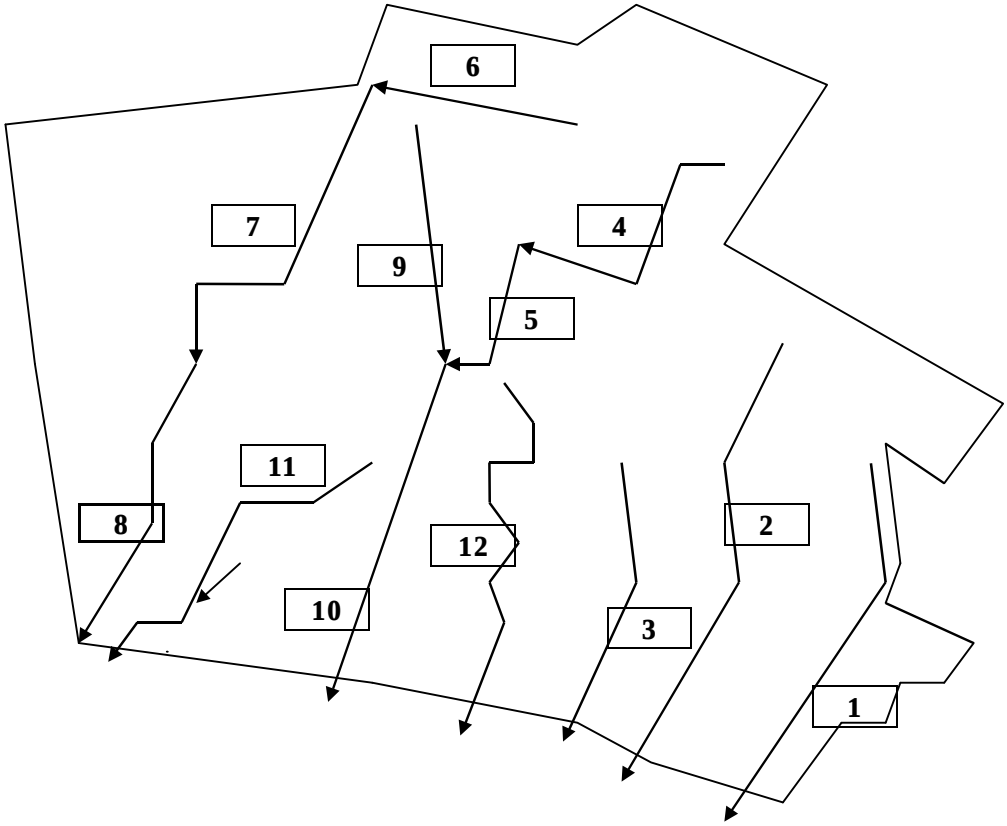


DRAINAGE NETWORK IN C3 (DEIZEBON) DICTRICT

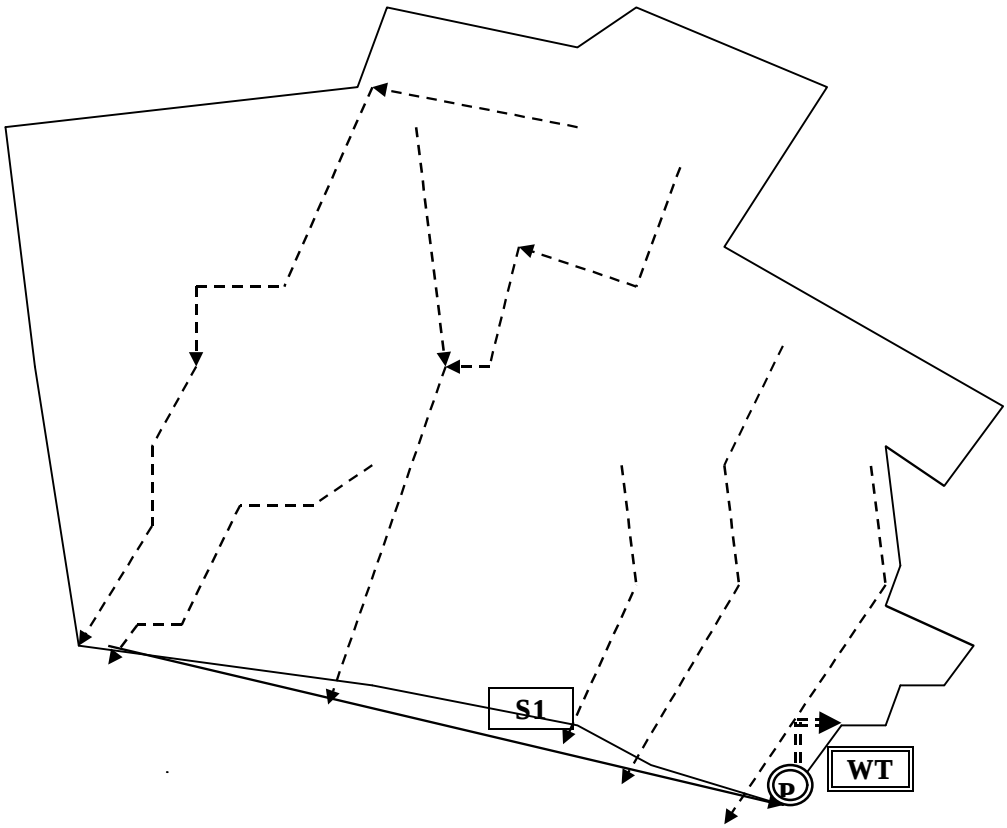


DRAINAGE NETWORK IN C3 (DEIZEBON) DICTRICT

DRAINAGE NETWORK DRAWING

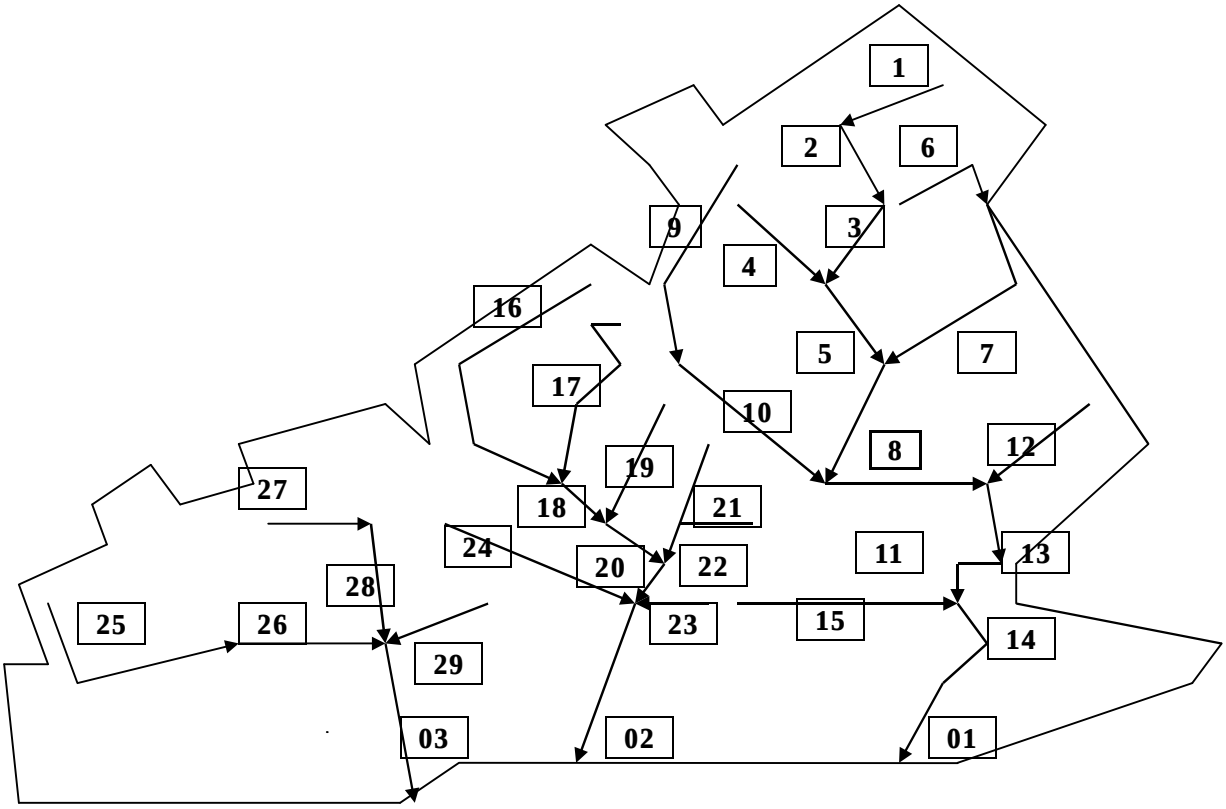


DRAINAGE NETWORK IN C4 (GAMKALLE) DICTRICT

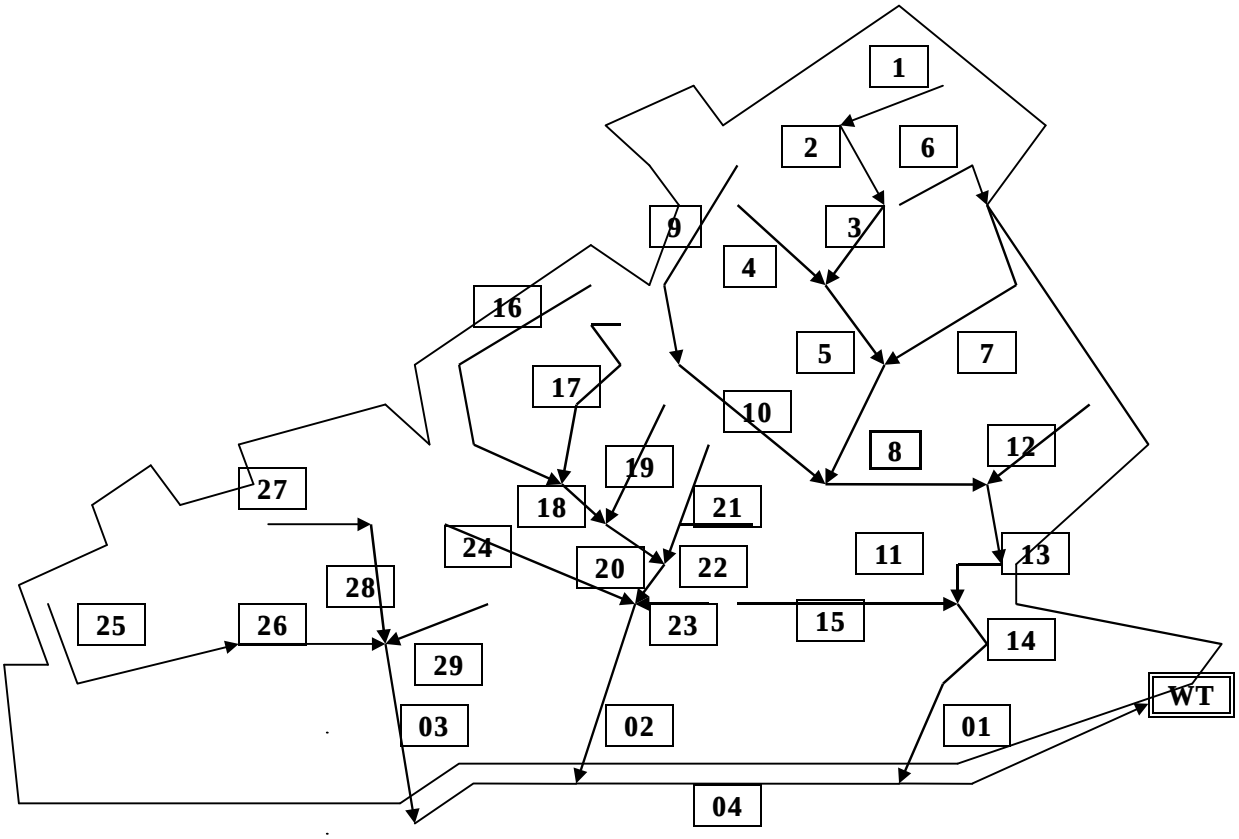


SEWAGE NETWORK IN C4 (GAMKALLE) DICTRICT

DRAINAGE NETWORK DRAWING

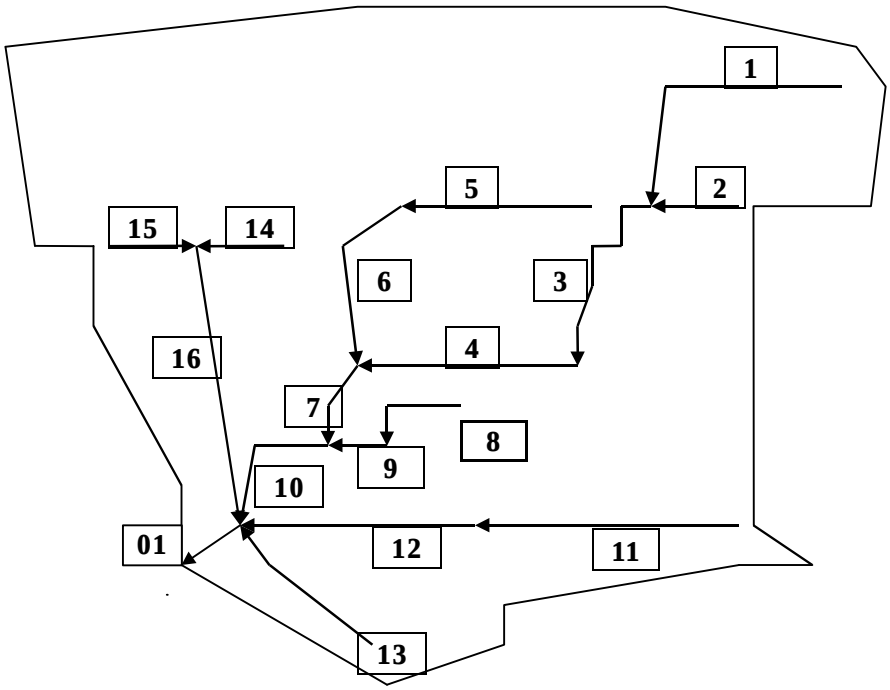


DRAINAGE NETWORK IN S1 (YANTALA) DICTRICT

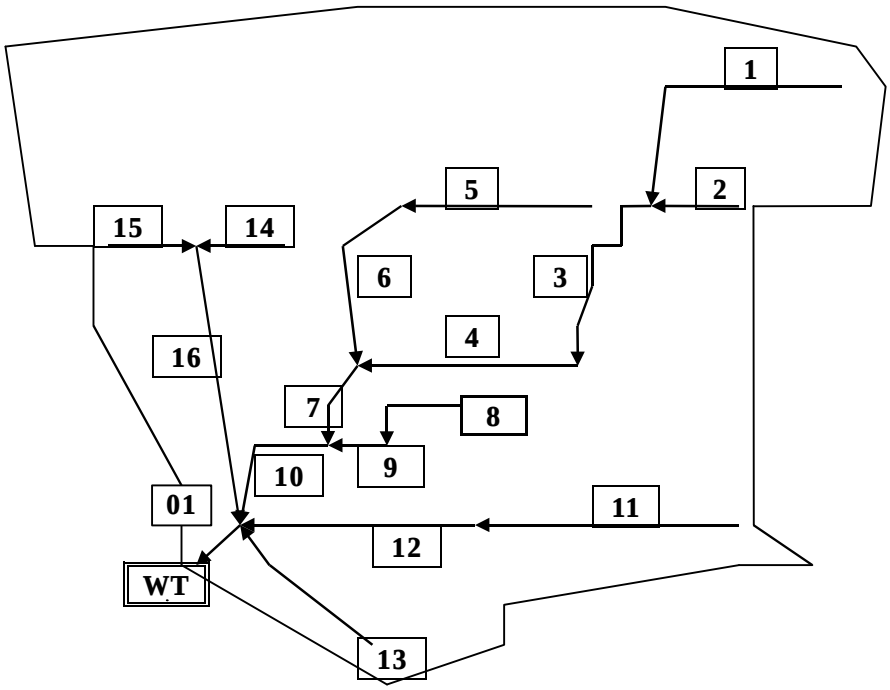


SEWAGE NETWORK IN S1 (YANTALA) DICTRICT

DRAINAGE NETWORK DRAWING

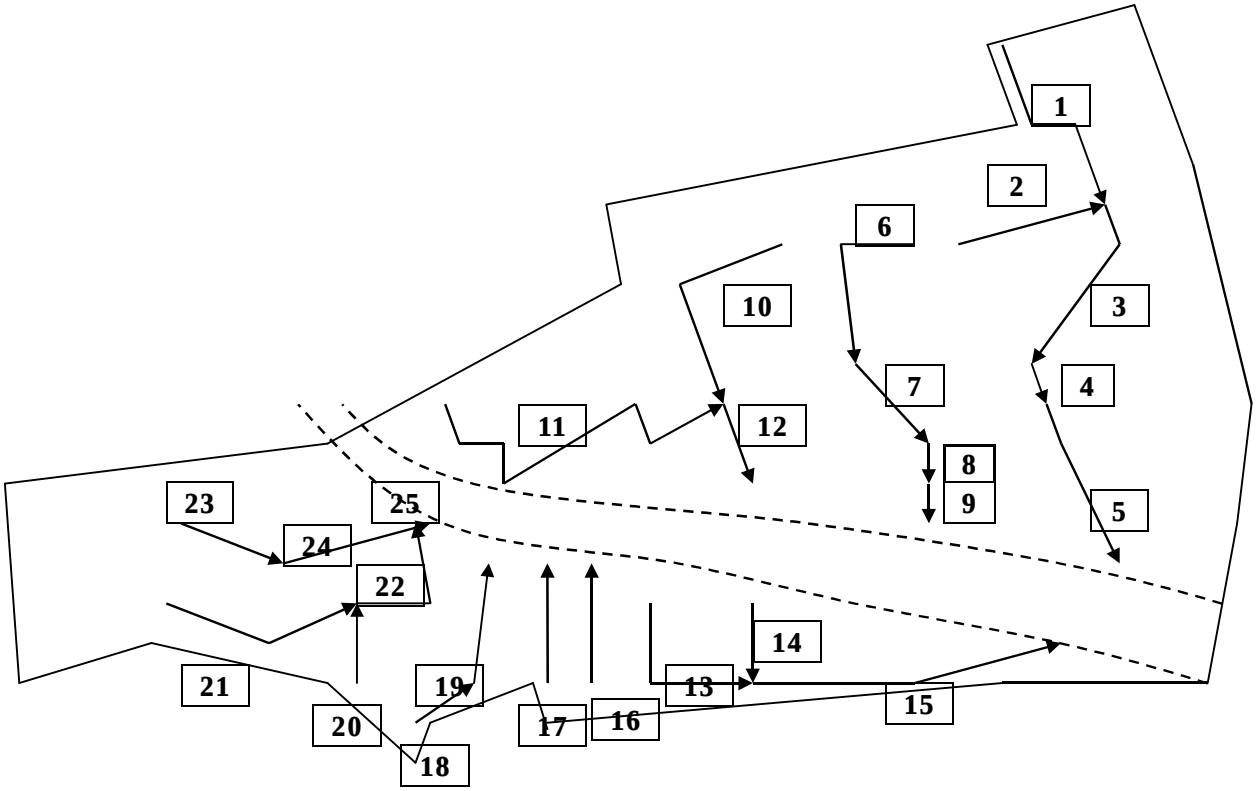


DRAINAGE NETWORK IN S2 (KOUARA KANO) DICTRICT

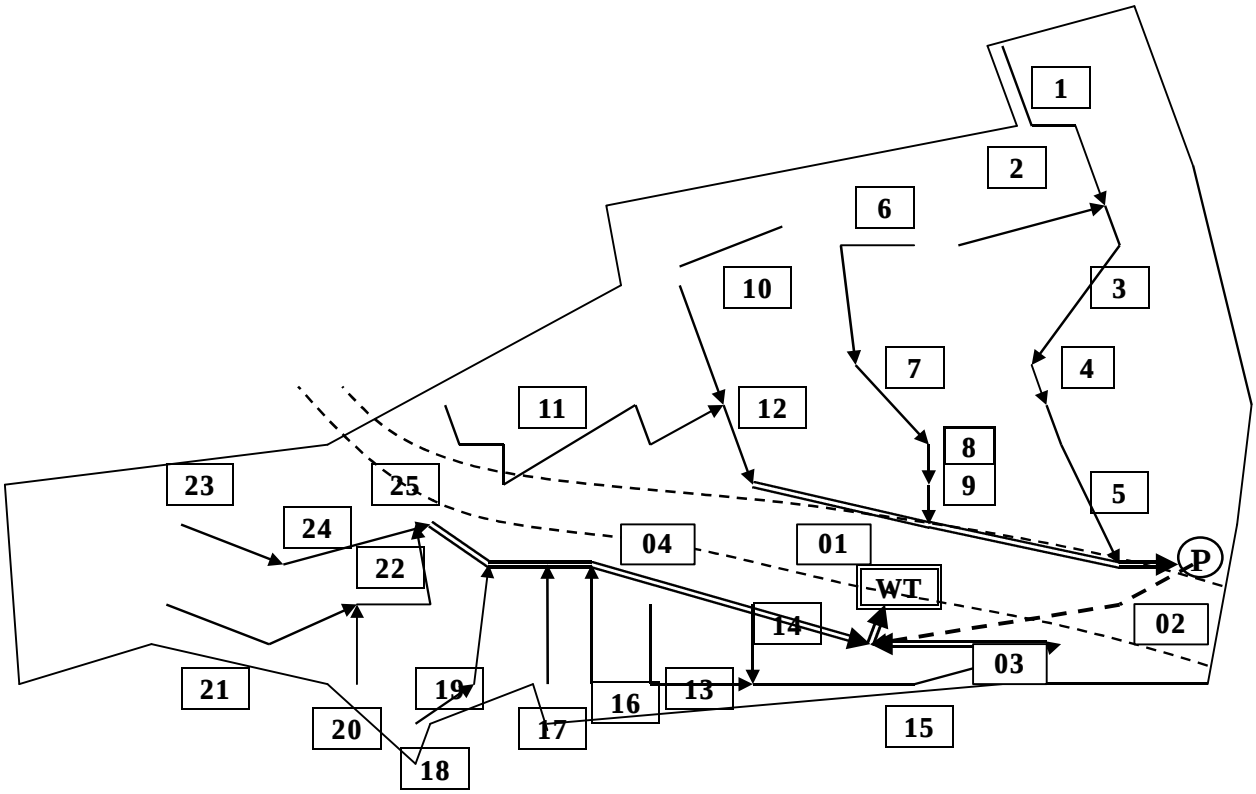


SEWAGE NETWORK IN S2 (KOUARA KANO) DICTRICT

DRAINAGE NETWORK DRAWING

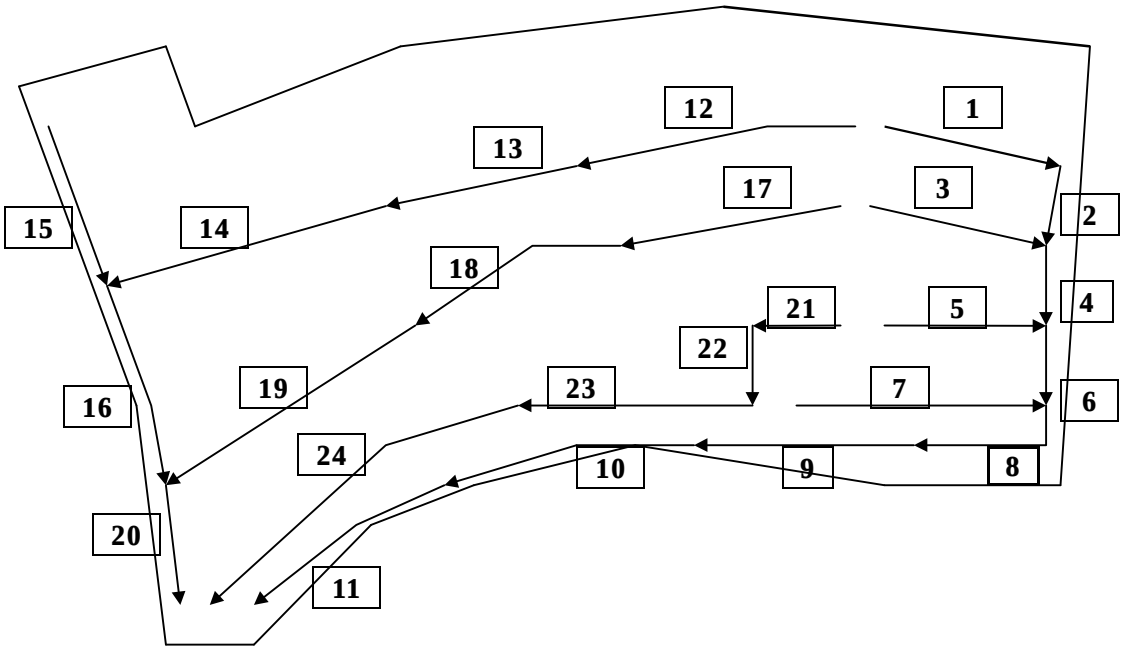


DRAINAGE NETWORK IN S3 (DAR ES SALAM) DICTRICT

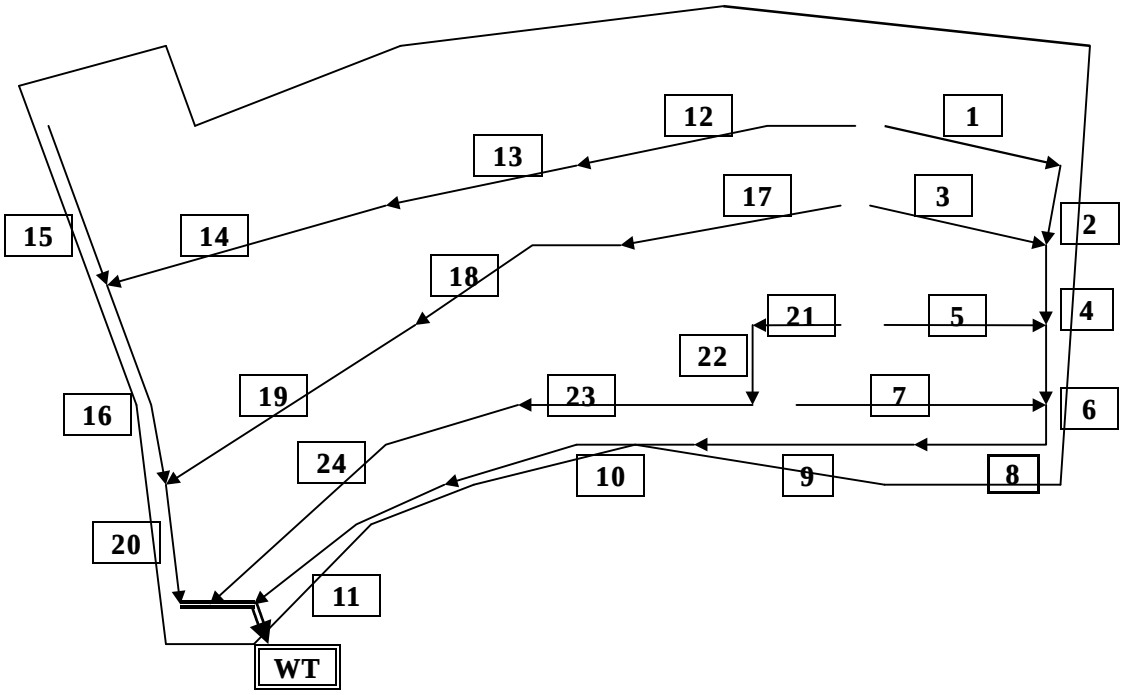


SEWAGE NETWORK IN S3 (DAR ES SALAM) DICTRICT

DRAINAGE NETWORK DRAWING

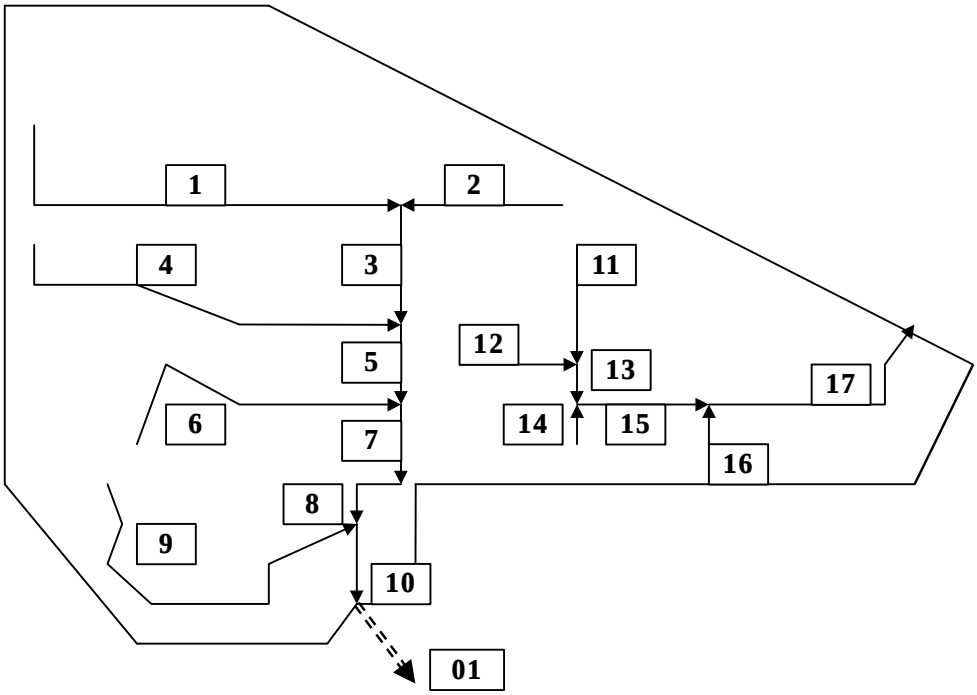


DRAINAGE NETWORK IN S4 (KOUARA ME) DICTRICT

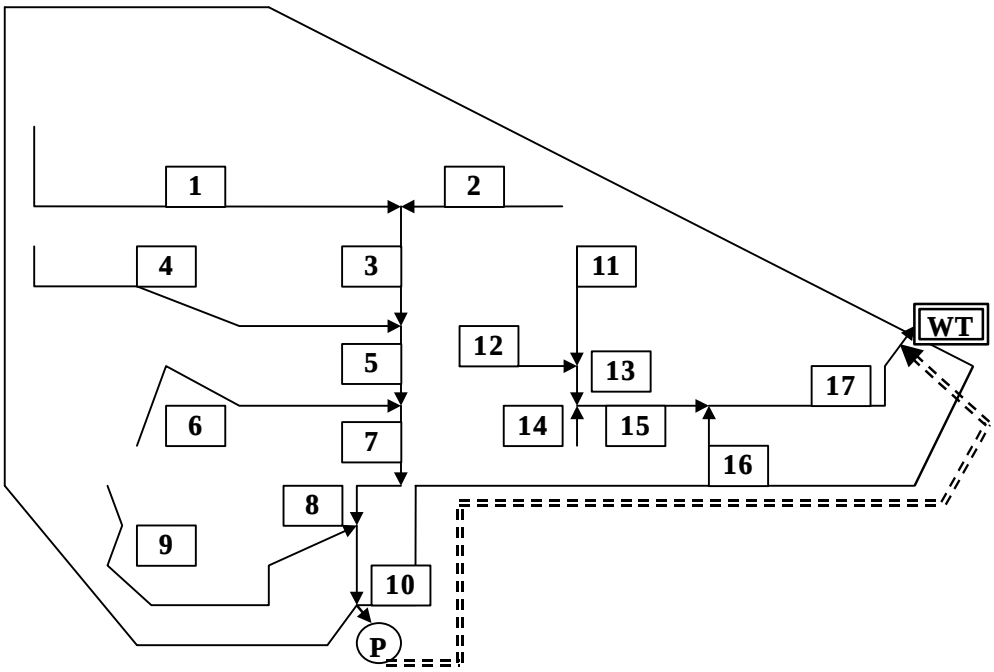


SEWAGE NETWORK IN S4 (KOUARA ME) DICTRICT

DRAINAGE NETWORK DRAWING

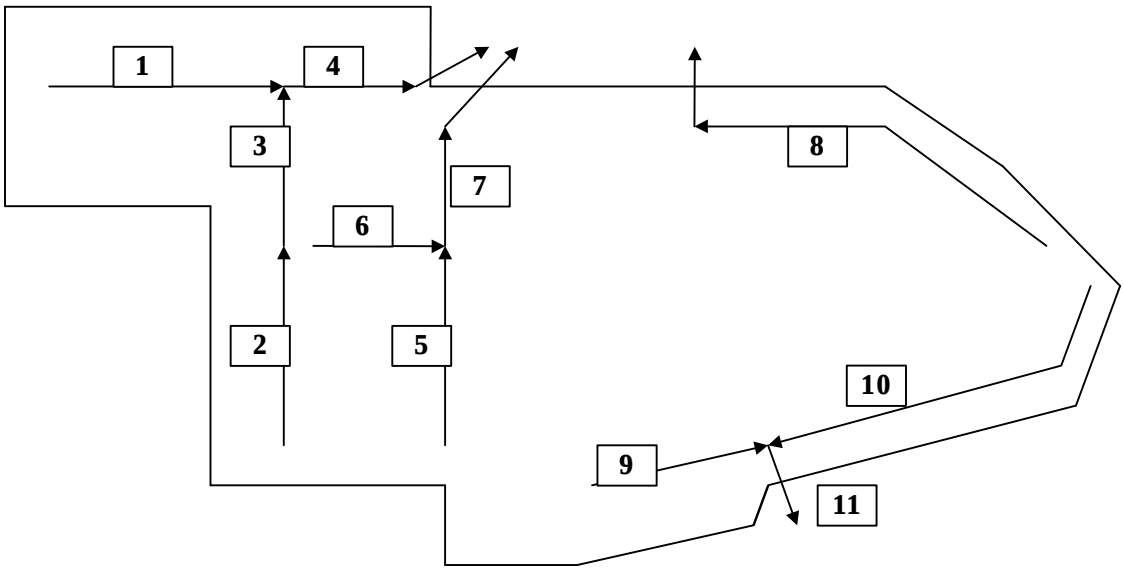


DRAINAGE NETWORK IN S5 (BANI FANDOU Ⅱ) DICTRICT

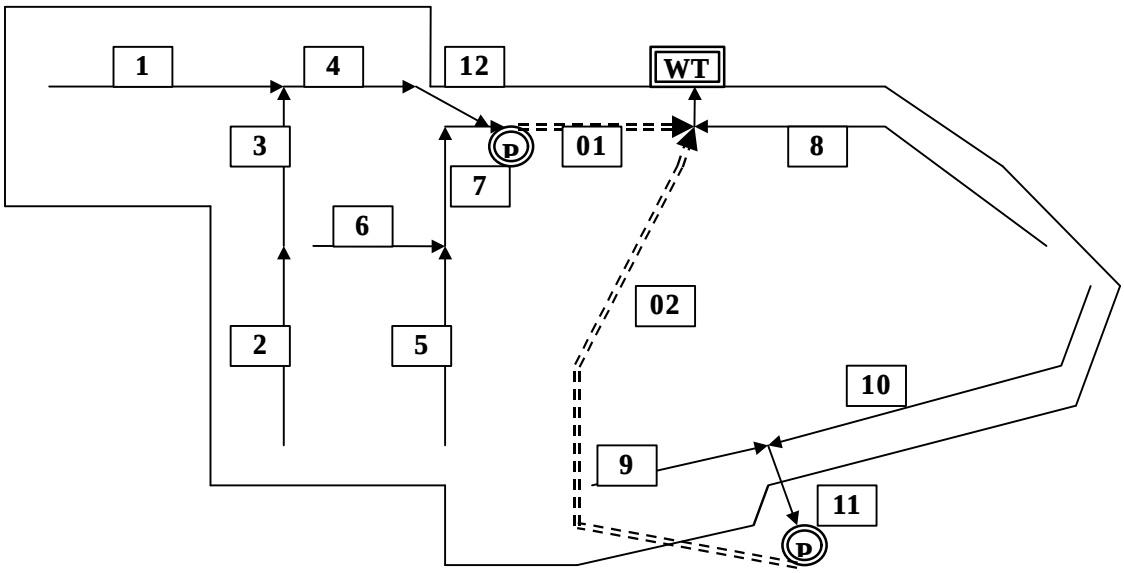


SEWAGE NETWORK IN S5 (BANI FANDOU Ⅱ) DICTRICT

DRAINAGE NETWORK DRAWING

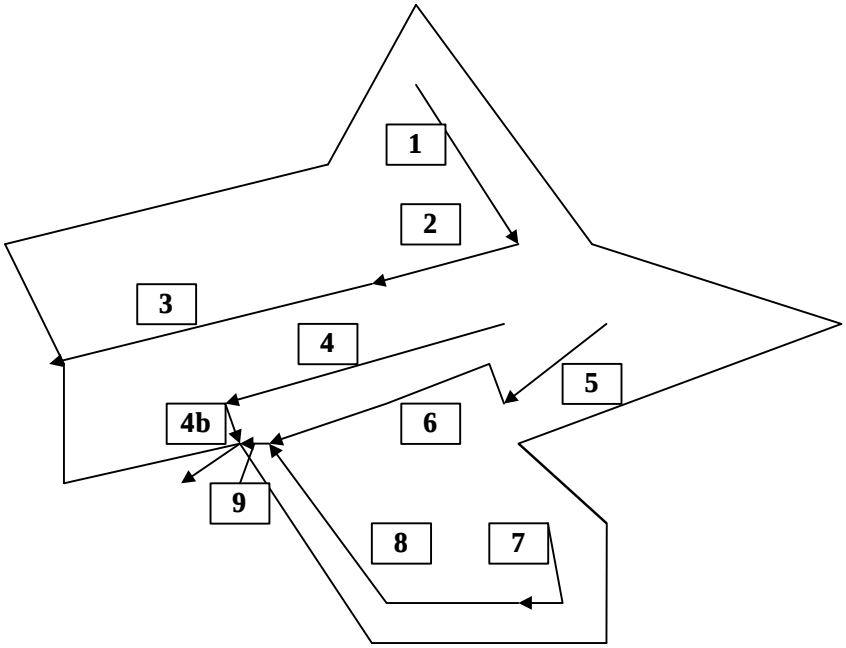


DRAINAGE NETWORK IN S6 (TALLADJE KOADO) DICTRICT

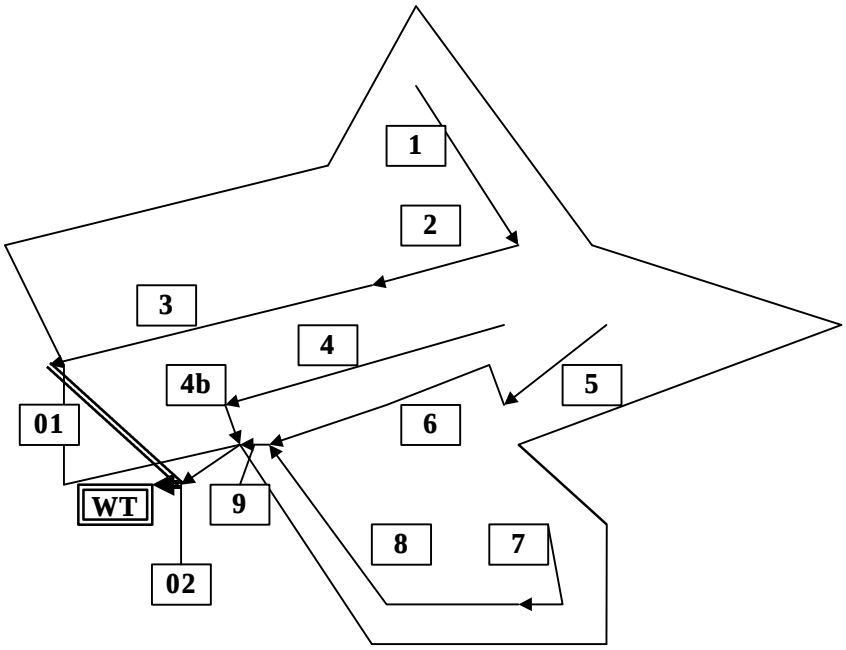


SEWAGE NETWORK IN S6 (TALLADJE KOADO) DICTRICT

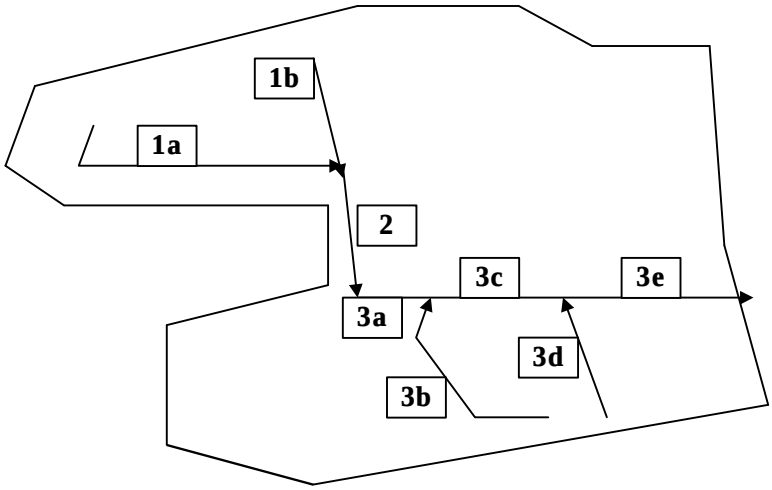
DRAINAGE NETWORK DRAWING



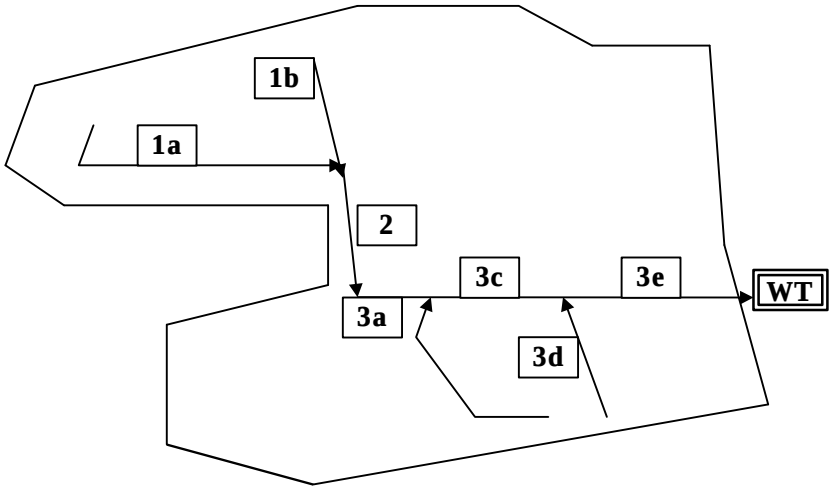
DRAINAGE NETWORK IN S7 (INDUSTRIELLE) DICTRICT



SEWAGE NETWORK IN S7 (INDUSTRIELLE) DICTRICT

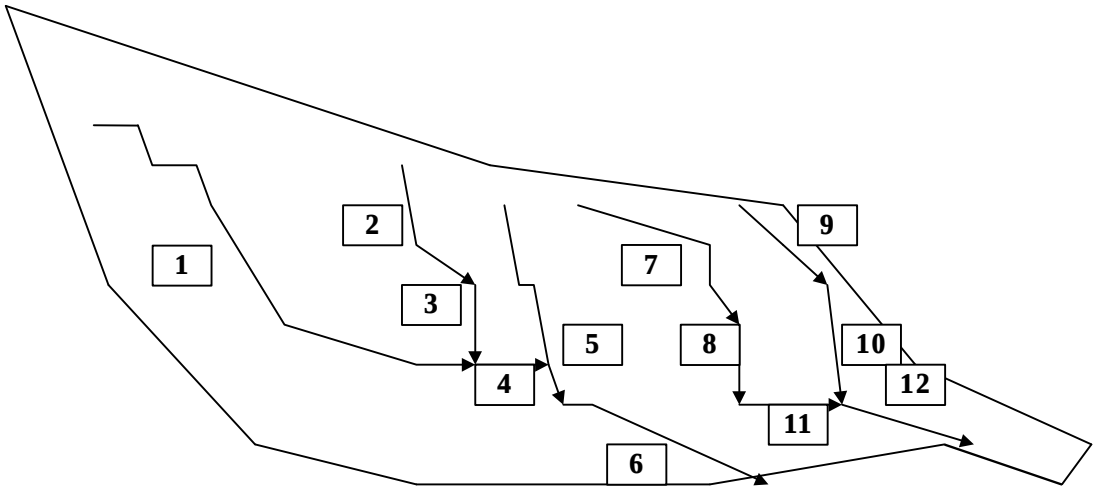


DRAINAGE NETWORK IN S8 (KARADJE) DICTRICT

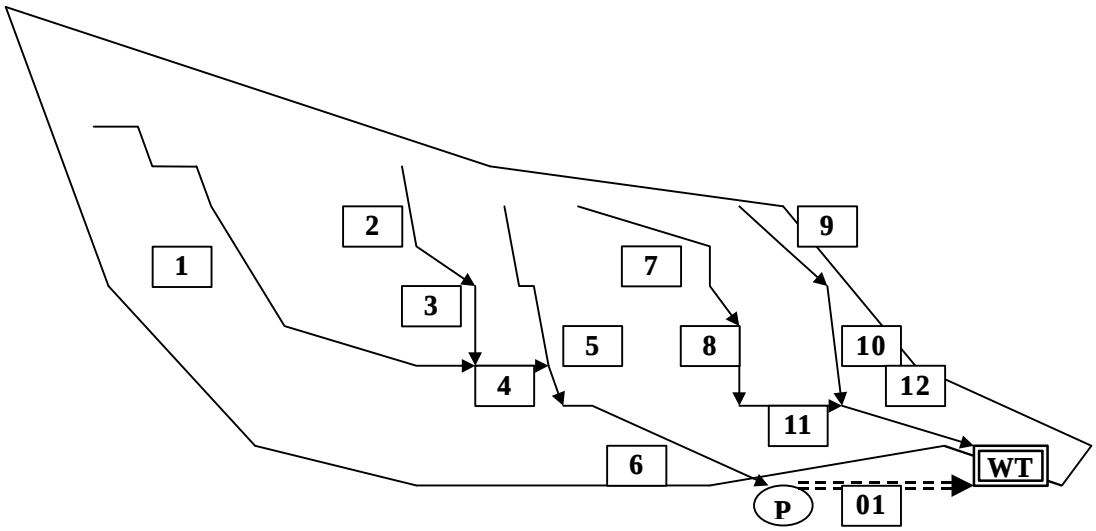


SEWAGE NETWORK IN S8 (KARADJE) DICTRICT

DRAINAGE NETWORK DRAWING

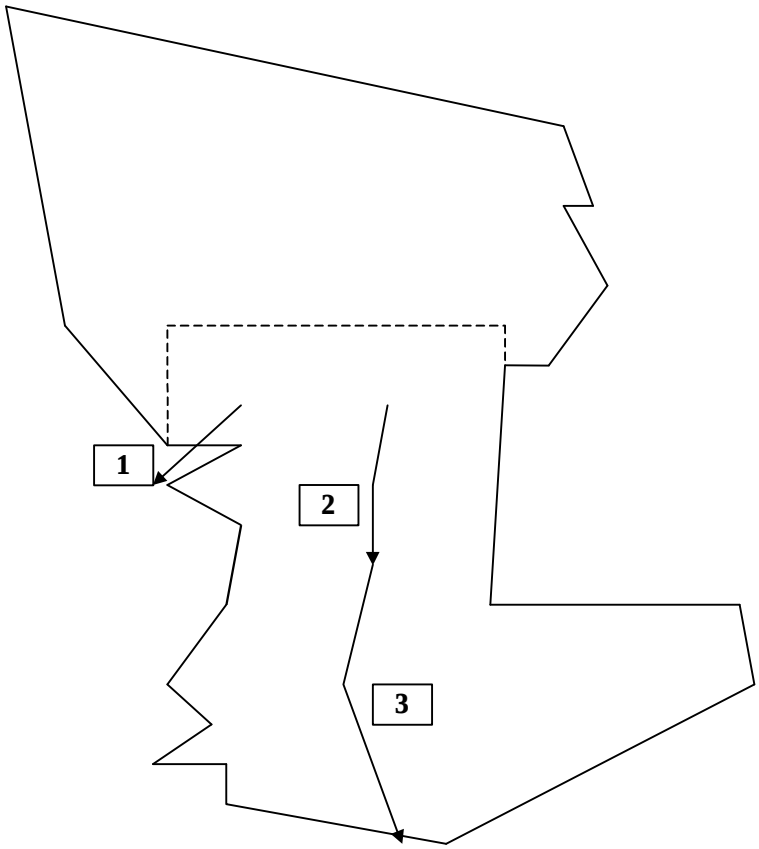


DRAINAGE NETWORK IN S10 (BANGA BANA) DICTRICT

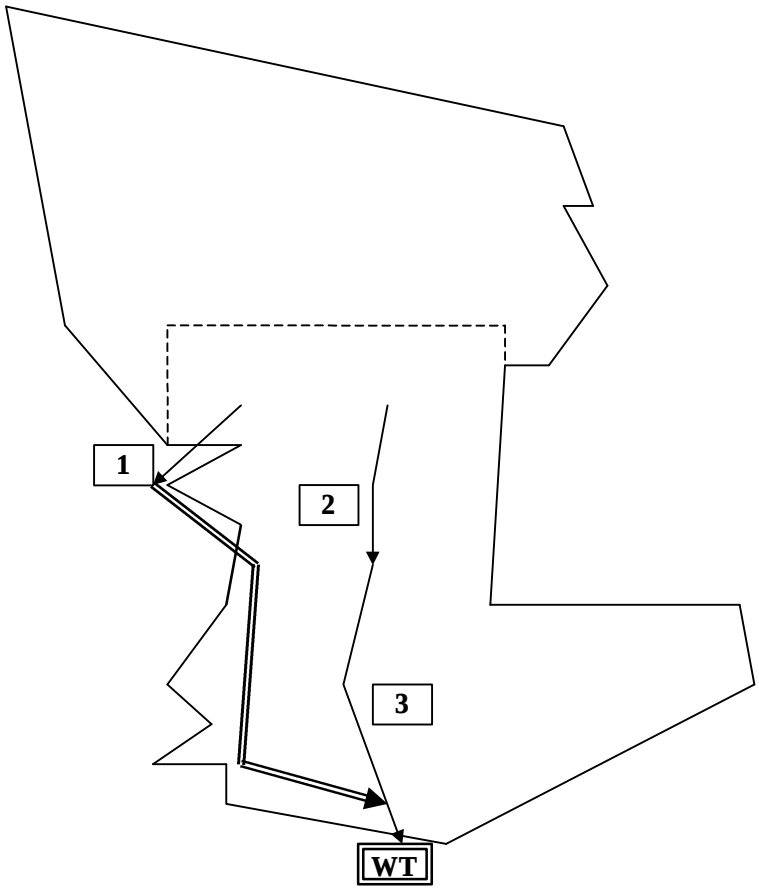


SEWAGE NETWORK IN S10 (BANGA BANA) DICTRICT

DRAINAGE NETWORK DRAWING



DRAINAGE NETWORK IN S11 (AVIATION) DICTRICT



SEWAGE NETWORK IN S11 (AVIATION) DICTRICT

APPENDIX I.2 CALCULATION OF DRAINAGE NETWORK

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	C1	C1	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.35	5 min	7.8E-05 (m^3/sec・ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
1		41.20	41.20			820	820	15.6	0.35	0.0886	3.650	0.003		3.653	U 800 × 600	2.0	1.291	0.558	207.20	205.60	207.80 206.20		Existing
1		41.20	41.20			820	820	11.5	0.35	0.1032	4.252	0.003	(0.558)	3.697	U 1500 × 1500	2.0	2.115	4.283	206.30	204.70	207.80 206.20		Newly Costruct
2		18.40	18.40			370	370	10.3	0.35	0.1091	2.007	0.001		2.008	U 800 × 600	1.6	1.154	0.499	207.20	206.60	207.80 207.20		Existing
2		18.40	18.40			370	370	9.0	0.35	0.1167	2.147	0.001	(0.499)	1.649	U 1200 × 1000	1.6	1.557	1.682	206.80	206.20	207.80 207.20		Newly Costruct
3		24.00	24.00			600	600	7.1	0.35	0.1314	3.154	0.002		3.156	U 700 × 700	27.3	4.702	2.074	206.50	190.10	207.20 190.80		Existing
3		24.00	24.00			600	600	7.4	0.35	0.1287	3.089	0.002	(2.074)	1.017	U 600 × 600	27.3	4.243	1.375	206.60	190.20	207.20 190.80		Newly Costruct
4a		13.30	13.30			390	390	7.7	0.35	0.1261	1.677	0.001		1.678	U 900 × 900	5.1	2.403	1.752	210.90	208.90	211.80 209.80		Newly Costruct
4b	4a	19.70	33.00			1,150	1,540	15.6	0.35	0.0886	2.924	0.003		2.927	U 1200 × 1200	3.5	2.411	3.125	208.60	204.60	209.80 205.80		Newly Costruct
5	4b	11.10	44.10			620	2,160	18.1	0.35	0.0823	3.629	0.003		3.632	U 800 × 700	18.7	4.115	2.074	205.10	193.50	205.80 194.20		Existing
5	4b	11.10	44.10			620	2,160	18.3	0.35	0.0818	3.607	0.003	(2.074)	1.536	U 700 × 700	18.7	3.891	1.716	205.10	193.50	205.80 194.20		Existing
6		11.70	11.70			350	350	8.9	0.35	0.1173	1.372	0.001		1.373	U 500 × 400	4.9	1.503	0.271	204.30	202.60	204.70 203.00		Existing
6		11.70	11.70			350	350	7.7	0.35	0.1261	1.475	0.001	(0.271)	1.205	U 800 × 800	4.9	2.177	1.254	203.90	202.20	204.70 203.00		Newly Costruct
7		11.60	11.60			820	820	9.7	0.35	0.1124	1.304	0.001		1.305	U 800 × 800	8.9	2.935	1.691	211.70	204.40	212.50 205.20		Newly Costruct
8		21.40	21.40			870	870	9.8	0.35	0.1118	2.393	0.002		2.395	U 1000 × 1000	7.1	3.041	2.737	210.40	204.20	211.40 205.20		Newly Costruct
9	7,8	8.80	41.80			250	1,120	12.4	0.35	0.0994	4.155	0.003		4.158	U 500 × 400	5.6	1.607	0.289	204.80	203.40	205.20 203.80		Existing
9	7,8	8.80	41.80			250	1,120	11.1	0.35	0.1051	4.393	0.003	(0.289)	4.107	U 1300 × 1300	5.6	3.217	4.893	203.90	202.50	205.20 203.80		Newly Costruct
10		20.70	20.70			1,430	1,430	13.7	0.35	0.0946	1.958	0.002		1.960	U 1000 × 1000	5.8	2.749	2.474	217.80	209.50	218.80 210.50		Newly Costruct
11		18.60	18.60			890	890	9.6	0.35	0.1130	2.102	0.001		2.103	U 900 × 900	9.3	3.245	2.366	217.90	209.60	218.80 210.50		Newly Costruct
12	10,11	38.50	77.80			470	1,900	18.2	0.35	0.0820	6.380	0.006		6.386	U 1800 × 1700	1.1	1.747	4.811	208.80	207.30	210.50 210.00		Newly Costruct
13	12	0.00	77.80			200	2,100	19.4	0.35	0.0795	6.185	0.006		6.191	U 1800 × 2000	2.5	2.736	8.865	207.30	207.50	210.00 209.50		Newly Costruct
S1	1,2					1,700						0.012		0.012	φ 150	9.1	4.459	0.080	205.20	189.73	206.20 190.80	1.00	Newly Costruct
S2	3,5,6,9,13					1,500						0.045		0.045	φ 150	12.5	5.226	0.094	208.50	189.75	209.50 190.80	1.00	Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	C2	C2	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.50	5 min	9.70E-05 (m^3/sec・ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Sewage Drainage Pipe: Gradient	Sewage Drainage Pipe: Velocity	Sewage Drainage Pipe: Runoff Capacity	Sewage Drainage Pipe: Sewer Invert Elevation Start	Sewage Drainage Pipe: Sewer Invert Elevation End	Sewage Drainage Pipe: Elevation Start End	Sewage Drainage Pipe: Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
1		9.70	9.70			750	750	11.7	0.50	0.1462	1.418	0.001		1.419	U 1000 × 1000	2.7	1.876	1.688	218.80	216.80	219.80 217.80		Newly Costruct
2		9.00	18.70			930	1,680	17.7	0.50	0.1188	2.222	0.002		2.224	U 1000 × 1000	5.1	2.578	2.320	216.80	212.10	217.80 213.10		Newly Costruct
3a		16.50	16.50			910	910	10.8	0.50	0.1521	2.510	0.002		2.512	U 1100 × 1000	4.8	2.603	2.577	218.70	214.30	219.70 215.30		Newly Costruct
3b		20.00	36.50			420	1,330	12.9	0.50	0.1392	5.081	0.004		5.085	U 1400 × 1400	5.2	3.257	5.745	213.90	211.70	215.30 213.10		Newly Costruct
4	2,3b	0.00	55.20			620	1,950	15.9	0.50	0.1254	6.922	0.005		6.927	U 1400 × 1400	5.8	3.440	6.068	211.70	208.10	213.10 209.50		Newly Costruct
5a		27.60	27.60			1,150	1,150	13.2	0.50	0.1376	3.798	0.003		3.801	U 1400 × 1400	2.7	2.347	4.140	212.40	209.30	213.80 210.70		Newly Costruct
5b	5a	8.30	35.90			390	1,540	15.7	0.50	0.1262	4.531	0.003		4.534	U 1500 × 1400	3.1	2.590	4.895	209.30	208.10	210.70 209.50		Newly Costruct
6	4,5b	0.00	63.50			290	1,830	16.8	0.50	0.1220	7.747	0.006		7.753	U 1500 × 1400	14.5	5.601	10.586	208.10	203.90	209.50 205.30		Existing
Inlet Pipe	6					30						0.018		0.018	φ 150	3.3	2.685	0.048	204.30	204.20	205.30 205.20	1.00	Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	C3	C3	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.66	5 min	1.56E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
1		11.60	11.60			380	380	6.3	0.66	0.2630	3.051	0.002		3.053	U 1500 × 1000	12.9	4.815	6.500	218.80	213.90	219.80 214.90		Existing
2	1	42.40	54.00			510	890	9.2	0.66	0.2176	11.750	0.008		11.758	U 1500 × 1000	4.9	2.967	4.005	213.90	211.40	214.90 212.40		Existing
2	1	42.40	54.00			510	890	11.6	0.66	0.1938	10.465	0.008	(4.005)	6.468	U 1700 × 1600	4.9	3.546	8.681	213.30	210.80	214.90 212.40		Newly Costruct
3	2	15.00	69.00			710	1,600	14.2	0.66	0.1751	12.082	0.011		12.093	U 1500 × 1500	9.0	4.487	9.086	210.90	204.50	212.40 206.00		Existing
3	2	15.00	69.00			710	1,600	14.7	0.66	0.1721	11.875	0.011	(9.086)	2.800	U 1200 × 1200	9.0	3.867	5.012	211.20	204.80	212.40 206.00		Newly Costruct
4		18.90	18.90			630	630	7.3	0.66	0.2443	4.617	0.003		4.620	U 1500 × 1500	9.0	4.487	9.086	211.40	205.70	212.90 207.20		Existing
5	3,4	0.00	87.90			30	1,630	14.8	0.66	0.1716	15.084	0.014		15.098	U 1500 × 1500	33.3	8.631	17.478	205.70	204.70	207.20 206.20		Existing
6a		34.60	34.60			690	690	7.2	0.66	0.2460	8.512	0.005		8.517	U 1400 × 1400	13.3	5.209	9.189	218.10	208.90	219.50 210.30		Newly Costruct
6b	6a	1.60	36.20			310	1,000	9.8	0.66	0.2108	7.631	0.006		7.637	U 800 × 800	4.2	2.016	1.161	209.50	208.20	210.30 209.00		Existing
6b	6a	1.60	36.20			310	1,000	8.8	0.66	0.2225	8.055	0.006	(1.161)	6.900	U 1600 × 1600	4.2	3.200	7.373	208.70	207.40	210.30 209.00		Newly Costruct
7	6b	14.60	50.80			410	1,410	25.2	0.66	0.1315	6.680	0.008		6.688	U 800 × 800	2.4	1.524	0.878	208.20	207.20	209.00 208.00		Existing
7	6b	14.60	50.80			410	1,410	18.9	0.66	0.1518	7.711	0.008	(0.878)	6.841	U 1800 × 1700	2.4	2.581	7.108	207.30	206.30	209.00 208.00		Newly Costruct
8		16.20	16.20			380	380	7.3	0.66	0.2443	3.958	0.003		3.961	D 1000	8.4	2.798	2.196	212.70	209.50	213.70 210.50		Existing
8		16.20	16.20			380	380	7.1	0.66	0.2477	4.013	0.003	(2.196)	1.820	U 900 × 900	8.4	3.084	2.248	212.80	209.60	213.70 210.50		Newly Costruct
9	8	14.60	30.80			410	790	9.5	0.66	0.2141	6.594	0.005		6.599	D 1200	6.1	3.040	3.435	209.30	206.80	210.50 208.00		Existing
9		14.60	30.80			410	790	9.6	0.66	0.2130	6.560	0.005	(3.435)	3.130	U 1000 × 1200	6.1	2.937	3.172	209.30	206.80	210.50 208.00		Newly Costruct
10	7,9	15.00	96.60			600	1,390	33.3	0.66	0.1144	11.051	0.015		11.066	U 2500 × 1800	2.2	2.860	11.583	206.20	204.90	208.00 206.70		Existing
11		15.00	15.00			600	1,990	7.9	0.66	0.2348	3.522	0.002		3.524	U 1500 × 1600	5.2	3.462	7.478	208.20	205.10	209.80 206.70		Existing
12	10,11	40.50	152.10			450	2,440	40.6	0.66	0.1036	15.758	0.024		15.782	U 2150 × 2150	8.7	5.608	23.329	204.55	200.65	206.70 202.80		Existing
S1	5,12					450						0.105		0.105	φ 250	7.6	5.672	0.278	205.20	201.78	206.20 202.80	1.00	Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	C4	C4	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.57	5 min	1.5E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: Stormwater RC (C)	Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
1		104.00	104.00			1,200	1,200	8.3	0.57	0.1978	20.571	0.016		20.587	U 1200 × 1200	21.7	6.004	7.781	221.80	195.80	223.00 197.00		Existing
1		104.00	104.00			1,200	1,200	7.9	0.57	0.2028	21.091	0.016	(7.781)	13.326	U 2000 × 3100 1100	20.0	6.830	13.523	219.90	195.90	223.00 197.00		Newly Costruct
2		74.00	74.00			1,100	1,100	8.6	0.57	0.1944	14.386	0.011		14.397	U 1200 × 1100	16.6	5.141	6.108	220.90	202.60	222.00 203.70		Existing
2		74.00	74.00			1,100	1,100	8.2	0.57	0.1991	14.733	0.011	(6.108)	8.636	U 1400 × 1300	16.6	5.716	9.363	220.70	202.40	222.00 203.70		Newly Costruct
3		40.50	40.50			700	700	7.5	0.57	0.2081	8.428	0.006		8.434	U 700 × 1000	23.6	4.715	2.970	219.20	202.70	220.20 203.70		Existing
3		40.50	40.50			700	700	7.0	0.57	0.2154	8.724	0.006	(2.970)	5.760	U 1100 × 1100	23.6	5.909	6.435	219.10	202.60	220.20 203.70		Newly Costruct
4		70.00	70.00			1,400	1,400	9.6	0.57	0.1840	12.880	0.011		12.891	φ 600	1.9	5.120	1.449	219.80	217.20	219.80 217.20		Existing
4		70.00	70.00			1,400	1,400	14.2	0.57	0.1513	10.591	0.011	(1.449)	9.153	U 2100 × 2000	1.9	2.550	9.639	217.80	215.20	219.80 217.20		Newly Costruct
5	4	17.00	87.00			600	2,000	16.1	0.57	0.1421	12.363	0.013		12.376	U 2000 × 1800 1300	10.9	5.320	12.449	215.40	208.86	217.20 210.30		Newly Costruct
6		45.00	45.00			700	700	9.4	0.57	0.1859	8.366	0.007		8.373	U 600 × 1000	8.7	2.654	1.433	215.90	209.80	216.90 210.80		Existing
6		45.00	45.00			700	700	7.7	0.57	0.2054	9.243	0.007	(1.433)	7.817	U 1500 × 1400	8.7	4.338	8.199	215.50	209.40	216.90 210.80		Newly Costruct
7	6	39.00	84.00			750	1,450	10.6	0.57	0.1751	14.708	0.013		14.721	U 2000 × 1900	5.9	4.347	14.867	208.90	204.50	210.80 206.40		Newly Costruct
8	7	59.00	143.00			1,050	2,500	13.5	0.57	0.1551	22.179	0.022		22.201	U 3700 × 3800 1100	11.2	6.077	22.260	202.60	190.84	206.40 192.00		Newly Costruct
9		21.40	21.40			980	3,480	28.9	0.57	0.1060	2.268	0.003		2.271	U 1500 × 1500	0.5	1.058	2.142	209.30	208.80	210.80 210.30		Newly Costruct
10	5,9	37.00	145.40			1,100	4,580	33.7	0.57	0.0982	14.278	0.022		14.300	U 2700 × 2000	3.5	3.828	18.604	208.30	204.40	210.30 206.40		Existing
11		120.00	120.00			1,700	1,700	9.9	0.57	0.1812	21.744	0.018		21.762	U 1500 × 1100	17.9	5.833	8.662	209.30	178.90	210.40 180.00		Existing
11		120.00	120.00			1,700	1,700	9.7	0.57	0.1830	21.960	0.018	(8.662)	13.316	U 3700 × 5670 770	15.0	5.968	15.302	204.73	179.23	210.40 180.00		Newly Costruct
12		49.00	49.00			1,500	1,500	9.3	0.57	0.1869	9.158	0.007		9.165	U 1500 × 1500	15.0	5.793	11.731	210.30	187.80	210.30 197.00		Newly Costruct
S1a	8,10,11					1,000						0.186		0.186	φ 300	2.8	3.924	0.279	185.30	182.50	186.30 183.50	1.00	Newly Costruct
S1b	1,2,3,12,S1a					1,500						0.306		0.306	φ 400	2.3	4.304	0.542	182.50	179.05	183.50 180.00	1.00	Newly Costruct
P1						300									φ 400								
Pump Station														18.4 (m3/min)									

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S1	S1	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.50	5 min	9.2E-05 (m^3/sec•ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		24.00	24.00			600	600	11.4	0.50	0.1481	3.554			3.554	U 1600 × 1600	1.0	1.561	3.597	219.20	218.60	220.80 220.20		Newly Costruct
R2	R1	8.60	32.60			320	920	14.1	0.50	0.1332	4.342			4.342	U 1600 × 1600	1.6	1.975	4.550	218.60	218.10	220.20 219.70		Newly Costruct
R3	R2	5.60	38.20			280	1,200	15.4	0.50	0.1274	4.867			4.867	U 1600 × 1100	6.8	3.683	5.834	218.10	216.70	219.70 217.80		Newly Costruct
R4		5.90	5.90			470	470	8.1	0.50	0.1757	1.037			1.037	U 800 × 800	6.8	2.565	1.477	220.20	217.00	221.00 217.80		Newly Costruct
R5	R3,R4	3.10	47.20			230	1,430	16.2	0.50	0.1242	5.862			5.862	U 1200 × 1200	13.5	4.736	6.138	217.00	213.50	217.80 214.70		Newly Costruct
R6		19.50	19.50			510	510	8.2	0.50	0.1746	3.405			3.405	U 1300 × 1200	3.9	2.633	3.697	219.60	217.60	220.80 218.80		Newly Costruct
R7	R6	15.60	35.10			750	2,180	11.9	0.50	0.1449	5.086			5.086	U 1600 × 1200	5.5	3.397	5.870	217.60	213.50	218.80 214.70		Newly Costruct
R8	R5,R7	5.50	87.80			340	2,520	17.4	0.50	0.1199	10.527			10.527	U 1800 × 1500	8.2	4.619	11.224	213.20	210.40	214.70 211.90		Newly Costruct
R9		28.00	28.00			580	580	7.7	0.50	0.1802	5.046			5.046	U 1300 × 1200	7.4	3.627	5.092	221.10	216.80	222.30 218.00		Newly Costruct
R10	R9	24.50	52.50			1,060	1,640	12.5	0.50	0.1414	7.424			7.424	U 1600 × 1500	5.8	3.702	7.996	216.50	210.40	218.00 211.90		Newly Costruct
R11	R8,R10	2.30	142.60			220	2,740	18.3	0.50	0.1169	16.670			16.670	U 2400 × 2000	4.1	3.957	17.094	209.90	209.00	211.90 211.00		Under Construction
R12		15.00	15.00			330	330	7.7	0.50	0.1802	2.703			2.703	U 1300 × 1200	2.4	2.065	2.899	210.60	209.80	211.80 211.00		Under Construction
R13	R11,R12	19.00	176.60			420	3,160	19.6	0.50	0.1129	19.938			19.938	U 3000 × 1500	8.3	5.580	22.599	209.00	206.00	211.00 207.50		Newly Costruct
R14	R13	1.30	177.90			150	3,310	20.1	0.50	0.1115	19.836			19.836	U 3000 × 1500	6.7	5.014	20.307	206.00	205.00	207.50 206.50		Newly Costruct
R15		19.00	19.00			800	800	9.0	0.50	0.1667	3.167			3.167	U 1000 × 1100	8.1	3.321	3.288	211.90	205.40	213.00 206.50		Newly Costruct
RO1	R14,R15	0.00	196.90			440	3,750	20.6	0.50	0.1102	21.698			21.698	U 3000 × 1500	58.0	14.751	59.742	205.00	179.50	206.50 181.00		Newly Costruct
R16		32.10	32.10			1,420	1,420	12.6	0.50	0.1409	4.523			4.523	U 1300 × 1300	5.2	3.100	4.715	218.70	211.30	220.00 212.60		Newly Costruct
R17		16.90	16.90			750	750	9.4	0.50	0.1631	2.756			2.756	U 1100 × 1000	5.6	2.812	2.784	215.80	211.60	216.80 212.60		Newly Costruct
R18	R16,R17	1.90	50.90			270	1,690	14.3	0.50	0.1322	6.729			6.729	U 1700 × 1700	2.6	2.622	6.820	210.90	210.20	212.60 211.90		Newly Costruct
R19		11.80	11.80			680	680	8.6	0.50	0.1705	2.012			2.012	U 900 × 900	9.0	3.192	2.327	217.10	211.00	218.00 211.90		Newly Costruct
R20	R18,R19	11.90	74.60			250	1,940	15.2	0.50	0.1282	9.564			9.564	U 1700 × 1600	7.6	4.417	10.813	210.20	208.40	211.90 210.00		Newly Costruct
R21		12.50	12.50			500	500	7.1	0.50	0.1876	2.345			2.345	U 900 × 900	14.0	3.981	2.902	216.10	209.10	217.00 210.00		Newly Costruct
R22	R20,R21	5.10	92.20			200	2,140	15.7	0.50	0.1262	11.636			11.636	U 1700 × 1700	17.5	6.801	17.689	208.40	204.80	210.00 206.50		Newly Costruct
R23		2.30	2.30			230	230	7.6	0.50	0.1814	0.417			0.417	U 800 × 800	2.2	1.459	0.840	206.20	205.70	207.00 206.50		Newly Costruct
R24		14.60	14.60			720	720	10.9	0.50	0.1514	2.210			2.210	U 1100 × 1100	2.8	2.035	2.216	207.40	205.40	208.50 206.50		Newly Costruct
RO2	R22,R23,R24	0.00	109.10			320	2,460	16.1	0.50	0.1246	13.594			13.594	U 1700 × 1700	79.7	14.515	37.754	205.70	179.30	206.50 181.00		Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	S1	S1	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.50	5 min	9.2E-05 (m^3/sec•ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume Stormwater Per ha	Runoff Volume Stormwater Volume	Runoff Volume Wastewater	Runoff Volume Others	Runoff Volume Total Volume	Sewage Drainage Pipe Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R25		28.30	28.30			1,020	1,020	9.4	0.50	0.1631	4.616			4.616	U 1200 × 1200	8.8	3.824	4.956	209.00	200.00	210.20 201.20		Newly Costruct
R26	R25	15.50	43.80			650	1,670	14.4	0.50	0.1318	5.773			5.773	U 1700 × 1600	1.8	2.149	5.261	200.00	198.40	201.20 200.00		Newly Costruct
R27		16.90	16.90			650	650	8.5	0.50	0.1715	2.898			2.898	U 1100 × 1000	6.6	3.052	3.021	211.00	206.70	212.00 207.70		Newly Costruct
R28	R27	7.50	24.40			200	850	9.1	0.50	0.1657	4.043			4.043	U 1000 × 900	28.5	5.937	4.809	206.70	201.10	207.70 202.00		Newly Costruct
R29		6.00	6.00			420	420	7.1	0.50	0.1876	1.126			1.126	U 800 × 600	12.9	3.278	1.416	206.80	201.40	207.40 202.00		Newly Costruct
RO3	R26,R28, R29	0.00	74.20			440	2,110	9.6	0.50	0.1614	11.976			11.976	U 3000 × 1500	47.7	13.377	54.177	198.40	179.50	202.00 181.00		Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S1	S1	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.50	5 min	9.2E-05 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		24.00	24.00			600	600					0.0022		0.0022	φ 150	1.0	1.478	0.027	218.91	218.31	220.80 220.20	1.74 1.74	Newly Costruct
S2	S1	8.60	32.60			320	920					0.0030		0.0030	φ 150	1.6	1.870	0.034	218.31	217.80	220.20 219.70	1.74 1.75	Newly Costruct
S3	S2	5.60	38.20			280	1,200					0.0035		0.0035	φ 150	4.1	2.993	0.054	217.80	216.65	219.70 217.80	1.75 1.00	Newly Costruct
S4		5.90	5.90			470	470					0.0005		0.0005	φ 150	4.1	2.993	0.054	218.58	216.65	221.00 217.80	2.27 1.00	Newly Costruct
S5	S3,S4	3.10	47.20			230	1,430					0.0043		0.0043	φ 150	4.1	2.993	0.054	214.49	213.55	217.80 214.70	3.16 1.00	Newly Costruct
S6		19.50	19.50			510	510					0.0018		0.0018	φ 150	3.9	2.919	0.053	219.65	217.66	220.80 218.80	1.00 0.99	Newly Costruct
S7	S6	15.60	35.10			750	2,180					0.0032		0.0032	φ 150	4.1	2.993	0.054	216.62	213.55	218.80 214.70	2.03 1.00	Newly Costruct
S8	S5,S7	5.50	87.80			340	2,520					0.0081		0.0081	φ 150	4.1	2.993	0.054	212.14	210.75	214.70 211.90	2.41 1.00	Newly Costruct
S9		28.00	28.00			580	580					0.0026		0.0026	φ 150	4.1	2.993	0.054	219.2	216.85	222.30 218.00	3.07 1.00	Newly Costruct
S10	S9	24.50	52.50			1,060	1,640					0.0048		0.0048	φ 150	4.1	2.993	0.054	215.10	210.75	218.00 211.90	2.75 1.00	Newly Costruct
S11	S8,S10	2.30	142.60			220	2,740					0.0131		0.0131	φ 150	4.1	2.993	0.054	210.75	209.85	211.90 211.00	1.00 1.00	Newly Costruct
S12		15.00	15.00			330	330					0.0014		0.0014	φ 150	2.4	2.290	0.041	210.65	209.86	211.80 211.00	1.00 0.99	Newly Costruct
S13	S11,S12	19.00	176.60			420	3,160					0.0162		0.0162	φ 150	4.1	2.993	0.054	207.68	205.96	211.00 207.50	3.17 1.39	Newly Costruct
S14	S13	1.30	177.90			150	3,310					0.0164		0.0164	φ 150	4.1	2.993	0.054	205.96	205.35	207.50 206.50	1.39 1.00	Newly Costruct
S15		19.00	19.00			800	800					0.0017		0.0017	φ 150	4.1	2.993	0.054	208.63	205.35	213.00 206.50	4.52 1.00	Newly Costruct
SO1	R14,R15	0.00	196.90			440	3,750					0.0181		0.0181	φ 150	4.1	2.993	0.054	178.65	176.85	206.50 178.00	28.00 1.00	Newly Costruct
S16		32.10	32.10			1,420	1,420					0.0030		0.0030	φ 150	4.1	2.993	0.054	217.27	211.45	220.00 212.60	2.58 1.00	Newly Costruct
S17		16.90	16.90			750	750					0.0016		0.0016	φ 150	4.1	2.993	0.054	214.52	211.45	216.80 212.60	2.13 1.00	Newly Costruct
S18	S16,S17	1.90	50.90			270	1,690					0.0047		0.0047	φ 150	2.6	2.383	0.043	211.45	210.75	212.60 211.90	1.00 1.00	Newly Costruct
S19		11.80	11.80			680	680					0.0011		0.0011	φ 150	4.1	2.993	0.054	212.81	210.02	218.00 211.90	5.04 1.73	Newly Costruct
S20	S18,S19	11.90	74.60			250	1,940					0.0069		0.0069	φ 150	4.1	2.993	0.054	209.87	208.85	211.90 210.00	1.73 1.00	Newly Costruct
S21		12.50	12.50			500	500					0.0012		0.0012	φ 150	4.1	2.993	0.054	208.22	206.17	217.00 210.00	8.63 3.68	Newly Costruct
S22	S20,S21	5.10	92.20			200	2,140					0.0085		0.0085	φ 150	4.1	2.993	0.054	206.17	205.35	210.00 206.50	3.68 1.00	Newly Costruct
S23		2.30	2.30			230	230					0.0002		0.0002	φ 150	2.2	2.192	0.039	205.85	205.34	207.00 206.50	1.00 1.01	Newly Costruct
S24		14.60	14.60			720	720					0.0013		0.0013	φ 150	2.8	2.473	0.045	207.35	205.33	208.50 206.50	1.00 1.02	Newly Costruct
SO2	S22,S23,S24	0.00	109.10			320	2,460					0.0100		0.0100	φ 150	4.1	2.993	0.054	181.09	179.78	206.50 180.00	25.56 0.07	Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S1	S1	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.50	5 min	9.2E-05 (m^3/sec•ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Sewage Drainage Pipe: Gradient	Sewage Drainage Pipe: Velocity	Sewage Drainage Pipe: Runoff Capacity	Sewage Drainage Pipe: Sewer Invert Elevation Start	Sewage Drainage Pipe: Sewer Invert Elevation End	Sewage Drainage Pipe: Elevation Start End	Sewage Drainage Pipe: Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S25		28.30	28.30			1,020	1,020					0.0026		0.0026	ϕ 150	4.1	2.993	0.054	204.20	200.02	210.20 201.20	5.85 1.03	Newly Costruct
S26	S25	15.50	43.80			650	1,670					0.0040		0.0040	ϕ 150	1.8	1.983	0.036	200.02	198.85	201.20 200.00	1.03 1.00	Newly Costruct
S27		16.90	16.90			650	650					0.0016		0.0016	ϕ 150	4.1	2.993	0.054	209.21	206.55	212.00 207.70	2.64 1.00	Newly Costruct
S28	S27	7.50	24.40			200	850					0.0022		0.0022	ϕ 150	4.1	2.993	0.054	201.67	200.85	207.70 202.00	5.88 1.00	Newly Costruct
S29		6.00	6.00			420	420					0.0006		0.0006	ϕ 150	4.1	2.993	0.054	202.57	200.85	207.40 202.00	4.68 1.00	Newly Costruct
SO3	R26,R28, R29	0.00	74.20			440	2,110					0.0068		0.0068	ϕ 150	4.0	2.956	0.053	180.61	178.85	202.00 180.00	21.54 1.00	Newly Costruct
SO4	SO1,SO2, SO3	190.20	570.40			3,100	6,850					0.0525		0.0525	ϕ 250	0.3	1.127	0.055	177.85	176.92	180.00 180.00		Newly Costruct
		570.40																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S2	S2	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.41	5 min	6.4E-05 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		28.10	28.10			950	950	12.1	0.41	0.1179	3.313			3.313	U 1400 × 1300	2.5	2.218	3.633	218.70	216.30	220.00 217.60		Newly Costruct
R2		7.50	7.50			320	320	7.0	0.41	0.1550	1.163			1.163	U 800 × 800	7.5	2.694	1.552	219.20	216.80	220.00 217.60		Newly Costruct
R3	R1,R2	33.00	68.60			750	1,700	15.7	0.41	0.1035	7.100			7.100	U 1600 × 1500	5.2	3.505	7.571	216.10	212.20	217.60 213.70		Newly Costruct
R4	R3	6.00	74.60			420	2,120	17.7	0.41	0.0975	7.274			7.274	U 1600 × 1500	5.0	3.437	7.424	212.20	210.10	213.70 211.60		Newly Costruct
R5		32.50	32.50			500	500	8.7	0.41	0.1390	4.518			4.518	U 1600 × 1500	2.2	2.280	4.925	216.10	215.00	217.60 216.50		Newly Costruct
R6	R5	33.30	65.80			650	1,150	11.3	0.41	0.1220	8.028			8.028	U 1600 × 1500	7.5	4.210	9.094	215.00	210.10	216.50 211.60		Newly Costruct
R7	R4,R6	1.80	142.20			230	2,350	12.2	0.41	0.1174	16.694			16.694	U 1600 × 1200	9.1	4.370	7.551	210.40	208.30	211.60 209.50		Newly Costruct
R8		6.20	6.20			250	2,600	10.2	0.41	0.1284	0.796			0.796	U 1800 × 1500	2.8	2.699	6.559	210.20	209.50	211.70 211.00		Newly Costruct
R9	R8	2.50	8.70			100	2,700	5.3	0.41	0.1781	1.549			1.549	U 1300 × 1200	15.0	5.164	7.250	209.80	208.30	211.00 209.50		Newly Costruct
R10	R7,R9	6.80	157.70			1,060	3,760	12.6	0.41	0.1155	18.214			18.214	U 1600 × 1500	2.5	2.430	5.249	208.00	205.30	209.50 206.80		Newly Costruct
R11		54.10	54.10			750	750	11.5	0.41	0.1209	6.541			6.541	U 1800 × 1800	1.3	1.926	5.616	209.20	208.20	211.00 210.00		Newly Costruct
R12	R11	6.90	61.00			500	1,250	13.5	0.41	0.1116	6.808			6.808	U 1800 × 1800	6.4	4.273	12.460	208.20	205.00	210.00 206.80		Newly Costruct
R13		29.00	29.00			780	780	17.1	0.41	0.0991	2.874			2.874	U 1200 × 1000	5.6	2.913	3.146	210.20	205.80	211.20 206.80		Newly Costruct
R14		18.00	18.00			250	250	6.3	0.41	0.1633	2.939			2.939	U 1000 × 800	9.2	3.270	2.354	214.50	212.20	215.30 213.00		Newly Costruct
R15		44.20	44.20			650	650	9.9	0.41	0.1303	5.759			5.759	U 2300 × 1300	1.7	2.206	5.936	212.80	211.70	214.10 213.00		Newly Costruct
R16	R14,R15	80.00	142.20			900	1,550	13.3	0.41	0.1124	15.983			15.983	U 2300 × 1300	6.9	4.444	11.959	211.70	205.50	213.00 206.80		Newly Costruct
RO1	R10,R12,R13,R16	0.00	389.90			50	3,810	17.2	0.41	0.0989	38.561			38.561	U 3000 × 1700	20.0	9.039	41.489	205.10	204.10	206.80 205.80		Newly Costruct
		389.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S2	S2	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.41	5 min	6.4E-05 (m^3/sec•ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		28.10	28.10			950	950					0.0018		0.0018	ϕ 150	2.5	2.337	0.042	217.99	215.62	220.00 217.60	1.86 1.83	Newly Costruct
S2		7.50	7.50			320	320					0.0005		0.0005	ϕ 150	4.10	2.993	0.054	217.76	216.45	220.00 217.60	2.09 1.00	Newly Costruct
S3	S1,S2	33.00	68.60			750	1,700					0.0044		0.0044	ϕ 150	4.1	2.993	0.054	215.62	212.55	217.60 213.70	1.83 1.00	Newly Costruct
S4	S3	6.00	74.60			420	2,120					0.0048		0.0048	ϕ 150	4.1	2.993	0.054	212.17	210.45	213.70 211.60	1.38 1.00	Newly Costruct
S5		32.50	32.50			500	500					0.0021		0.0021	ϕ 150	2.2	2.192	0.039	214.59	213.49	217.60 216.50	2.86 2.86	Newly Costruct
S6	S5	33.30	65.80			650	1,150					0.0042		0.0042	ϕ 150	4.1	2.993	0.054	213.11	210.45	216.50 211.60	3.24 1.00	Newly Costruct
S7	S4,S6	1.80	142.20			230	2,350					0.0091		0.0091	ϕ 150	4.1	2.993	0.054	209.29	208.35	211.60 209.50	2.16 1.00	Newly Costruct
S8		6.20	6.20			250	2,600					0.0004		0.0004	ϕ 150	2.8	2.473	0.045	210.55	209.85	211.70 211.00	1.00 1.00	Newly Costruct
S9	S8	2.50	8.70			100	2,700					0.0006		0.0006	ϕ 150	4.1	2.993	0.054	208.76	208.35	211.00 209.50	2.09 1.00	Newly Costruct
S10	S7,S9	6.80	157.70			1,060	3,760					0.0101		0.0101	ϕ 150	2.5	2.337	0.042	208.30	205.65	209.50 206.80	1.05 1.00	Newly Costruct
S11		54.10	54.10			750	750					0.0035		0.0035	ϕ 150	1.3	1.685	0.030	209.82	208.85	211.00 210.00	1.03 1.00	Newly Costruct
S12	S11	6.90	61.00			500	1,250					0.0039		0.0039	ϕ 150	4.1	2.993	0.054	207.70	205.65	210.00 206.80	1.03 1.00	Newly Costruct
S13		29.00	29.00			780	780					0.0019		0.0019	ϕ 150	4.1	2.993	0.054	208.85	205.65	211.20 206.80	2.20 1.00	Newly Costruct
S14		18.00	18.00			250	250					0.0012		0.0012	ϕ 150	4.1	2.993	0.054	212.87	211.85	215.30 213.00	2.28 1.00	Newly Costruct
S15		44.20	44.20			650	650					0.0028		0.0028	ϕ 150	1.7	1.927	0.035	212.95	211.85	214.10 213.00	1.00 1.00	Newly Costruct
S16	S14,S15	80.00	142.20			900	1,550					0.009		0.009	ϕ 150	4.1	2.993	0.054	209.34	205.65	213.00 206.80	3.51 1.00	Newly Costruct
SO1	S10,S12,S13,S16	0.00	389.90			50	3,810					0.025		0.025	ϕ 150	4.1	2.993	0.054	204.85	204.65	206.80 205.80	1.80 1.00	Newly Costruct
		389.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S3	S3	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.48	5 min	1.3E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		39.55	39.55			1,080	1,080	10.4	0.48	0.1488	5.885			5.885	U 1400 × 1400	5.5	3.350	5.909	218.10	212.20	219.50 213.60		Newly Costruct
R2		9.90	9.90			620	620	11.2	0.48	0.1434	1.420			1.420	U 1000 × 1000	2.1	1.654	1.489	213.90	212.60	214.90 213.60		Newly Costruct
R3	R1,R2	45.10	94.55			820	1,900	15.2	0.48	0.1231	11.639			11.639	U 2200 × 1800	3.4	3.383	12.057	211.80	209.00	213.60 210.80		Newly Costruct
R4	R3	26.40	120.95			360	2,260	16.5	0.48	0.1182	14.296			14.296	U 2200 × 1800	6.4	4.642	16.544	209.00	206.70	210.80 208.50		Newly Costruct
R5	R4	18.00	138.95			400	2,660	18.1	0.48	0.1128	15.674			15.674	U 2200 × 2000	5.0	4.217	16.699	206.50	204.50	208.50 206.50		Newly Costruct
R6		30.80	30.80			550	550	8.2	0.48	0.1676	5.162			5.162	U 1500 × 1400	3.8	2.867	5.419	213.50	211.40	214.90 212.80		Newly Costruct
R7	R6	14.30	45.10			350	900	9.7	0.48	0.1541	6.950			6.950	U 1500 × 1400	6.6	3.778	7.140	211.40	209.10	212.80 210.50		Newly Costruct
R8	R7	12.00	57.10			200	1,100	10.4	0.48	0.1488	8.496			8.496	U 1500 × 1400	10.0	4.651	8.790	209.10	207.10	210.50 208.50		Newly Costruct
R9	R8	12.80	69.90			270	1,370	6.1	0.48	0.1943	13.582			13.582	U 2000 × 1800	5.6	4.178	13.537	206.70	205.20	208.50 207.00		Newly Costruct
R10		38.90	38.90			700	700	9.4	0.48	0.1566	6.092			6.092	U 1400 × 1400	6.1	3.528	6.223	215.80	211.50	217.20 212.90		Newly Costruct
R11		32.50	32.50			1,330	1,330	14.9	0.48	0.1244	4.043			4.043	U 1500 × 1400	2.3	2.231	4.217	214.50	211.50	215.90 212.90		Newly Costruct
R12	R10,R11	21.40	92.80			300	1,630	15.9	0.48	0.1204	11.173			11.173	U 1600 × 1600	10.3	5.011	11.545	211.30	208.20	212.90 209.80		Newly Costruct
R13		34.50	34.50			1,060	1,060	10.9	0.48	0.1454	5.016			5.016	U 1400 × 1400	4.4	2.996	5.285	216.30	211.60	217.70 213.00		Newly Costruct
R14		13.00	13.00			1,050	1,050	17.9	0.48	0.1135	1.476			1.476	U 1200 × 1200	1.1	1.352	1.752	213.00	211.80	214.20 213.00		Newly Costruct
R15	R13,R14	42.00	89.50			1,050	1,050	23.8	0.48	0.0984	8.807			8.807	U 1900 × 1800	2.9	2.943	9.059	211.20	208.20	213.00 210.00		Newly Costruct
R16		20.20	20.20			900	900	12.6	0.48	0.1352	2.731			2.731	U 1300 × 1200	2.2	1.978	2.777	208.20	213.80	217.00 215.00		Newly Costruct
R17		23.00	23.00			930	930	12.4	0.48	0.1363	3.135			3.135	U 1300 × 1300	2.4	2.106	3.203	213.80	214.00	217.50 215.30		Newly Costruct
R18		15.00	15.00			680	680	8.8	0.48	0.1618	2.427			2.427	U 1000 × 1000	6.8	2.976	2.678	214.00	217.00	222.60 218.00		Newly Costruct
R19	R18	28.00	28.00			1,050	1,730	16.8	0.48	0.1171	3.279			3.279	U 1300 × 1300	2.6	2.192	3.334	217.00	214.00	218.00 215.30		Newly Costruct
R20		24.50	24.50			380	380	7.0	0.48	0.1814	4.444			4.444	U 1300 × 1200	5.8	3.211	4.508	217.80	215.60	219.00 216.80		Newly Costruct
R21		34.10	34.10			940	940	11.7	0.48	0.1403	4.784			4.784	U 1600 × 1500	2.3	2.331	5.035	217.50	215.30	219.00 216.80		Newly Costruct
R22	R20,R21	28.60	87.20			730	1,670	16.9	0.48	0.1168	10.185			10.185	U 2500 × 2000	1.4	2.350	10.575	214.80	213.80	216.80 215.80		Newly Costruct
R23		39.90	39.90			600	600	10.0	0.48	0.1518	6.057			6.057	U 2000 × 1700	1.3	1.983	6.068	216.00	215.20	217.70 216.90		Newly Costruct
R24	R23	27.00	66.90			730	1,330	15.3	0.48	0.1227	8.209			8.209	U 2300 × 1800	1.5	2.287	8.521	215.10	214.00	216.90 215.80		Newly Costruct
R25	R22,R24	0.00	154.10			20	1,690	15.4	0.48	0.1223	18.846			18.846	U 2300 × 1800	10.0	5.905	22.002	214.00	213.80	215.80 215.60		Newly Costruct
		631.45																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S3	S3	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.48	5 min	1.3E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume Stormwater Per ha	Runoff Volume Stormwater Volume	Runoff Volume Wastewater	Runoff Volume Others	Runoff Volume Total Volume	Sewage Drainage Pipe Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		39.55	39.55			1,080	1,080					0.0052		0.0052	φ 150	4.1	2.993	0.054	216.88	212.45	219.50 213.60	2.47 1.00	Newly Costruct
S2		9.90	9.90			620	620					0.0013		0.0013	φ 150	2.1	2.142	0.039	213.75	212.45	214.90 213.60	1.00 1.00	Newly Costruct
S3	S1,S2	45.10	94.55			820	1,900					0.0124		0.0124	φ 150	3.4	2.726	0.049	212.44	209.65	213.60 210.80	1.01 1.00	Newly Costruct
S4	S3	26.40	120.95			360	2,260					0.0158		0.0158	φ 150	4.1	2.993	0.054	208.83	207.35	210.80 208.50	1.82 1.00	Newly Costruct
S5	S4	18.00	138.95			400	2,660					0.0182		0.0182	φ 150	4.1	2.993	0.054	206.99	205.35	208.50 206.50	1.36 1.00	Newly Costruct
S6		30.80	30.80			550	550					0.0040		0.0040	φ 150	3.8	2.881	0.052	213.74	211.65	214.90 212.80	1.01 1.00	Newly Costruct
S7	S6	14.30	45.10			350	900					0.0059		0.0059	φ 150	4.1	2.993	0.054	210.78	209.35	212.80 210.50	1.87 1.00	Newly Costruct
S8	S7	12.00	57.10			200	1,100					0.0075		0.0075	φ 150	4.1	2.993	0.054	208.17	207.35	210.50 208.50	2.18 1.00	Newly Costruct
S9	S8	12.80	69.90			270	1,370					0.0092		0.0092	φ 150	4.1	2.993	0.054	206.96	205.85	208.50 207.00	1.39 1.00	Newly Costruct
S10		38.90	38.90			700	700					0.0051		0.0051	φ 150	4.1	2.993	0.054	214.62	211.75	217.20 212.90	2.43 1.00	Newly Costruct
S11		32.50	32.50			1,330	1,330					0.0043		0.0043	φ 150	2.3	2.242	0.040	214.75	211.69	215.90 212.90	1.00 1.06	Newly Costruct
S12	S10,S11	21.40	92.80			300	1,630					0.0122		0.0122	φ 150	4.1	2.993	0.054	209.88	208.65	212.90 209.80	2.87 1.00	Newly Costruct
S13		34.50	34.50			1,060	1,060					0.0045		0.0045	φ 150	4.1	2.993	0.054	216.20	211.85	217.70 213.00	1.35 1.00	Newly Costruct
S16		20.20	20.20			900	900					0.0026		0.0026	φ 150	2.2	2.192	0.039	215.83	213.85	217.00 215.00	1.02 1.00	Newly Costruct
S17		23.00	23.00			930	930					0.0030		0.0030	φ 150	2.4	2.290	0.041	216.35	214.12	217.50 215.30	1.00 1.03	Newly Costruct
S18		15.00	15.00			680	680					0.0020		0.0020	φ 150	4.1	2.993	0.054	219.64	216.85	222.60 218.00	2.81 1.00	Newly Costruct
S19	S18	28.00	28.00			1,050	1,730					0.0037		0.0037	φ 150	2.6	2.383	0.043	216.85	214.12	218.00 215.30	1.00 1.03	Newly Costruct
S20		24.50	24.50			380	380					0.0032		0.0032	φ 150	4.1	2.993	0.054	217.21	215.65	219.00 216.80	1.64 1.00	Newly Costruct
S21		34.10	34.10			940	940					0.0045		0.0045	φ 150	2.3	2.242	0.040	217.81	215.65	219.00 216.80	1.04 1.00	Newly Costruct
S22	S20,S21	28.60	87.20			730	1,670					0.0114		0.0114	φ 150	1.4	1.749	0.031	215.65	214.63	216.80 215.80	1.00 1.02	Newly Costruct
S23		39.90	39.90			600	600					0.0052		0.0052	φ 150	1.3	1.685	0.030	216.53	215.75	217.70 216.90	1.02 1.00	Newly Costruct
S24	S23	27.00	66.90			730	1,330					0.0088		0.0088	φ 150	1.5	1.810	0.033	215.74	214.65	216.90 215.80	1.01 1.00	Newly Costruct
S25	S22,S24	0.00	154.10			20	1,690					0.0202		0.0202	φ 150	10.0	4.674	0.084	214.65	214.45	215.80 215.60	1.00 1.00	Newly Costruct
S01	S5,S9,S12					1,300						0.0396		0.0396	φ 200	2.5	2.797	0.087	208.60	205.35	209.80 206.50	1.00 0.95	Newly Costruct
Pump Station														1.2									
S02	S01					800						0.0396		0.0396	φ 200						206.50 209.00	1.00	Newly Costruct
S03	S15					300						0.0117		0.0117	φ 150	3.3	2.685	0.048	208.85	207.86	210.00 209.00	1.00 0.99	Newly Costruct
S04	S16,S17,S19,S25					2,100						0.0295		0.0295	φ 200	3.1	3.114	0.097	214.40	207.89	215.60 209.00	1.00 0.91	Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S4	S4	T=2 I=360t$^{-0.5}$ mm/hr T=1 I=312t$^{-0.5}$ mm/hr	0.48	5 min	1.5E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: Stormwater RC (C)	Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		38.20	38.20			750	750	15.3	0.48	0.1227	4.687			4.687	U 2500 × 1800	0.4	1.219	4.937	225.40	225.10	227.20 226.90		Newly Costruct
R2	R1	16.00	54.20			400	1,150	6.7	0.48	0.1854	10.049			10.049	U 1600 × 1800	6.3	4.026	10.435	225.10	222.60	226.90 224.40		Newly Costruct
R3		16.10	16.10			700	700	15.7	0.48	0.1211	1.950			1.950	U 1300 × 1300	0.9	1.290	1.962	223.70	223.10	225.00 224.40		Newly Costruct
R4	R2,R3	17.50	87.80			500	1,650	18.4	0.48	0.1119	9.825			9.825	U 2000 × 1800	3.0	3.058	9.908	222.60	221.10	224.40 222.90		Newly Costruct
R5		12.50	12.50			500	500	24.8	0.48	0.0964	1.205			1.205	U 1100 × 1000	1.2	1.302	1.289	222.50	221.90	223.50 222.90		Newly Costruct
R6	R4,R5	14.80	115.10			550	2,200	7.1	0.48	0.1801	20.730			20.730	U 2700 × 2000	4.4	4.292	20.859	220.90	218.50	222.90 220.50		Newly Costruct
R7		14.30	14.30			850	850	15.8	0.48	0.1208	1.727			1.727	U 800 × 1600	2.1	1.625	1.872	220.70	218.90	222.30 220.50		Newly Costruct
R8	R6,R7	9.00	138.40			600	2,800	19.7	0.48	0.1081	14.961			14.961	U 3400 × 2000	1.3	2.536	15.520	218.50	217.70	220.50 221.70	-4.00	Newly Costruct
R9	R8	8.60	147.00			270	3,070	6.2	0.48	0.1928	28.342			28.342	U 3400 × 2700	2.2	3.609	29.818	217.70	217.10	221.70 219.80	-4.00	Newly Costruct
R10	R9	10.60	157.60			530	3,600	8.1	0.48	0.1687	26.587			26.587	U 2500 × 2700	4.5	4.541	27.587	217.10	214.70	219.80 217.40		Newly Costruct
R11	R10	39.70	197.30			950	4,550	7.6	0.48	0.1741	34.350			34.350	U 2500 × 2700	8.0	6.054	36.778	214.70	207.10	217.40 209.80		Newly Costruct
R12		58.20	58.20			920	920	19.4	0.48	0.1090	6.344			6.344	U 2500 × 2300	0.4	1.303	6.743	224.90	224.50	227.20 226.80		Newly Costruct
R13	R12	58.50	116.70			720	1,640	9.4	0.48	0.1566	18.275			18.275	U 3000 × 2600	1.4	2.711	19.031	224.20	223.20	226.80 225.80		Newly Costruct
R16	R14,R15	27.00	190.70			950	3,690	7.7	0.48	0.1730	32.991			32.991	U 2300 × 2600	8.5	5.963	32.093	219.75	208.90	221.00 211.50		Newly Costruct
R17		39.10	39.10			750	750	16.5	0.48	0.1182	4.622			4.622	U 2700 × 1800	0.3	1.086	4.750	208.90	223.00	225.00 224.80		Newly Costruct
R18	R17	38.80	77.90			770	1,520	7.5	0.48	0.1753	13.656			13.656	U 1700 × 1800	9.6	5.105	14.059	223.00	215.60	224.80 217.40		Newly Costruct
R19	R18	47.10	125.00			1,000	2,520	11.1	0.48	0.1441	18.013			18.013	U 2500 × 1800	5.9	4.683	18.966	215.60	209.70	217.40 211.50		Newly Costruct
R20	R16,R19	15.20	330.90			820	4,510	9.0	0.48	0.1600	52.944			52.944	2X U 3300 × 2600	2.1	3.449	53.266	208.90	207.20	211.50 209.80		Newly Costruct
R21		35.10	35.10			760	760	15.8	0.48	0.1208	4.240			4.240	U 2100 × 2000	0.4	1.170	4.423	221.50	221.20	223.50 223.20		Newly Costruct
R22	R21	8.00	43.10			800	1,560	23.8	0.48	0.0984	4.241			4.241	U 1500 × 2000	1.1	1.670	4.509	221.20	220.30	223.20 222.30		Newly Costruct
R23	R22	59.80	102.90			620	2,180	6.7	0.48	0.1854	19.078			19.078	U 2000 × 2000	10.9	5.982	21.535	220.30	213.54	222.30 215.00		Newly Costruct
R24	R23	57.00	159.90			1,050	3,230	10.5	0.48	0.1481	23.681			23.681	U 2300 × 2600	5.0	4.574	24.617	212.40	207.20	215.00 209.80		Newly Costruct
		746.30																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S4	S4	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.48	5 min	1.5E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: Stormwater RC (C)	Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		38.20	38.20			750	750					0.0057		0.0057	ϕ 150	0.4	0.935	0.017	226.05	225.75	227.20 226.90	1.00 1.00	Newly Costruct
S2	S1	16.00	54.20			400	1,150					0.0080		0.0080	ϕ 150	6.3	3.710	0.067	225.75	223.23	226.90 224.40	1.00 1.02	Newly Costruct
S3		16.10	16.10			700	700					0.0024		0.0024	ϕ 150	0.9	1.402	0.025	223.85	223.22	225.00 224.40	1.00 1.03	Newly Costruct
S4	S2,S3	17.50	87.80			500	1,650					0.0130		0.0130	ϕ 150	3.0	2.560	0.046	223.22	221.72	224.40 222.90	1.03 1.03	Newly Costruct
S5		12.50	12.50			500	500					0.0019		0.0019	ϕ 150	1.2	1.619	0.029	222.35	221.75	223.50 222.90	1.00 1.00	Newly Costruct
S6	S4,S5	14.80	115.10			550	2,200					0.0170		0.0170	ϕ 150	4.4	3.101	0.056	221.72	219.30	222.90 220.50	1.03 1.05	Newly Costruct
S7		14.30	14.30			850	850					0.0021		0.0021	ϕ 150	2.1	2.142	0.039	221.13	219.35	222.30 220.50	1.02 1.00	Newly Costruct
S8	S6,S7	9.00	138.40			600	2,800					0.0205		0.0205	ϕ 150	1.1	1.550	0.028	219.35	218.69	220.50 221.70	1.00 2.86	Newly Costruct
S9	S8	8.60	147.00			270	3,070					0.0218		0.0218	ϕ 150	7.0	3.911	0.070	220.52	218.63	221.70 219.80	1.03 1.02	Newly Costruct
S10	S9	10.60	157.60			530	3,600					0.0233		0.0233	ϕ 150	4.5	3.136	0.056	218.63	216.25	219.80 217.40	1.02 1.00	Newly Costruct
S11	S10	39.70	197.30			950	4,550					0.0292		0.0292	ϕ 150	8.0	4.181	0.075	216.25	208.65	217.40 209.80	1.00 1.00	Newly Costruct
S12		58.20	58.20			920	920					0.0086		0.0086	ϕ 150	0.4	0.935	0.017	226.02	225.65	227.20 226.80	1.03 1.00	Newly Costruct
S13	S12	58.50	116.70			720	1,640					0.0173		0.0173	ϕ 150	1.4	1.749	0.031	225.65	224.64	226.80 225.80	1.00 1.01	Newly Costruct
S16	S14,S15	27.00	190.70			950	3,690					0.0282		0.0282	ϕ 150	10.0	4.674	0.084	219.85	210.35	221.00 211.50	1.00 1.00	Newly Costruct
S17		39.10	39.10			750	750					0.0058		0.0058	ϕ 150	0.3	0.810	0.015	223.85	223.63	225.00 224.80	1.00 1.02	Newly Costruct
S18	S17	38.80	77.90			770	1,520					0.0115		0.0115	ϕ 150	9.6	4.580	0.082	223.63	216.24	224.80 217.40	1.02 1.01	Newly Costruct
S19	S18	47.10	125.00			1,000	2,520					0.0185		0.0185	ϕ 150	5.9	3.590	0.065	216.24	210.34	217.40 211.50	1.01 1.01	Newly Costruct
S20	S16,S19	15.20	330.90			820	4,510					0.0490		0.0490	ϕ 150	2.1	2.142	0.039	210.34	208.62	211.50 209.80	1.01 1.03	Newly Costruct
S21		35.10	35.10			760	760					0.0052		0.0052	ϕ 150	0.4	0.935	0.017	222.31	222.01	223.50 223.20	1.04 1.04	Newly Costruct
S22	S21	8.00	43.10			800	1,560					0.0064		0.0064	ϕ 150	1.1	1.550	0.028	222.01	221.13	223.20 222.30	1.04 1.02	Newly Costruct
S23	S22	59.80	102.90			620	2,180					0.0152		0.0152	ϕ 150	11.8	5.078	0.091	221.13	213.81	222.30 215.00	1.02 1.04	Newly Costruct
S24	S23	57.00	159.90			1,050	3,230					0.0237		0.0237	ϕ 150	5.0	3.305	0.059	213.81	208.56	215.00 209.80	1.04 1.09	Newly Costruct
S01	S11,S20,S24					50						0.1019		0.1019	ϕ 200	16.0	7.075	0.219	208.60	207.80	209.80 209.00	1.00 1.00	Newly Costruct

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S5	S5	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.65	5 min	1.5E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Sewage Drainage Pipe: Gradient	Sewage Drainage Pipe: Velocity	Sewage Drainage Pipe: Runoff Capacity	Sewage Drainage Pipe: Sewer Invert Elevation Start	Sewage Drainage Pipe: Sewer Invert Elevation End	Sewage Drainage Pipe: Elevation Start End	Sewage Drainage Pipe: Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		55.40	55.40			1,530	1,530	18.5	0.65	0.1511	8.371			8.371	U 2600 × 1900	0.9	1.886	8.385	223.80	222.40	225.70 224.30		Newly Costruct
R2		22.50	22.50			660	660	8.7	0.65	0.2204	4.959			4.959	U 1400 × 1400	4.4	2.996	5.285	225.80	222.90	227.20 224.30		Newly Costruct
R3	R1,R2	36.30	114.20			370	1,900	19.9	0.65	0.1457	16.639			16.639	U 2200 × 1900	5.9	4.521	17.008	222.40	220.20	224.30 222.10		Newly Costruct
R4		25.60	25.60			1,460	1,460	16.8	0.65	0.1586	4.060			4.060	U 1500 × 1500	1.9	2.062	4.176	223.40	220.60	224.90 222.10		Newly Costruct
R5	R3,R4	27.00	166.80			350	2,250	20.8	0.65	0.1425	23.769			23.769	U 2200 × 1900	11.7	6.367	23.953	220.20	216.10	222.10 218.00		Newly Costruct
R6		46.60	46.60			1,150	1,150	21.2	0.65	0.1412	6.580			6.580	U 3000 × 2100	0.3	1.183	6.708	216.20	215.90	218.30 218.00		Newly Costruct
R7	R5,R6	35.10	248.50			500	2,750	23.8	0.65	0.1332	33.100			33.100	2X U 2800 × 2100	2.4	3.259	34.494	215.90	214.70	218.00 216.80		Newly Costruct
R8	R7	6.50	255.00			360	3,110	27.0	0.65	0.1251	31.901			31.901	2X U 3200 × 3000	0.6	1.890	32.660	213.80	213.60	216.80 216.60		Newly Costruct
R9		63.70	63.70			1,850	4,960	34.8	0.65	0.1102	7.020			7.020	U 3500 × 2200	0.2	1.036	7.179	214.80	214.40	217.00 216.60		Newly Costruct
R10	R8,R9	18.60	337.30			350	5,310	37.8	0.65	0.1057	35.653			35.653	2X U 3500 × 3000	0.6	1.961	37.062	213.60	213.40	216.60 216.40		Newly Costruct
R11		16.50	16.50			350	350	7.6	0.65	0.2358	3.891			3.891	U 1500 × 1400	2.3	2.231	4.217	218.60	217.80	220.00 219.20		Newly Costruct
R12		13.60	13.60			280	280	9.7	0.65	0.2087	2.838			2.838	U 1300 × 1200	2.9	2.270	3.187	218.80	218.00	220.00 219.20		Newly Costruct
R13	R11,R12	3.40	33.50			150	500	11.3	0.65	0.1934	6.479			6.479	U 2300 × 2000	0.7	1.607	6.653	217.20	217.10	219.20 219.10		Newly Costruct
R16		11.60	11.60			330	330	6.7	0.65	0.2511	2.913			2.913	U 1000 × 1000	8.5	3.328	2.995	216.30	217.50	218.70 218.50		Newly Costruct
R17	R15,R16	63.80	138.10			1,350	1,350	22.4	0.65	0.1373	18.961			18.961	U 2900 × 2700	1.5	2.794	19.689	217.50	213.80	218.50 216.50		Newly Costruct
R01	R10					1,500								35.653	U 3500 × 2000	9.1	6.776	42.689	213.40	200.80	216.40 202.80		Newly Costruct
		475.40																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S5	S5	T=2 I=360t$^{-0.5}$ mm/hr T=1 I=312t$^{-0.5}$ mm/hr	0.65	5 min	1.5E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: Stormwater RC (C)	Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		55.40	55.40			1,530	1,530					0.0085		0.0085	φ 150	0.9	1.402	0.025	224.53	223.15	225.70 224.30	1.02 1.00	Newly Costruct
S2		22.50	22.50			660	660					0.0035		0.0035	φ 150	4.1	2.993	0.054	225.86	223.15	227.20 224.30	1.19 1.00	Newly Costruct
S3	S1,S2	36.30	114.20			370	1,900					0.0176		0.0176	φ 150	4.1	2.993	0.054	222.47	220.95	224.30 222.10	1.68 1.00	Newly Costruct
S4		25.60	25.60			1,460	1,460					0.0039		0.0039	φ 150	1.9	2.037	0.037	223.72	220.95	224.90 222.10	1.03 1.00	Newly Costruct
S5	S3,S4	27.00	166.80			350	2,250					0.0257		0.0257	φ 150	4.1	2.993	0.054	218.28	216.85	222.10 218.00	3.67 1.00	Newly Costruct
S6		46.60	46.60			1,150	1,150					0.0072		0.0072	φ 150	0.3	0.810	0.015	217.15	216.81	218.30 218.00	1.00 1.04	Newly Costruct
S7	S5,S6	35.10	248.50			500	2,750					0.0383		0.0383	φ 200	2.4	2.740	0.085	216.76	215.56	218.00 216.80	1.04 1.04	Newly Costruct
S8	S7	6.50	255.00			360	3,110					0.0393		0.0393	φ 250	1.1	2.158	0.106	215.51	215.11	216.80 216.60	1.04 1.24	Newly Costruct
S9		63.70	63.70			1,850	4,960					0.0098		0.0098	φ 150	0.2	0.661	0.012	215.82	215.45	217.00 216.60	1.03 1.00	Newly Costruct
S10	S8,S9	18.60	337.30			350	5,310					0.0519		0.0519	φ 300	0.6	1.817	0.129	215.28	215.07	216.60 216.40	1.02 1.03	Newly Costruct
S11		16.50	16.50			350	350					0.0025		0.0025	φ 150	2.3	2.242	0.040	218.85	218.05	220.00 219.20	1.00 1.00	Newly Costruct
S12		13.60	13.60			280	280					0.0021		0.0021	φ 150	2.9	2.517	0.045	218.85	218.04	220.00 219.20	1.00 1.01	Newly Costruct
S13	S11,S12	3.40	33.50			150	500					0.0052		0.0052	φ 150	0.7	1.237	0.022	218.04	217.94	219.20 219.10	1.01 1.01	Newly Costruct
S16		11.60	11.60			330	330					0.0018		0.0018	φ 150	0.6	1.145	0.021	217.55	217.35	218.70 218.50	1.00 1.00	Newly Costruct
S17	S15,S16	63.80	138.10			1,350	1,350					0.0213		0.0213	φ 200	1.5	2.166	0.067	217.29	215.27	218.50 216.50	1.01 1.03	Newly Costruct
Pump Station														3.1									
														(m3/min)									
S01						2,700						0.0213		0.0213	φ 200								Newly Costruct
		475.40																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S6	S6	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.55	5 min	1.2E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Sewage Drainage Pipe: Gradient	Sewage Drainage Pipe: Velocity	Sewage Drainage Pipe: Runoff Capacity	Sewer Invert Elevation: Start	Sewer Invert Elevation: End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		47.60	47.60			1,150	1,150	21.9	0.55	0.1175	5.593			5.593	U 2800 × 2000	0.3	1.136	5.725	216.30	216.00	218.30 218.00		Newly Costruct
R2		41.00	41.00			800	800	15.5	0.55	0.1397	5.728			5.728	U 2800 × 1800	0.4	1.271	5.765	218.40	218.10	220.20 219.90		Newly Costruct
R3	R2	10.10	51.10			450	1,600	17.7	0.55	0.1307	6.679			6.679	U 1800 × 1800	4.2	3.461	10.092	218.10	216.20	219.90 218.00		Newly Costruct
R4	R1,R3	36.80	135.50			1,350	2,950	52.2	0.55	0.0761	10.312			10.312	2X U 4000 × 2000	0.1	0.742	10.684	216.00	215.80	218.00 217.80		Newly Costruct
R5		45.60	45.60			850	850	11.1	0.55	0.1651	7.529			7.529	U 2500 × 1300	1.8	2.333	6.824	220.20	218.70	221.50 220.00		Newly Costruct
R6		14.10	14.10			730	730	27.1	0.55	0.1057	1.490			1.490	U 2500 × 1300	0.1	0.550	1.609	218.80	218.70	220.10 220.00		Newly Costruct
R7	R5,R6	11.20	70.90			900	1,750	32.7	0.55	0.0962	6.821			6.821	U 2500 × 1300	2.4	2.694	7.880	218.70	216.50	220.00 217.80		Newly Costruct
R8		64.50	64.50			1,450	1,450	16.1	0.55	0.1371	8.843			8.843	U 3000 × 1600	1.2	2.170	9.374	222.30	220.50	223.90 222.10		Newly Costruct
R9		36.00	36.00			600	600	11.3	0.55	0.1636	5.890			5.890	U 3000 × 1400	0.7	1.581	5.976	221.20	220.80	222.60 222.20		Newly Costruct
R10		38.00	38.00			1,250	1,250	15.5	0.55	0.1397	5.309			5.309	U 2000 × 1500	1.4	1.989	5.370	222.40	220.70	223.90 222.20		Newly Costruct
R11	R9,R10	0.00	74.00			50	1,300	15.7	0.55	0.1388	10.271			10.271	U 2200 × 1500	4.0	3.484	10.347	220.70	220.50	222.20 222.00		Newly Costruct
		344.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	S6	S6	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.55	5 min	1.2E-04 (m^3/sec・ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: Stormwater RC (C)	Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		47.60	47.60			1,150	1,150					0.0056		0.0056	ϕ 150	0.3	0.810	0.015	217.15	216.81	218.30 218.00	1.00 1.04	Newly Costruct
S2		41.00	41.00			800	800					0.0048		0.0048	ϕ 150	0.4	0.935	0.017	219.05	218.73	220.20 219.90	1.00 1.02	Newly Costruct
S3	S2	10.10	51.10			450	1,600					0.0060		0.0060	ϕ 150	4.1	2.993	0.054	218.69	216.85	219.90 218.00	1.06 1.00	Newly Costruct
S4	S1,S3	36.80	135.50			1,350	2,950					0.0160		0.0160	ϕ 250	0.1	0.651	0.032	216.68	216.55	218.00 217.80	1.07 1.00	Newly Costruct
S5		45.60	45.60			850	850					0.0054		0.0054	ϕ 150	1.8	1.983	0.036	220.35	218.82	221.50 220.00	1.00 1.03	Newly Costruct
S6		14.10	14.10			730	730					0.0017		0.0017	ϕ 150	0.1	0.467	0.008	218.92	218.85	220.10 220.00	1.03 1.00	Newly Costruct
S7	S5,S6	11.20	70.90			900	1,750					0.0084		0.0084	ϕ 150	2.4	2.290	0.041	218.81	216.65	220.00 217.80	1.04 1.00	Newly Costruct
S8		64.50	64.50			1,450	1,450					0.0076		0.0076	ϕ 150	1.2	1.619	0.029	222.69	220.95	223.90 222.10	1.06 1.00	Newly Costruct
S9		36.00	36.00			600	600					0.0042		0.0042	ϕ 150	0.7	1.237	0.022	221.45	221.03	222.60 222.20	1.00 1.02	Newly Costruct
S10		38.00	38.00			1,250	1,250					0.0045		0.0045	ϕ 150	1.4	1.749	0.031	222.75	221.00	223.90 222.20	1.00 1.05	Newly Costruct
S11	S9,S10	0.00	74.00			50	1,300					0.0087		0.0087	ϕ 150	4.0	2.956	0.053	221.00	220.80	222.20 222.00	1.05 1.05	Newly Costruct
S12	S4,S7	0.00	206.40									0.0244		0.0244	ϕ 150		3.000	0.054					Pressure Pipe Newly Costruct
S13	S11	0.00	74.00									0.0087		0.0087	ϕ 150		3.000	0.054					Pressure Pipe Newly Costruct
S01						600						0.0244		0.0244	ϕ 150								Newly Costruct
Pump Station														1.5									
														(m3/min)									
S02						1,000						0.0087		0.0087	ϕ 150								Newly Costruct
Pump Station														0.5									
														(m3/min)									
		344.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S7	S7	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.65	5 min	1.4E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		23.00	23.00			700	700	7.2	0.65	0.2422	5.571			5.571	U 1200 × 1000	18.9	5.352	5.780	220.80	207.60	221.80 208.60		Newly Costruct
R2	R1	24.50	47.50			650	1,350	9.1	0.65	0.2155	10.236			10.236	U 2000 × 1100	13.7	5.653	11.193	207.50	198.60	208.60 199.70		Newly Costruct
R3	R2	10.60	58.10			450	1,800	10.2	0.65	0.2035	11.823			11.823	U 1500 × 1100	25.8	7.003	10.399	198.60	187.00	199.70 188.10		Newly Costruct
R4		38.80	38.80			850	850	7.0	0.65	0.2457	9.533			9.533	U 1500 × 1000	29.3	7.256	9.796	209.80	184.90	210.80 185.90		Newly Costruct
R4b		3.00	41.80			200	1,050	7.5	0.65	0.2373	9.919			9.919	U 1400 × 1100	21.0	6.153	8.528	184.80	180.60	185.90 181.70		Newly Costruct
R5		38.60	38.60			550	550	8.0	0.65	0.2298	8.870			8.870	U 2300 × 1500	2.9	3.015	9.362	197.40	195.80	198.90 197.30		Newly Costruct
R6	R5	33.00	71.60			970	1,520	10.5	0.65	0.2006	14.363			14.363	U 1700 × 1500	16.2	6.344	14.559	195.80	180.10	197.30 181.60		Newly Costruct
R7		28.30	28.30			620	620	7.6	0.65	0.2358	6.673			6.673	U 1500 × 1500	6.9	3.929	7.956	191.60	187.30	193.10 188.80		Newly Costruct
R8	R7	48.50	76.80			1,380	2,000	13.2	0.65	0.1789	13.740			13.740	U 2500 × 1500	5.1	4.118	13.898	187.30	180.20	188.80 181.70		Newly Costruct
R9	R6,R8	2.00	150.40			80	2,080	13.8	0.65	0.1750	26.320			26.320	2X U 3500 × 1800	1.2	2.375	26.932	179.90	179.80	181.70 181.60		Newly Costruct
		250.30																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S7	S7	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.65	5 min	1.4E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation: Start	Sewer Invert Elevation: End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		23.00	23.00			700	700					0.0033		0.0033	ϕ 150	4.1	2.993	0.054	210.32	207.45	221.80 208.60	11.33 1.00	Newly Costruct
S2	S1	24.50	47.50			650	1,350					0.0067		0.0067	ϕ 150	4.1	2.993	0.054	201.21	198.55	208.60 199.70	7.24 1.00	Newly Costruct
S3	S2	10.60	58.10			450	1,800					0.0083		0.0083	ϕ 150	4.1	2.993	0.054	188.79	186.95	199.70 188.10	10.76 1.00	Newly Costruct
S3b	S3	0.00	58.10			450	2,250					0.0083		0.0083	ϕ 150	4.1	2.993	0.054	182.59	180.75	188.10 181.90	5.36 1.00	Newly Costruct
S4		38.80	38.80			850	850					0.0055		0.0055	ϕ 250	4.1	4.166	0.204	188.13	184.65	210.80 185.90	22.42 1.00	Newly Costruct
S4b		3.00	41.80			200	1,050					0.0059		0.0059	ϕ 150	4.1	2.993	0.054	181.37	180.55	185.90 181.70	4.38 1.00	Newly Costruct
S5		38.60	38.60			550	550					0.0055		0.0055	ϕ 150	2.9	2.517	0.045	197.74	196.15	198.90 197.30	1.01 1.00	Newly Costruct
S6	S5	33.00	71.60			970	1,520					0.0102		0.0102	ϕ 150	4.1	2.993	0.054	184.43	180.45	197.30 181.60	12.72 1.00	Newly Costruct
S7		28.30	28.30			620	620					0.0040		0.0040	ϕ 150	4.1	2.993	0.054	190.19	187.65	193.10 188.80	2.76 1.00	Newly Costruct
S8	S7	48.50	76.80			1,380	2,000					0.0109		0.0109	ϕ 150	4.1	2.993	0.054	186.21	180.55	188.80 181.70	2.44 1.00	Newly Costruct
S9	S6,S8	2.00	150.40			80	2,080					0.0214		0.0214	ϕ 150	1.2	1.619	0.029	180.55	180.45	181.70 181.60	1.00 1.00	Newly Costruct
S01						400						0.0083		0.0083	ϕ 150	3.3	2.685	0.048	182.75	181.43	182.90 181.60		Newly Costruct
		250.30																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	S8	S8	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.65	5 min	1.6E-04 (m^3/sec•ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	Runoff Volume: Stormwater RC (C)	Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1a		20.90	20.90			1,000	1,000	11.2	0.65	0.1942	4.059			4.059	U 1500 × 1200	3.6	2.681	4.343	185.70	182.10	186.90 183.30		Newly Costruct
R1b		10.00	10.00			600	600	13.2	0.65	0.1789	1.789			1.789	U 1300 × 1300	0.8	1.216	1.850	182.50	182.00	183.80 183.30		Newly Costruct
R2	R1,R1b	0.00	30.90			250	1,250	12.0	0.65	0.1876	5.797			5.797	U 1500 × 1300	12.0	5.000	8.775	182.00	179.00	183.30 180.30		Newly Costruct
R3a	R2	22.00	52.90			400	1,400	17.2	0.65	0.1567	8.289			8.289	U 3500 × 2300	0.3	1.286	9.317	178.00	177.90	180.30 180.20		Newly Costruct
R3b		30.00	30.00			1,100	1,100	11.5	0.65	0.1917	5.751			5.751	U 1600 × 1500	3.4	2.834	6.121	182.40	178.70	183.90 180.20		Newly Costruct
R3c	R3a,R3b	20.00	102.90			500	1,900	23.1	0.65	0.1352	13.912			13.912	U 3000 × 2300	0.4	1.402	17.412	177.90	177.70	180.20 180.00		Newly Costruct
R3d	R3a	28.00	28.00			1,000	1,000	9.3	0.65	0.2131	5.967			5.967	U 1500 × 1500	6.6	3.842	7.780	185.10	178.50	186.60 180.00		Newly Costruct
R3e	R3b	28.00	158.90			1,000	2,900	38.8	0.65	0.1044	16.589			16.589	2X U 3000 × 3000	0.2	1.062	17.204	177.00	176.80	180.00 179.80		Newly Costruct
		158.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S8	S8	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.65	5 min	1.6E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1a		20.90	20.90			1,000						0.0033		0.0033	φ 150	3.6	2.805	0.050	185.75	182.15	186.90 183.30	1.00 1.00	Newly Costruct
S1b		10.00	10.00			600						0.0016		0.0016	φ 150	4.1	2.993	0.054	180.67	178.21	183.80 183.30	2.98 4.94	Newly Costruct
S2	S1,S1b	0.00	30.90			250						0.0049		0.0049	φ 150	12.0	5.120	0.092	182.14	179.14	183.30 180.30	1.01 1.01	Newly Costruct
S3a	S2	22.00	52.90			400						0.0083		0.0083	φ 200	0.3	0.969	0.030	179.09	178.97	180.30 180.20	1.01 1.03	Newly Costruct
S3b		30.00	30.00			1,100						0.0047		0.0047	φ 150	3.4	2.726	0.049	182.74	179.00	183.90 180.20	1.01 1.05	Newly Costruct
S3c	S3a,S3b	20.00	102.90			500						0.0162		0.0162	φ 200	0.4	1.119	0.035	178.99	178.79	180.20 180.00	1.01 1.01	Newly Costruct
S3d	S3a	28.00	28.00			1,000						0.0044		0.0044	φ 150	6.6	3.797	0.068	185.44	178.84	186.60 180.00	1.01 1.01	Newly Costruct
S3e	S3b	28.00	158.90			1,000						0.0249		0.0249	φ 250	0.2	0.920	0.045	178.74	178.54	180.00 179.80	1.01 1.01	Newly Costruct
		158.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	S10	S10	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.51	5 min	1.5E-04 (m^3/sec・ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		122.50	122.50			2,300	2,300	28.7	0.51	0.0952	11.662			11.662	U 5000 × 1600	0.5	1.620	11.664	181.40	180.30	183.00 181.90		Newly Costruct
R2		28.60	28.60			700	3,000	13.5	0.51	0.1388	3.970			3.970	U 1500 × 1300	0.9	1.369	2.403	182.20	181.60	183.50 182.90		Newly Costruct
R3	R2	5.10	33.70			300	3,300	15.4	0.51	0.1300	4.381			4.381	U 1500 × 1300	3.3	2.622	4.602	181.60	180.60	182.90 181.90		Newly Costruct
R4	R1,R3	5.10	161.30			300	3,600	30.4	0.51	0.0925	14.920			14.920	U 5000 × 1600	1.7	2.986	21.499	180.30	179.80	181.90 181.40		Newly Costruct
R5	R4	0.00	161.30			300	3,900	31.7	0.51	0.0906	14.614			14.614	U 5000 × 1600	3.0	3.967	28.562	179.80	178.90	181.40 180.50		Newly Costruct
R6	R5	34.50	195.80			900	4,800	39.6	0.51	0.0810	15.860			15.860	U 5000 × 1900	0.6	1.904	16.279	178.60	178.10	180.50 180.00		Newly Costruct
R7		39.30	39.30			1,000	1,000	10.8	0.51	0.1552	6.099			6.099	U 1700 × 1500	3.3	2.863	6.571	185.00	181.70	186.50 183.20		Newly Costruct
R8	R7	22.00	61.30			500	1,500	13.1	0.51	0.1409	8.637			8.637	U 1700 × 1600	5.0	3.582	8.769	181.60	179.10	183.20 180.70		Newly Costruct
R9		22.40	22.40			970	970	11.6	0.51	0.1497	3.353			3.353	U 1300 × 1200	3.4	2.458	3.451	185.30	182.00	186.50 183.20		Newly Costruct
R10	R9	30.80	53.20			650	1,620	15.0	0.51	0.1317	7.006			7.006	U 1700 × 1500	4.2	3.230	7.413	181.70	179.00	183.20 180.50		Newly Costruct
R11	R8	21.10	82.40			1,000	2,620	29.0	0.51	0.0947	7.803			7.803	U 5500 × 1600	0.2	1.048	8.300	179.10	178.90	180.70 180.50		Newly Costruct
R12	R10,R11	42.50	178.10			400	3,020	31.6	0.51	0.0907	16.154			16.154	U 5000 × 1600	1.3	2.612	18.806	178.90	178.40	180.50 180.00		Newly Costruct
		373.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area
Combined	S10	S10	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.51	5 min	1.5E-04 (m^3/sec・ha)

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Stormwater Volume	Wastewater	Others	Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		122.50	122.50			2,300	2,300					0.0186		0.0186	φ 200	0.5	1.251	0.039	181.80	180.65	183.00 181.90	1.00 1.05	Newly Costruct
S2		28.60	28.60			700	3,000					0.0043		0.0043	φ 250	0.9	1.952	0.096	182.25	181.62	183.50 182.90	1.00 1.03	Newly Costruct
S3	S2	5.10	33.70			300	3,300					0.0051		0.0051	φ 150	3.3	2.685	0.048	181.72	180.73	182.90 181.90	1.03 1.02	Newly Costruct
S4	S1,S3	5.10	161.30			300	3,600					0.0245		0.0245	φ 200	1.7	2.306	0.071	180.65	180.14	181.90 181.40	1.05 1.06	Newly Costruct
S5	S4	0.00	161.30			300	3,900					0.0245		0.0245	φ 200	3.0	3.063	0.095	180.20	179.30	181.40 180.50	1.00 1.00	Newly Costruct
S6	S5	34.50	195.80			900	4,800					0.0298		0.0298	φ 250	0.6	1.594	0.078	179.25	178.71	180.50 180.00	1.00 1.04	Newly Costruct
S7		39.30	39.30			1,000	1,000					0.0060		0.0060	φ 150	3.3	2.685	0.048	185.35	182.05	186.50 183.20	1.00 1.00	Newly Costruct
S8	S7	22.00	61.30			500	1,500					0.0093		0.0093	φ 150	4.1	2.993	0.054	181.60	179.55	183.20 180.70	1.45 1.00	Newly Costruct
S9		22.40	22.40			970	970					0.0034		0.0034	φ 150	3.4	2.726	0.049	185.35	182.05	186.50 183.20	1.00 1.00	Newly Costruct
S10	S9	30.80	53.20			650	1,620					0.0081		0.0081	φ 150	4.1	2.993	0.054	182.01	179.35	183.20 180.50	1.04 1.00	Newly Costruct
S11	S8	21.10	82.40			1,000	2,620					0.0125		0.0125	φ 200	0.2	0.791	0.025	179.50	179.30	180.70 180.50	1.00 1.00	Newly Costruct
S12	S10,S11	42.50	178.10			400	3,020					0.0271		0.0271	φ 200	1.3	2.017	0.063	179.30	178.78	180.50 180.00	1.00 1.02	Newly Costruct
S01	S6					700						0.0298		0.0298	φ 200								Newly Costruct
Pump Station														1.8 (m3/min)									
		373.90																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	S11	S11	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.58	5 min	7.0E-05 (m^3/sec・ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
R1		126.50	126.50			550	550	7.2	0.58	0.2162	27.349			27.349	2×U 2500 × 1500	5.3	4.198	28.336	221.40	218.50	222.90 220.00		Newly Costruct
R2		319.60	319.60			1,350	1,350	8.3	0.58	0.2013	64.335			64.335	2×U 2700 × 2000	10.8	6.724	65.358	218.00	203.40	220.00 205.40		Newly Costruct
R3	R2	309.60	629.20			900	2,250	10.3	0.58	0.1807	113.696			113.696	2×U 3400 × 2500	9.9	7.491	114.612	202.90	194.00	205.40 196.50		Newly Costruct
		755.70																					

CALICULATION OF DRANAGE NETWORK

System	Discharge District	Treatment Area	Rainfall Intensity	Runoff Coefficiency	Inlet Time	Maximum Hourly Wastewater Flow per Unit Area		
Combined	S11	S11	T=2 $I=360t^{-0.5}$ mm/hr T=1 $I=312t^{-0.5}$ mm/hr	0.58	5 min	7.0E-05 (m^3/sec・ha)		

Line	Inlet Line	Area (A) Each	Area (A) Sub-Total	Converted Area(AxC) Each	Converted Area(AxC) Sub-Total	Length Each	Length Sub-Total	Concentration Time	RC (C)	Runoff Volume: Stormwater Per ha	Runoff Volume: Stormwater Volume	Runoff Volume: Wastewater	Runoff Volume: Others	Runoff Volume: Total Volume	Sewage Drainage Pipe: Dimension	Gradient	Velocity	Runoff Capacity	Sewer Invert Elevation Start	Sewer Invert Elevation End	Elevation Start End	Covering Start End	Remarks
		ha	ha	ha	ha	m	m	min		m3/sec	m3/sec	m3/sec	m3/sec	m3/sec	mm	‰	m/sec	m3/sec	m	m	m	m	
S1		126.50	126.50			550	550	7.7				0.0089		0.009	φ 150	5.3	3.403	0.122	222.90	220.00	222.90 220.00		Newly Costruct
S2		319.60	319.60			1,350	1,350	9.6				0.0224		0.022	φ 150	10.8	4.858	0.174	220.00	205.40	220.00 205.40		Newly Costruct
S3	S2	309.60	629.20			900	2,250	12.8				0.0440		0.044	φ 150	9.9	4.651	0.168	205.40	196.50	205.40 196.50		Newly Costruct
		755.70																					

APPENDIX I.3 EQUIPMENT SHORT SPECIFICATION FOR WASTE WATER TREATMENT PLANT

EQUIPMENT SHORT SPECIFICATION 1,600 M3/D UASB

SERVICE	NO. INSTALLED	SPECIFICATION	MATERIAL
INLET CHAMBER	1	0.5 M-W x 0.5 M-L x 1 M-H	
SCREEN CHAMBER			
PUMP PIT	1	2.0 M-W x 2.0 M-L x 4 M-H	
GRIT CHAMBER	1 + 1	0.1 M-W x 12.4 M-L x 0.7 M-H	
UASB REACTOR	2	7.9 M-W x 7.9 M-L x 4 M-H	
SLUDGE DRYING BED	2	12.8 M-W x 12.8 M-L x 1.0 M-H	
SLUDGE SUMP	1	1.2 M3	
FINAL POLISHING POND	1 ST	16.3 M-W x 16.3 M-L x 1 M-H	
	2 ND	16.3 M-W x 16.3 M-L x 1 M-H	
	3 RD	16.3 M-W x 16.3 M-L x 1 M-H	
CHLORINATION	1	8.0 KG/D AS 100% Cl2	
TRANSFER PUMP	2 + 1	46.2 M3/H x 20.0 MH x 3.3 BKW	
SLUDGE DICHARGE PUM	1 + 1	2.4 M3/H x 5.0 MH x 0.1 BKW	

EQUIPMENT SHORT SPECIFICATION 2,500 M3/D UASB

SERVICE	NO. INSTALLED	SPECIFICATION	MATERIAL
INLET CHAMBER	1	0.6 M-W x 0.6 M-L x 1 M-H	
SCREEN CHAMBER			
PUMP PIT	1	2.5 M-W x 2.5 M-L x 4 M-H	
GRIT CHAMBER	1 + 1	0.2 M-W x 12.4 M-L x 0.7 M-H	
UASB REACTOR	2	9.8 M-W x 9.8 M-L x 4 M-H	
SLUDGE DRYING BED	2	16.1 M-W x 16.1 M-L x 1.0 M-H	
SLUDGE SUMP	1	1.9 M3	
FINAL POLISHING POND	1 ST	20.4 M-W x 20.4 M-L x 1 M-H	
	2 ND	20.4 M-W x 20.4 M-L x 1 M-H	
	3 RD	20.4 M-W x 20.4 M-L x 1 M-H	
CHLORINATION	1	12.5 KG/D AS 100% Cl2	
TRANSFER PUMP	2 + 1	72.1 M3/H x 20.0 MH x 5.2 BKW	
SLUDGE DICHARGE PUM	1 + 1	3.8 M3/H x 5.0 MH x 0.1 BKW	

EQUIPMENT SHORT SPECIFICATION 3,500 M3/D UASB

SERVICE	NO. INSTALLED			SPECIFICATION			MATERIAL
INLET CHAMBER	1			0.7 M-W x	0.7 M-L x	1 M-H	
SCREEN CHAMBER							
PUMP PIT	1			2.9 M-W x	2.9 M-L x	4 M-H	
GRIT CHAMBER	1	+	1	0.3 M-W x	12.4 M-L x	0.7 M-H	
UASB REACTOR	2			11.7 M-W x	11.7 M-L x	4 M-H	
SLUDGE DRYING BED	2			19.0 M-W x	19.0 M-L x	1.0 M-H	
SLUDGE SUMP	1			2.6 M3			
FINAL POLISHING POND	1	ST		24.2 M-W x	24.2 M-L x	1 M-H	
	2	ND		24.2 M-W x	24.2 M-L x	1 M-H	
	3	RD		24.2 M-W x	24.2 M-L x	1 M-H	
CHLORINATION	1			17.5 KG/D AS 100% Cl2			
TRANSFER PUMP	2	+	1	101.0 M3/H x	20.0 MH x	7.3 BKW	
SLUDGE DICHARGE PUM	1	+	1	5.3 M3/H x	5.0 MH x	0.1 BKW	

EQUIPMENT SHORT SPECIFICATION 5,000 M3/D UASB

SERVICE	NO. INSTALLED			SPECIFICATION			MATERIAL
INLET CHAMBER	1			0.9 M-W x	0.9 M-L x	1 M-H	
SCREEN CHAMBER							
PUMP PIT	1			3.5 M-W x	3.5 M-L x	4 M-H	
GRIT CHAMBER	1	+	1	0.4 M-W x	12.4 M-L x	0.7 M-H	
UASB REACTOR	2			13.9 M-W x	13.9 M-L x	4 M-H	
SLUDGE DRYING BED	2			22.7 M-W x	22.7 M-L x	1.0 M-H	
SLUDGE SUMP	1			3.8 M3			
FINAL POLISHING POND	1	ST		28.9 M-W x	28.9 M-L x	1 M-H	
	2	ND		28.9 M-W x	28.9 M-L x	1 M-H	
	3	RD		28.9 M-W x	28.9 M-L x	1 M-H	
CHLORINATION	1			25.0 KG/D AS 100% Cl2			
TRANSFER PUMP	2	+	1	144.2 M3/H x	20.0 MH x	10.4 BKW	
SLUDGE DICHARGE PUM	1	+	1	7.5 M3/H x	5.0 MH x	0.2 BKW	

EQUIPMENT SHORT SPECIFICATION 6,000 M3/D UASB

SERVICE	NO. INSTALLED			SPECIFICATION			MATERIAL
INLET CHAMBER	1			1.0 M-W x	1.0 M-L x	1 M-H	
SCREEN CHAMBER							
PUMP PIT	1			3.8 M-W x	3.8 M-L x	4 M-H	
GRIT CHAMBER	1	+	1	0.5 M-W x	12.4 M-L x	0.7 M-H	
UASB REACTOR	2			15.3 M-W x	15.3 M-L x	4 M-H	
SLUDGE DRYING BED	2			24.9 M-W x	24.9 M-L x	1.0 M-H	
SLUDGE SUMP	1			4.5 M3			
FINAL POLISHING POND	1	ST		31.6 M-W x	31.6 M-L x	1 M-H	
	2	ND		31.6 M-W x	31.6 M-L x	1 M-H	
	3	RD		31.6 M-W x	31.6 M-L x	1 M-H	
CHLORINATION	1			30.0 KG/D AS 100% Cl2			
TRANSFER PUMP	2	+	1	173.1 M3/H x	20.0 MH x	12.5 BKW	
SLUDGE DICHARGE PUM	1	+	1	9.0 M3/H x	5.0 MH x	0.2 BKW	

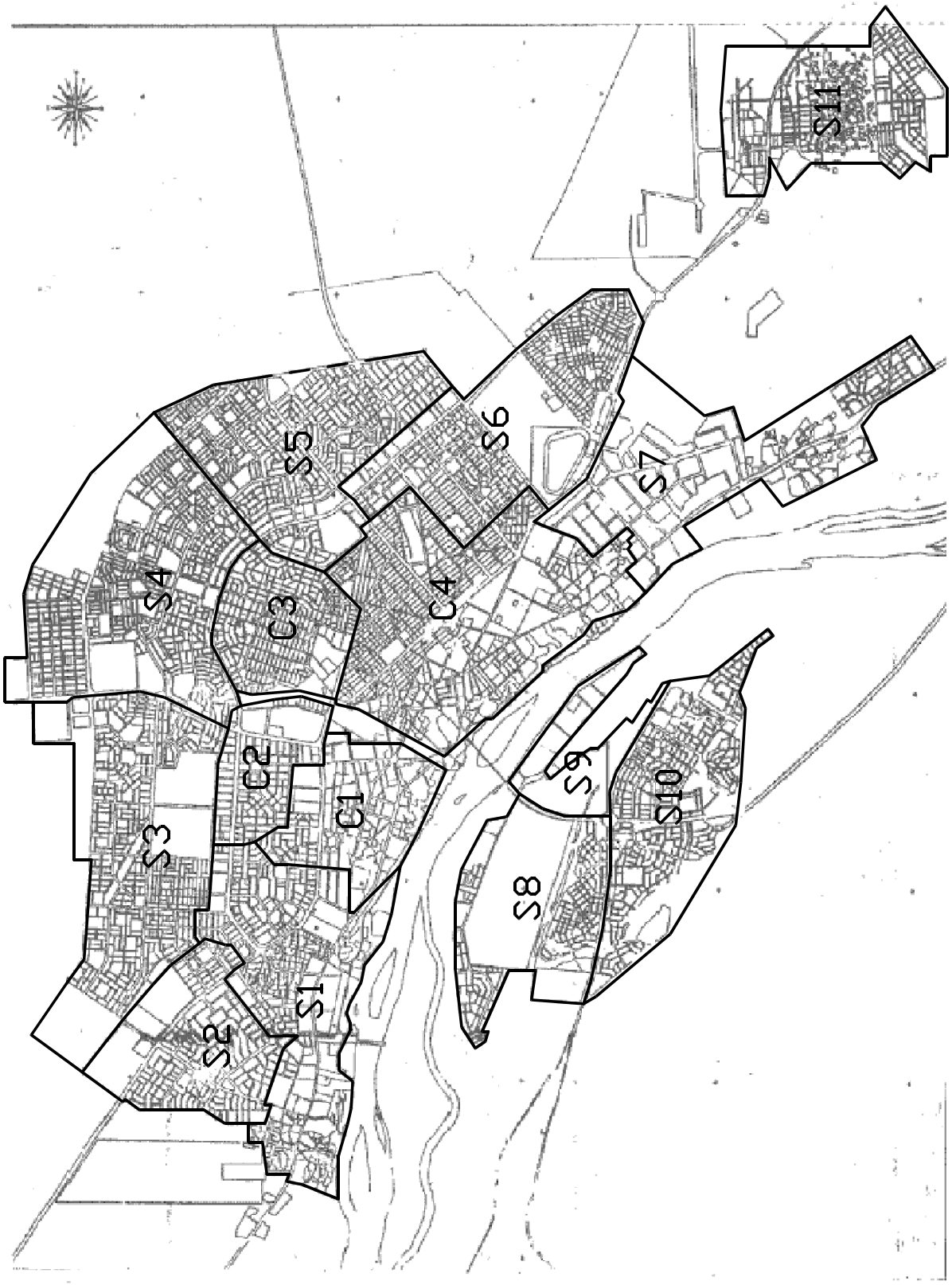
EQUIPMENT SHORT SPECIFICATION 8,000 M3/D UASB

SERVICE	NO. INSTALLED			SPECIFICATION			MATERIAL
INLET CHAMBER	1			1.1 M-W x	1.1 M-L x	1 M-H	
SCREEN CHAMBER							
PUMP PIT	1			4.4 M-W x	4.4 M-L x	4 M-H	
GRIT CHAMBER	1	+	1	0.6 M-W x	12.4 M-L x	0.7 M-H	
UASB REACTOR	2			17.6 M-W x	17.6 M-L x	4 M-H	
SLUDGE DRYING BED	2			28.7 M-W x	28.7 M-L x	1.0 M-H	
SLUDGE SUMP	1			6.0 M3			
FINAL POLISHING POND	1	ST		36.5 M-W x	36.5 M-L x	1 M-H	
	2	ND		36.5 M-W x	36.5 M-L x	1 M-H	
	3	RD		36.5 M-W x	36.5 M-L x	1 M-H	
CHLORINATION	1			40.0 KG/D AS 100% Cl2			
TRANSFER PUMP	2	+	1	230.8 M3/H x	20.0 MH x	16.7 BKW	
SLUDGE DICHARGE PUM	1	+	1	12.0 M3/H x	5.0 MH x	0.3 BKW	

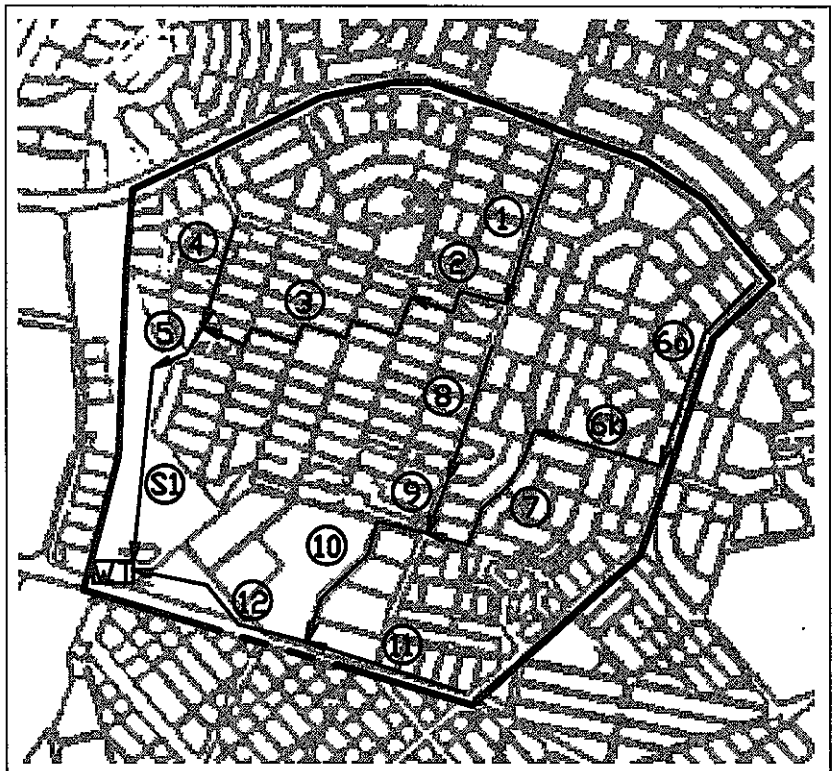
EQUIPMENT SHORT SPECIFICATION 3,300 M3/D STABILIZATION POND

SERVICE	NO. INSTALLED	SPECIFICATION	MATERIAL
ANAEROBIC POND	3	16.6 M-W x 16.6 M-L x 4 M-H	W/HDPE SHEET
FACULTATIVE POND	3	38.9 M-W x 38.9 M-L x 1.5 M-H	
PRIMARY MATURATION POND	3	74.2 M-W x 74.2 M-L x 1 M-H	
SECONDARY MATURATION PON	3	74.2 M-W x 74.2 M-L x 1 M-H	

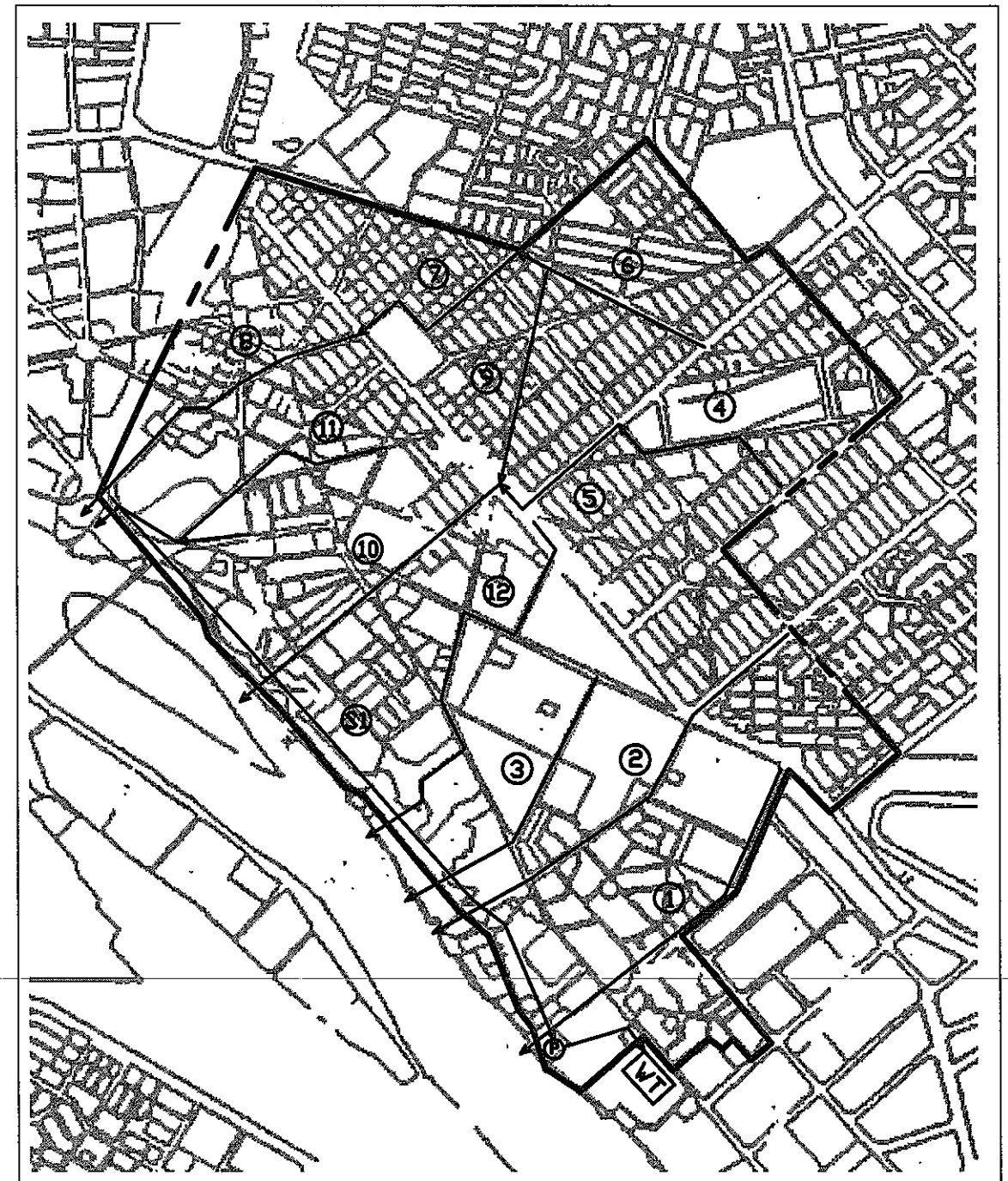
APPENDIX I.4 DETAIL OF SEWAGE / DRAINAGE NETWORK


S11
S5
S6
S7
S4
C3
C4
C2
C1
S3
S9
S10
S8
S1
S2

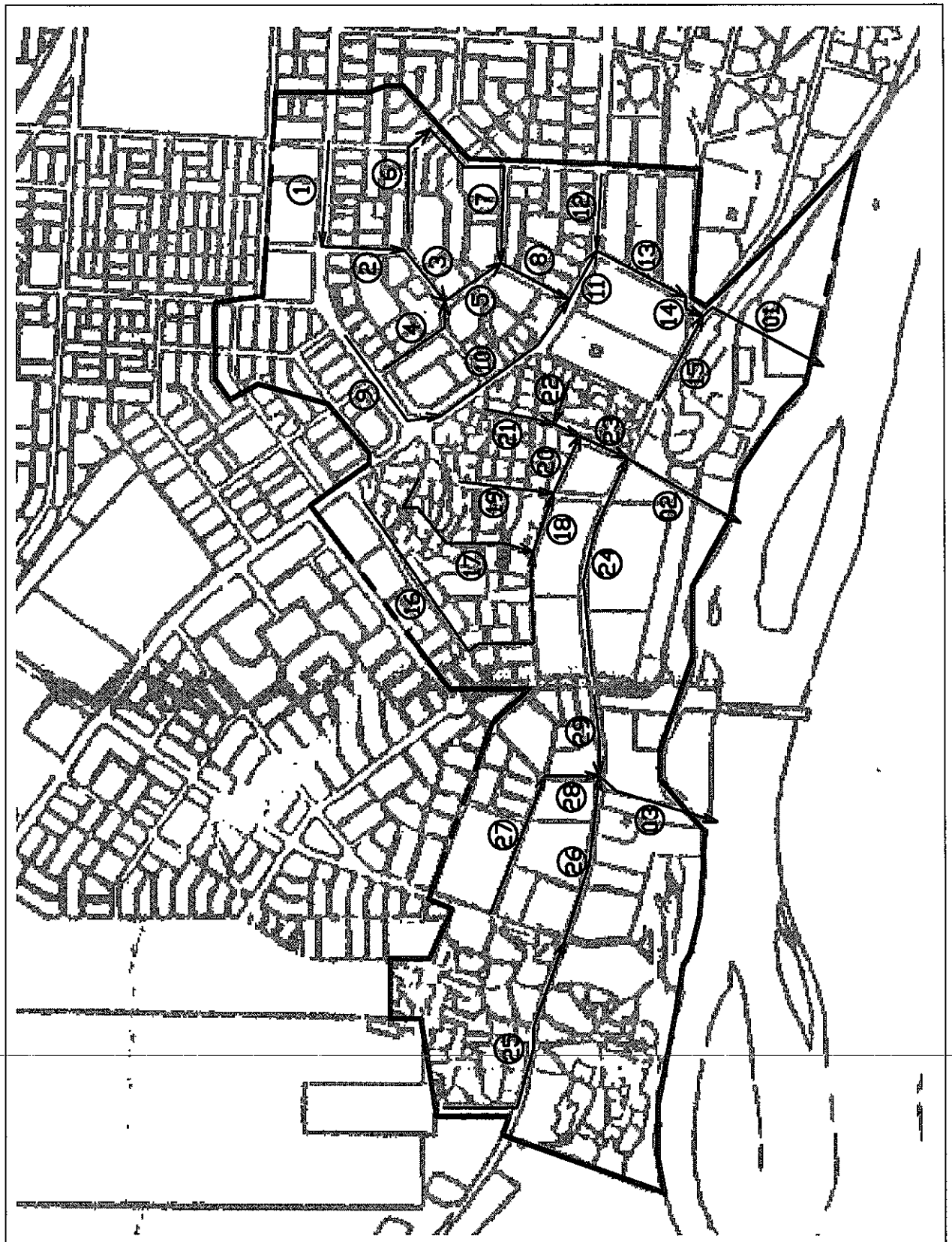
DRAINAGE AND SEWAGE NETWORK IN C1,C2



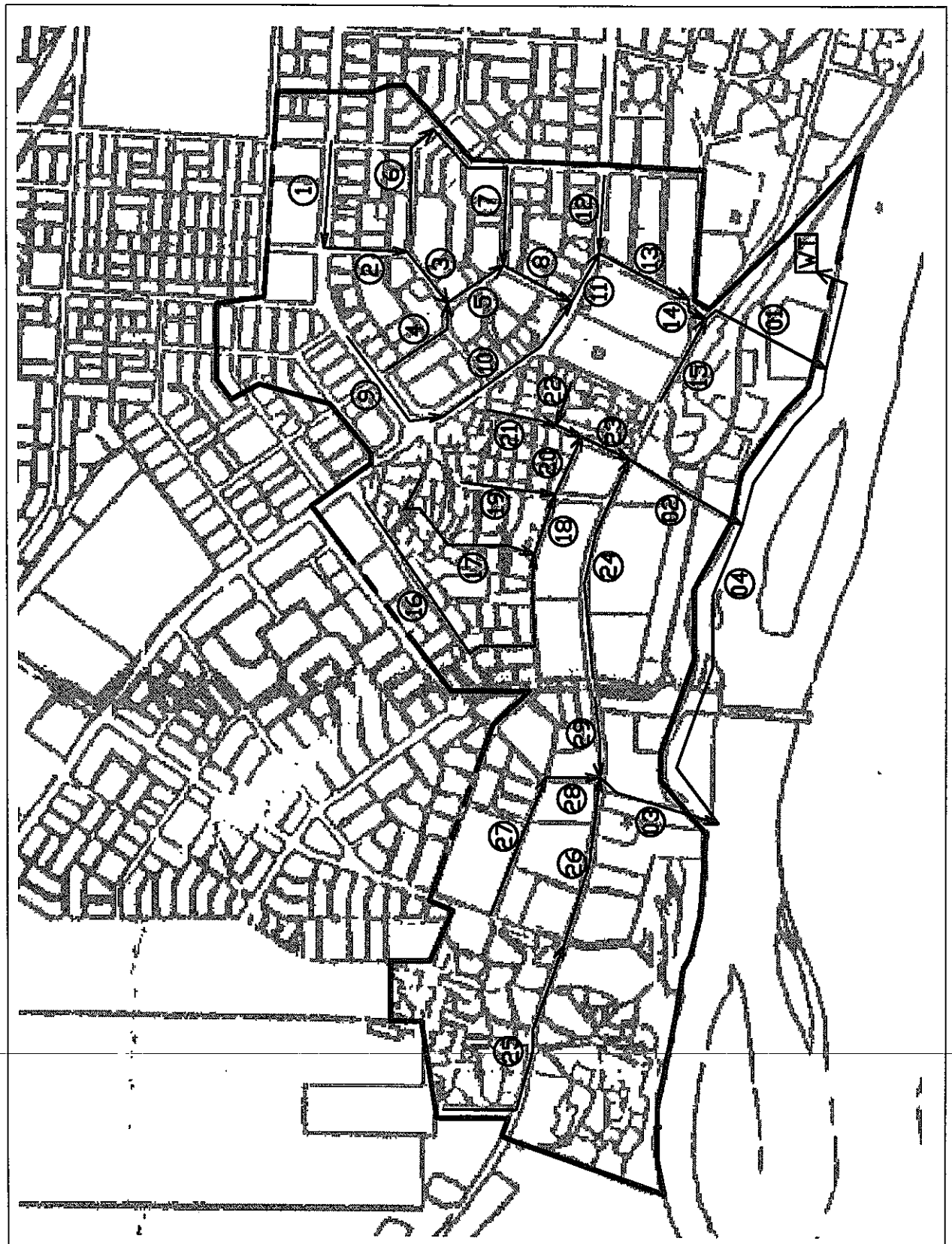
DRAINAGE AND SEWAGE NETWORK IN C3



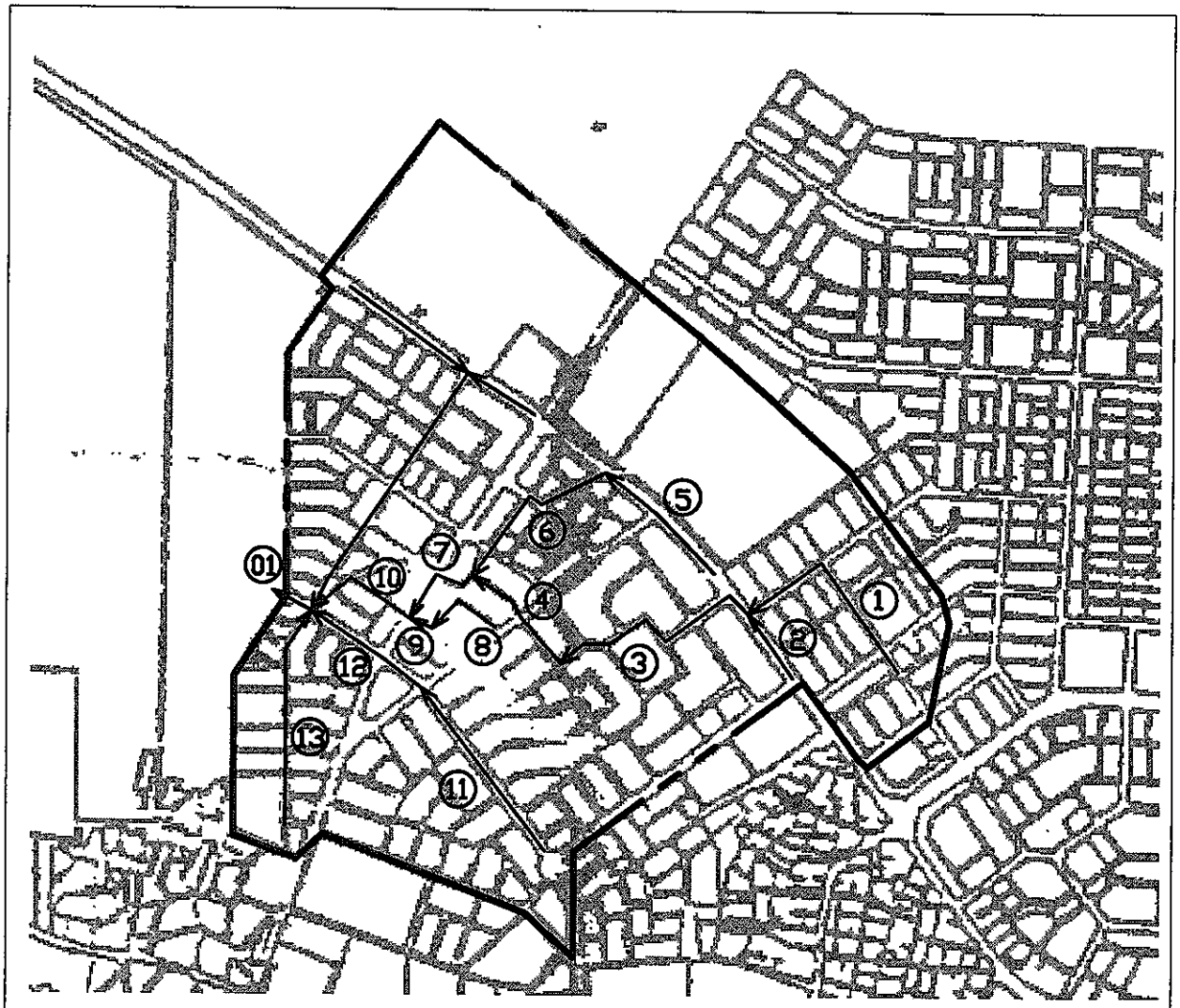
DRAINAGE AND SEWAGE NETWORK IN C4



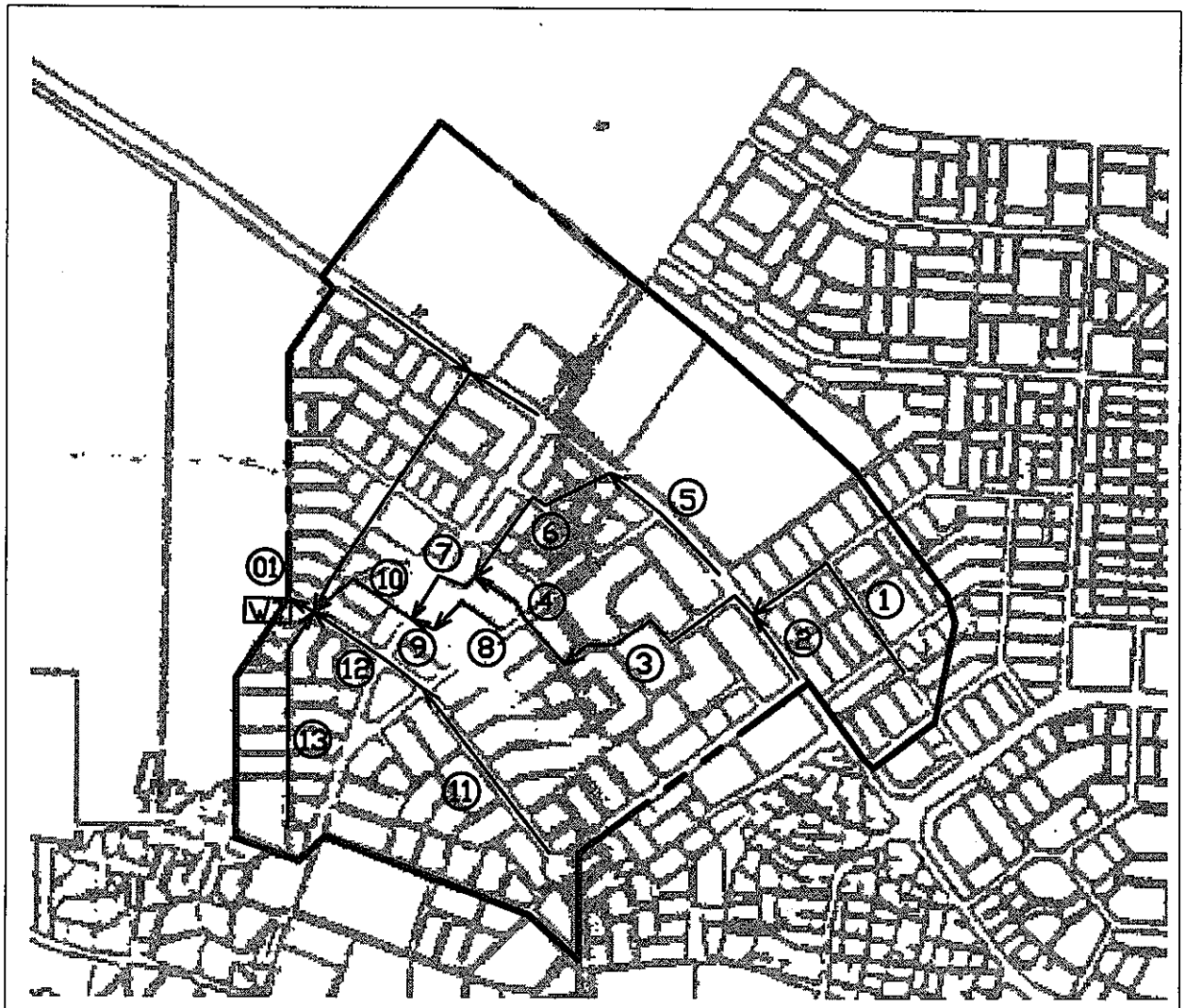
DRAINAGE NETWORK IN S1



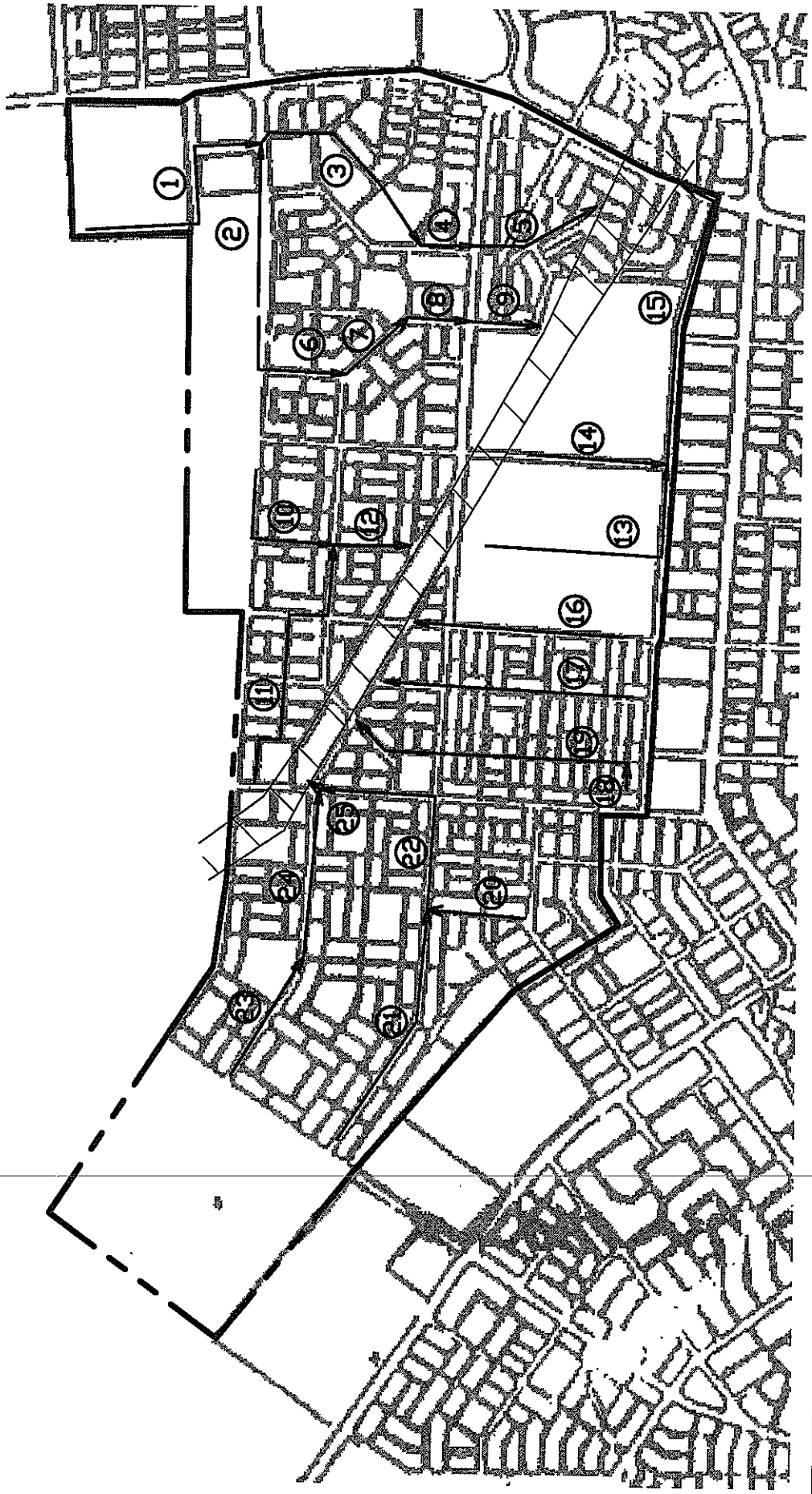
SEWAGE NETWORK IN S1



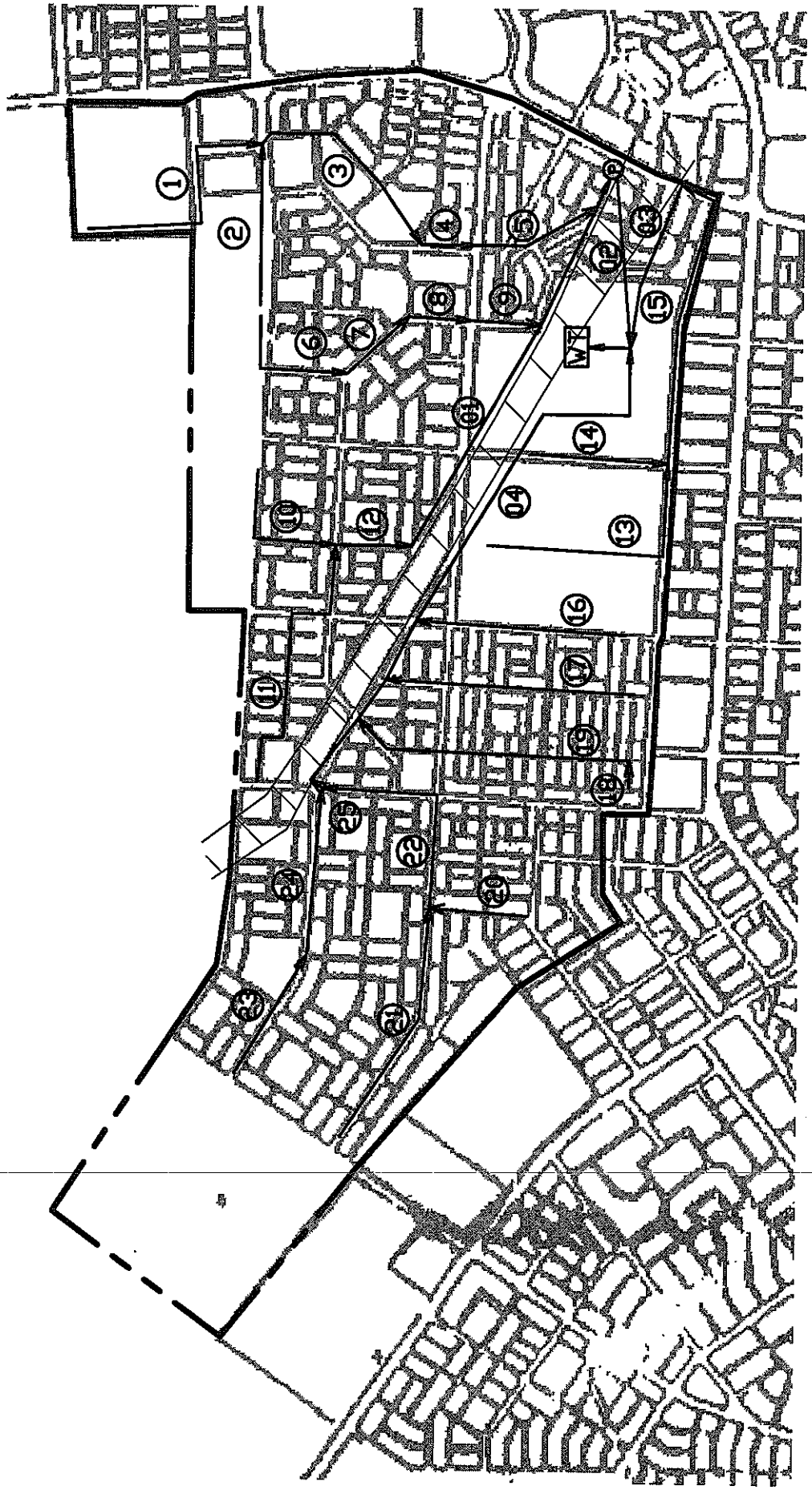
DRAINAGE NETWORK IN S2



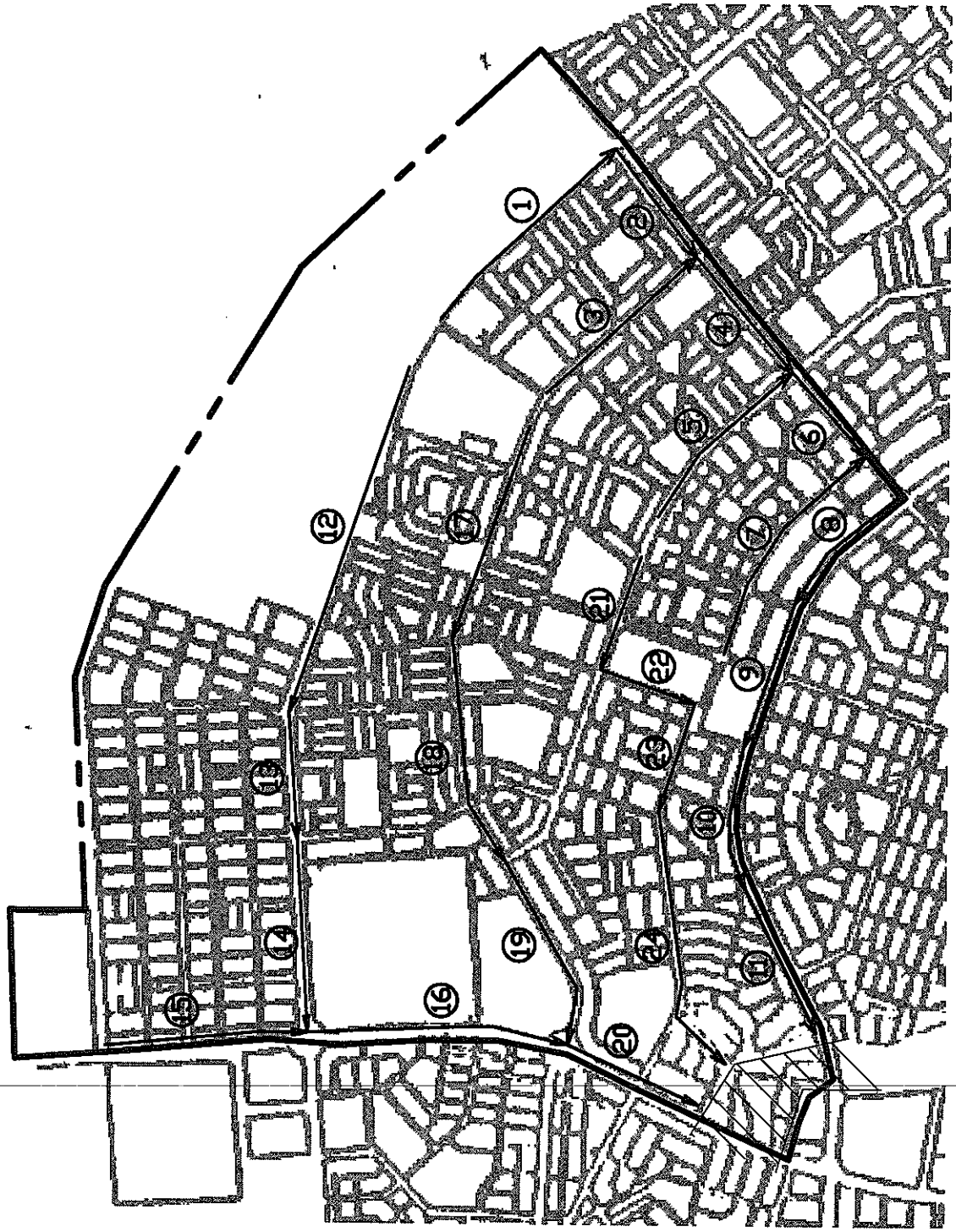
SEWAGE NETWORK IN S2



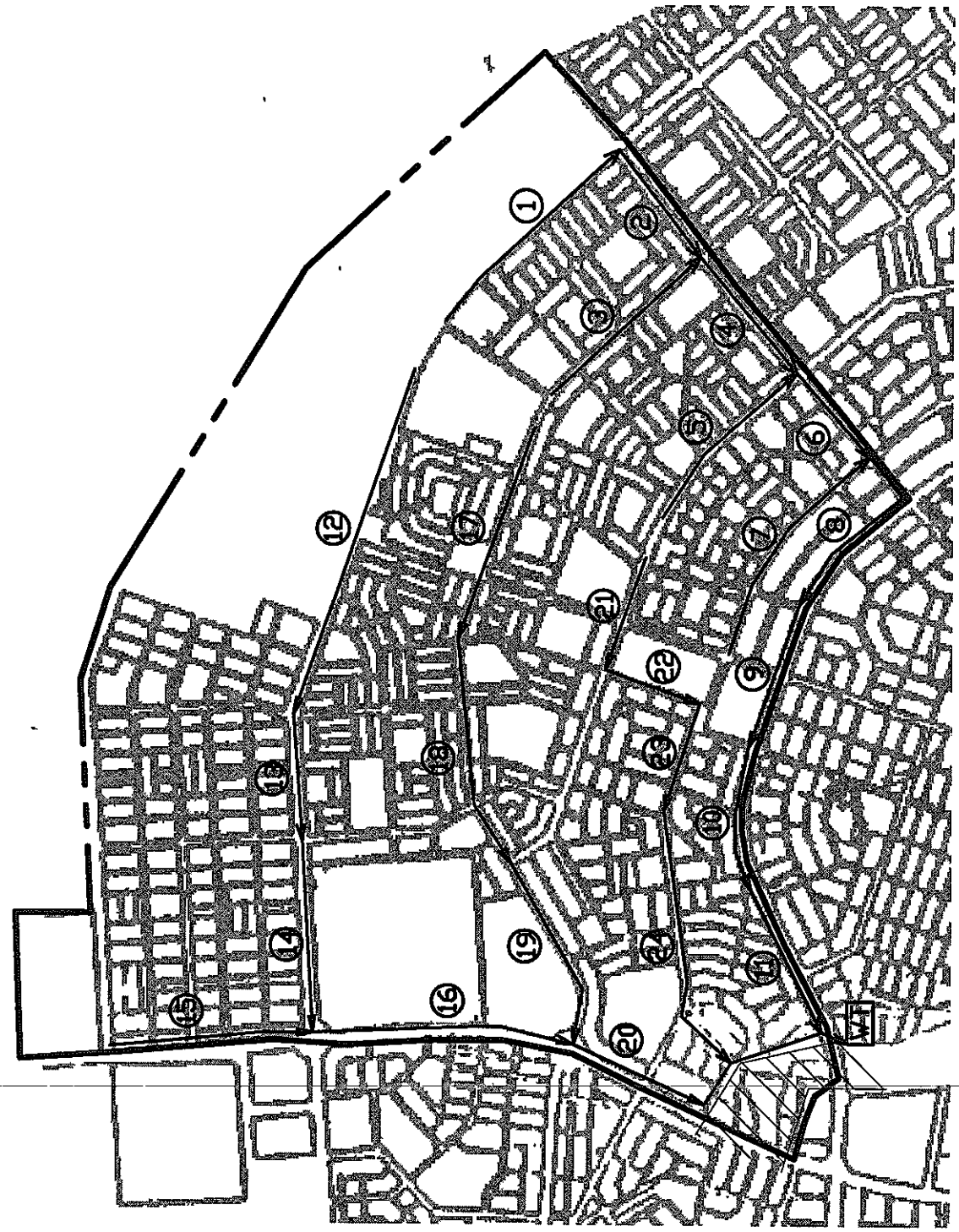
DRAINAGE NETWORK IN S3



SEWAGE NETWORK IN S3



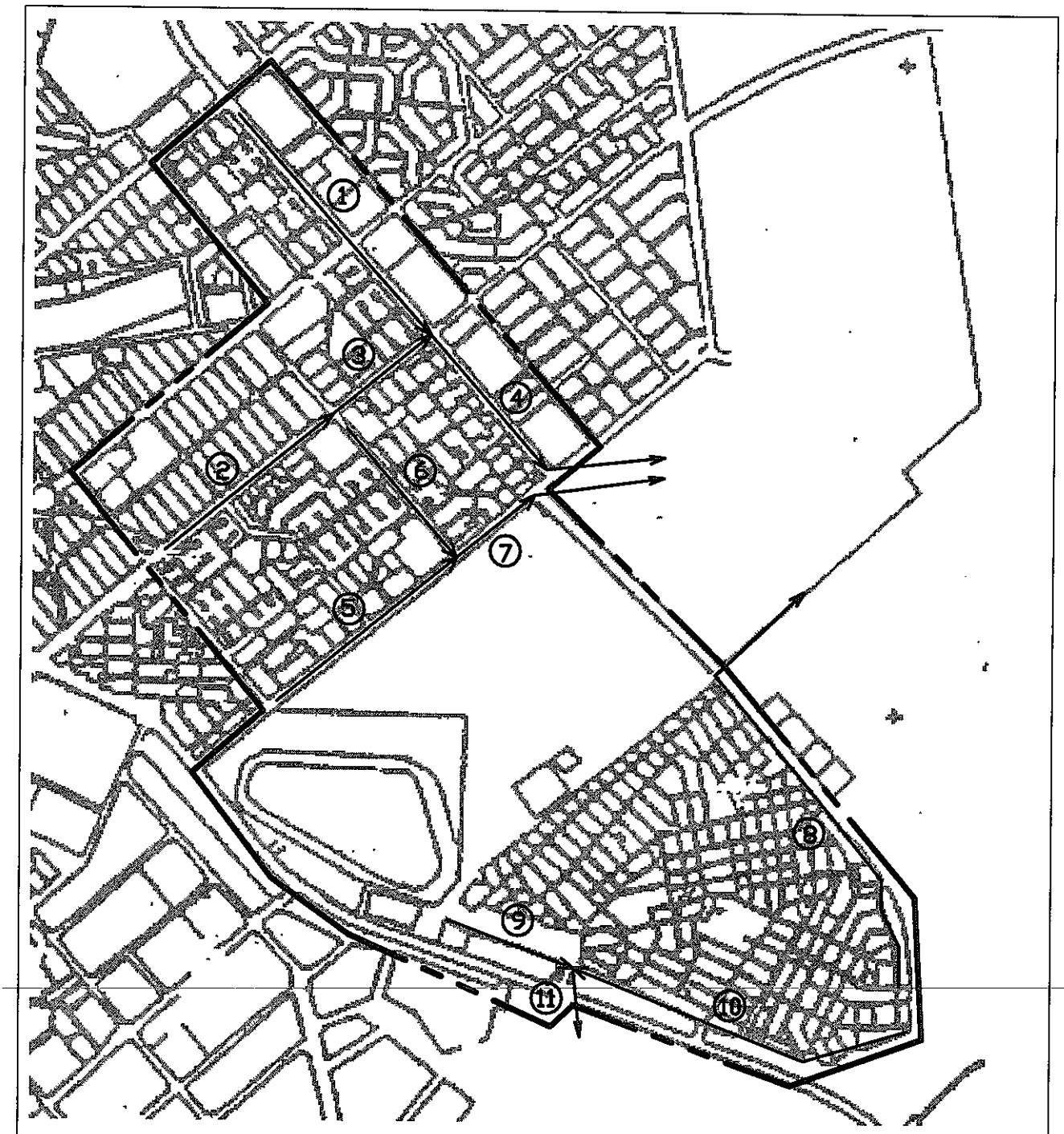
DRAINAGE NETWORK IN S4



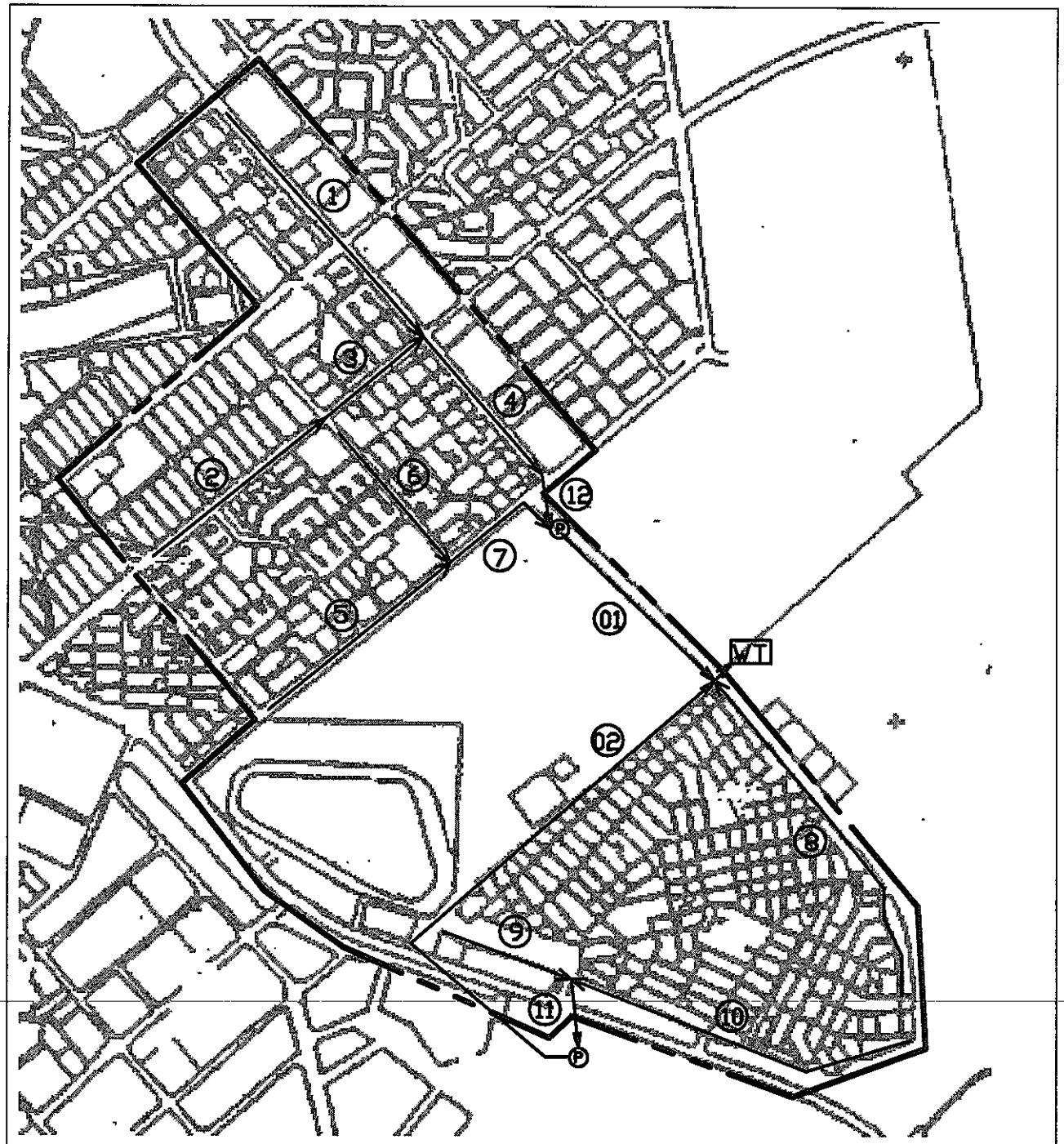
SEWAGE NETWORK IN S4

DRAINAGE NETWORK IN S5

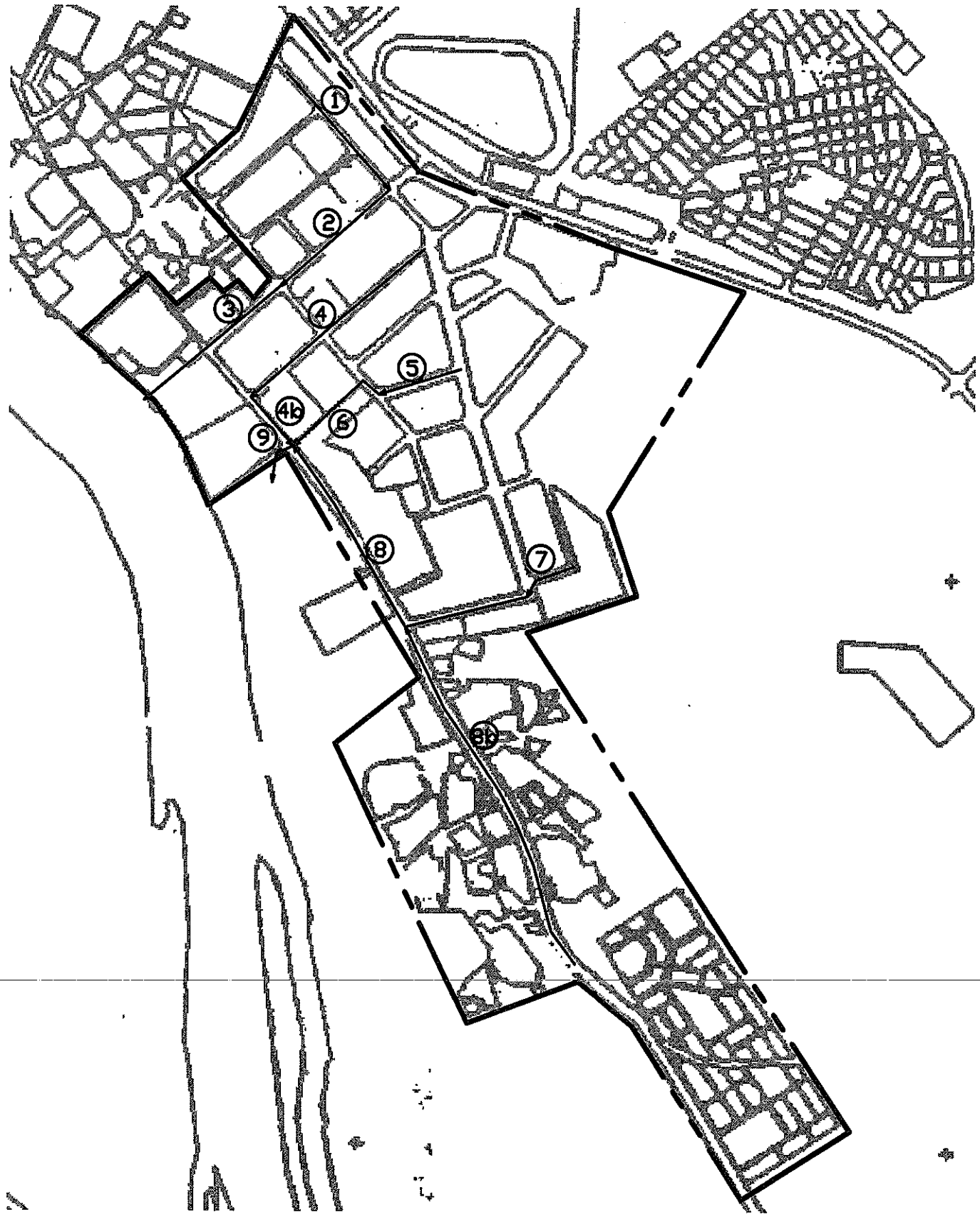
SEWAGE NETWORK IN S5



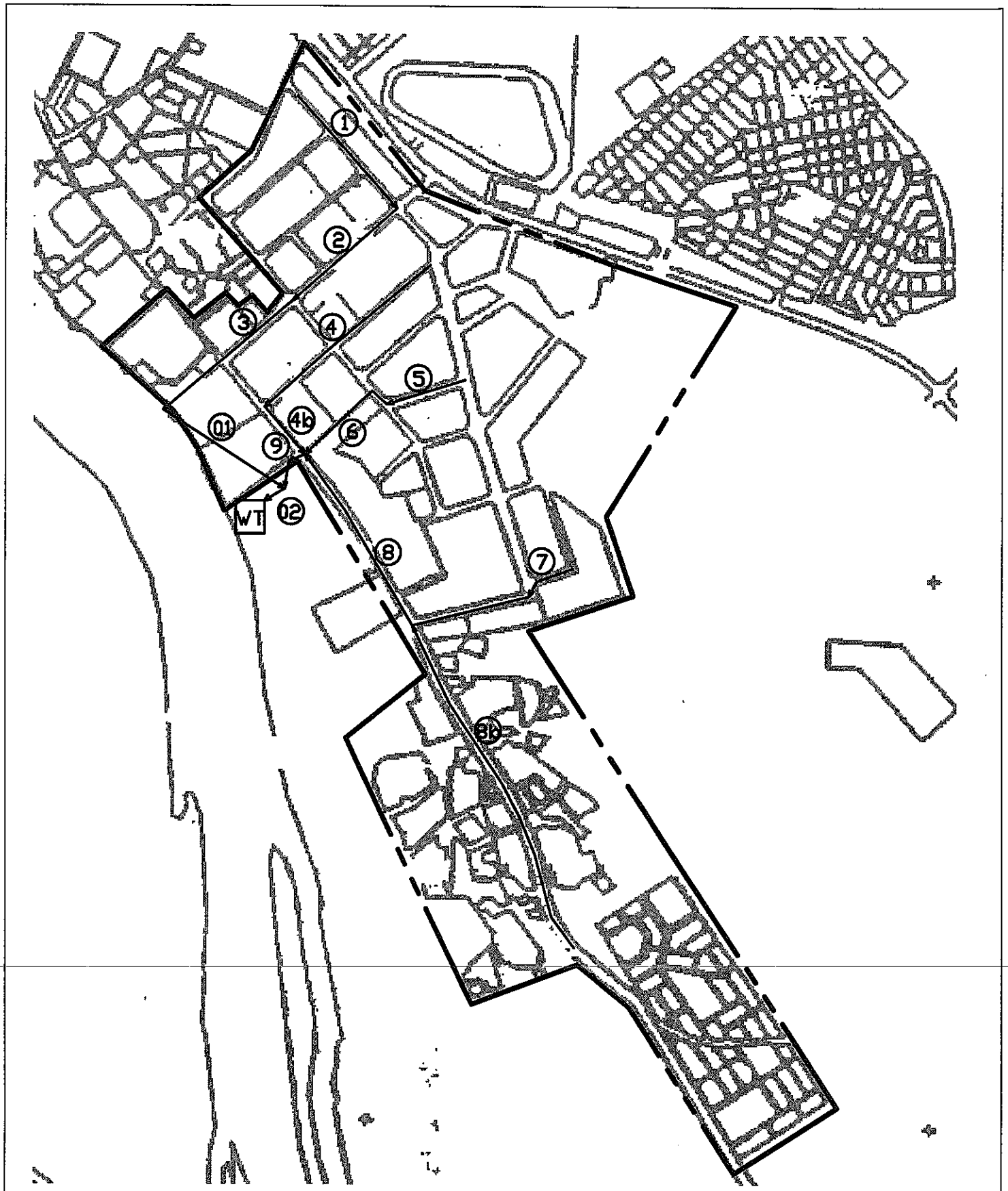
DRAINAGE NETWORK IN S6



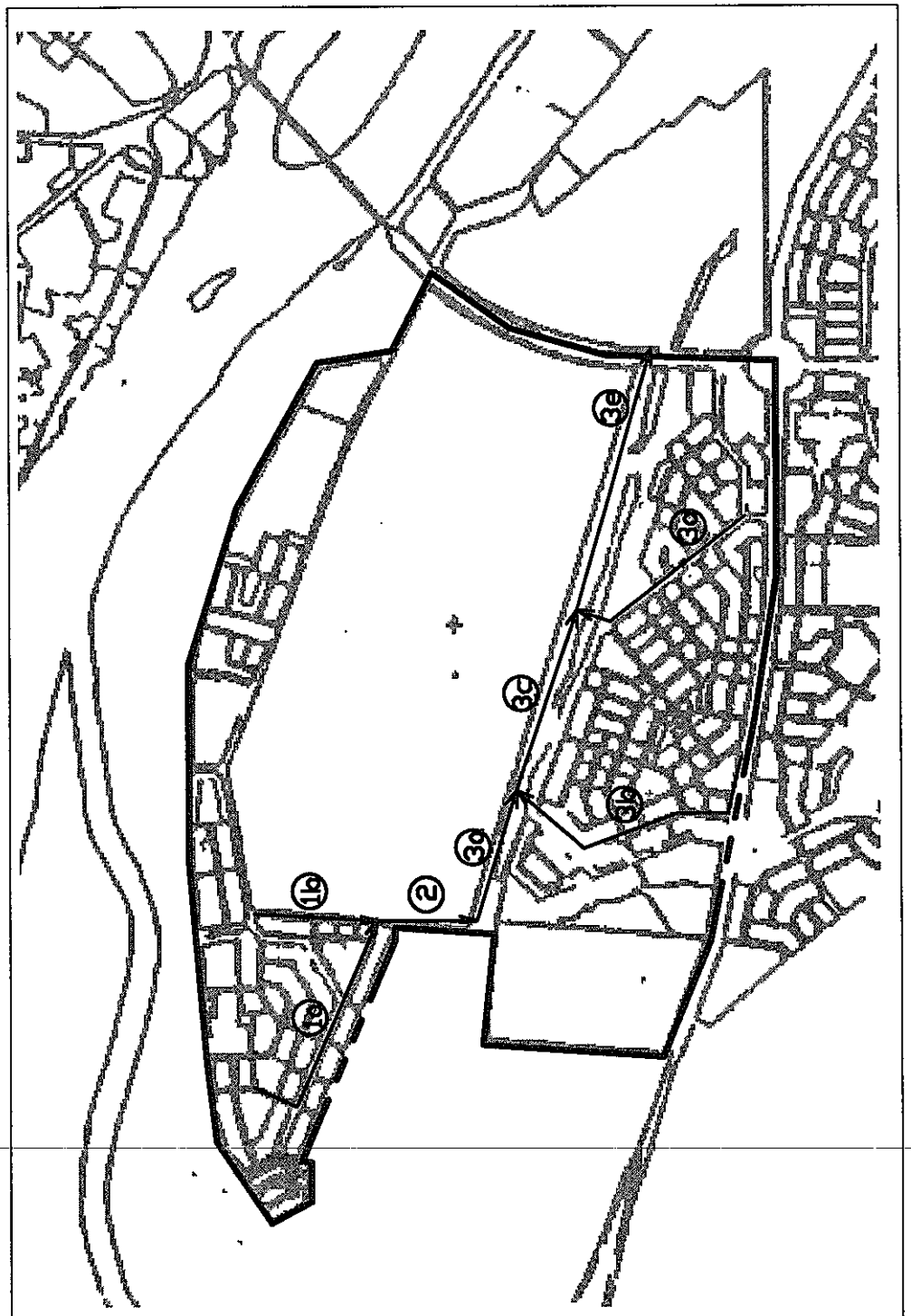
SEWAGE NETWORK IN S6



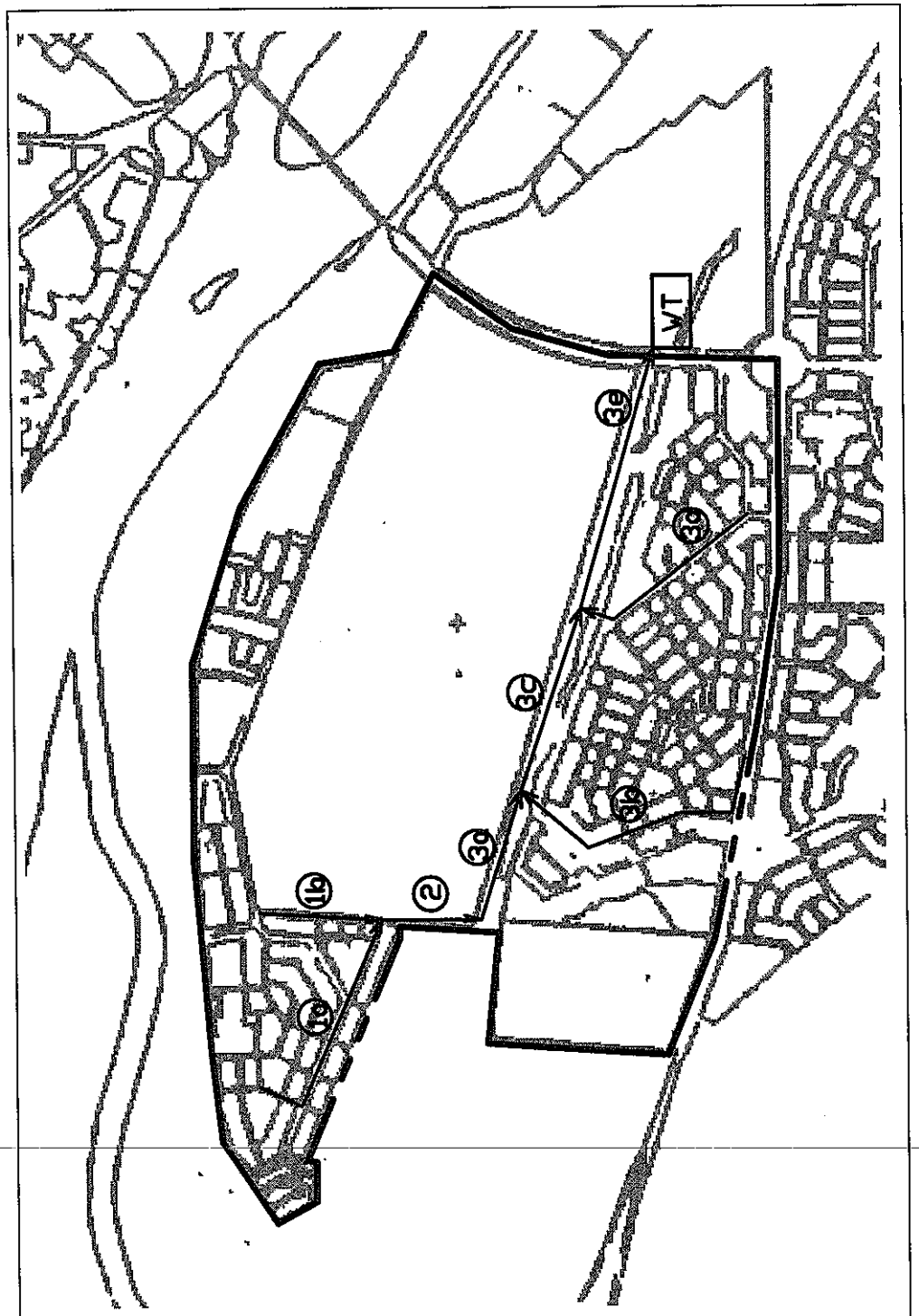
DRAINAGE NETWORK IN S7



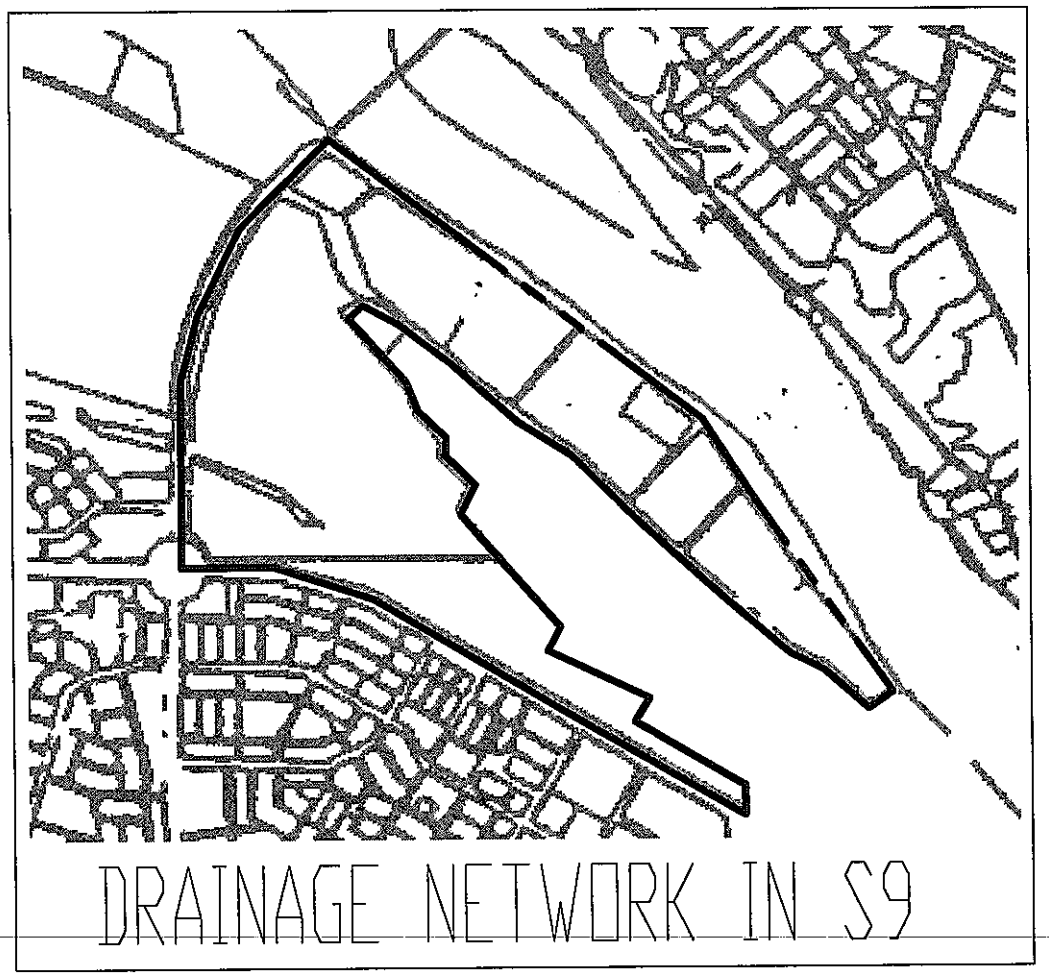
SEWAGE NETWORK IN S7

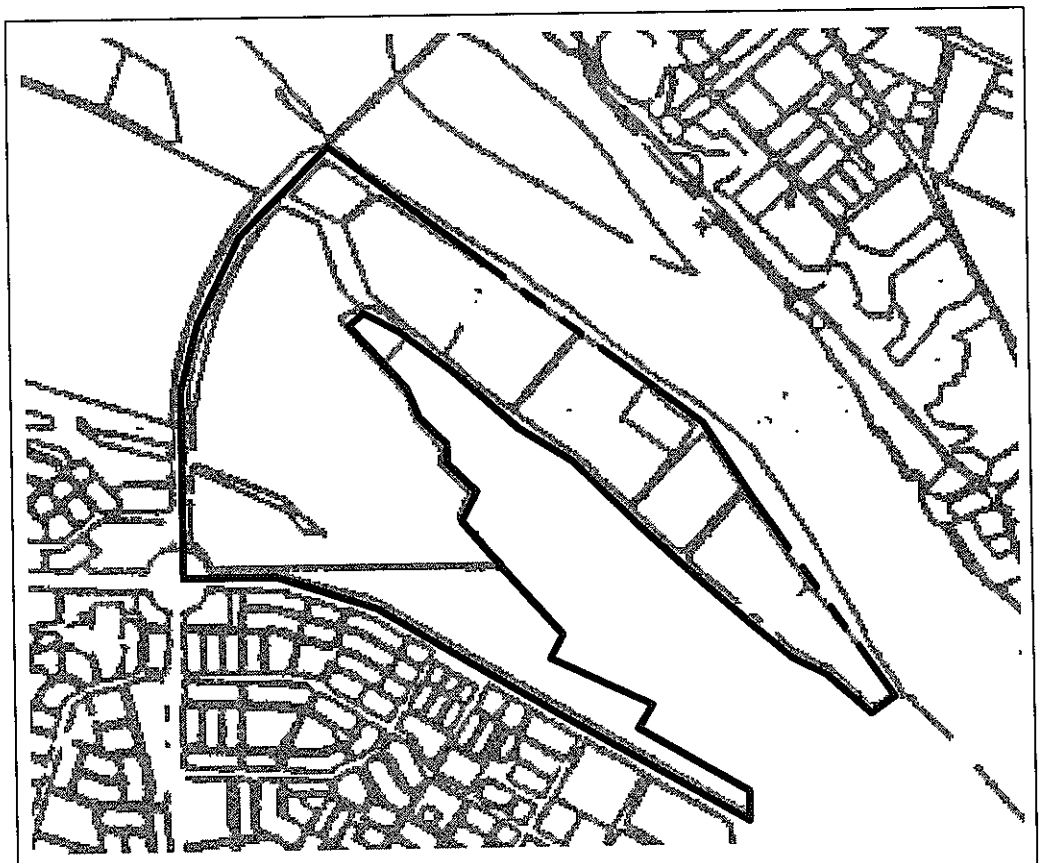


DRAINAGE NETWORK IN S8



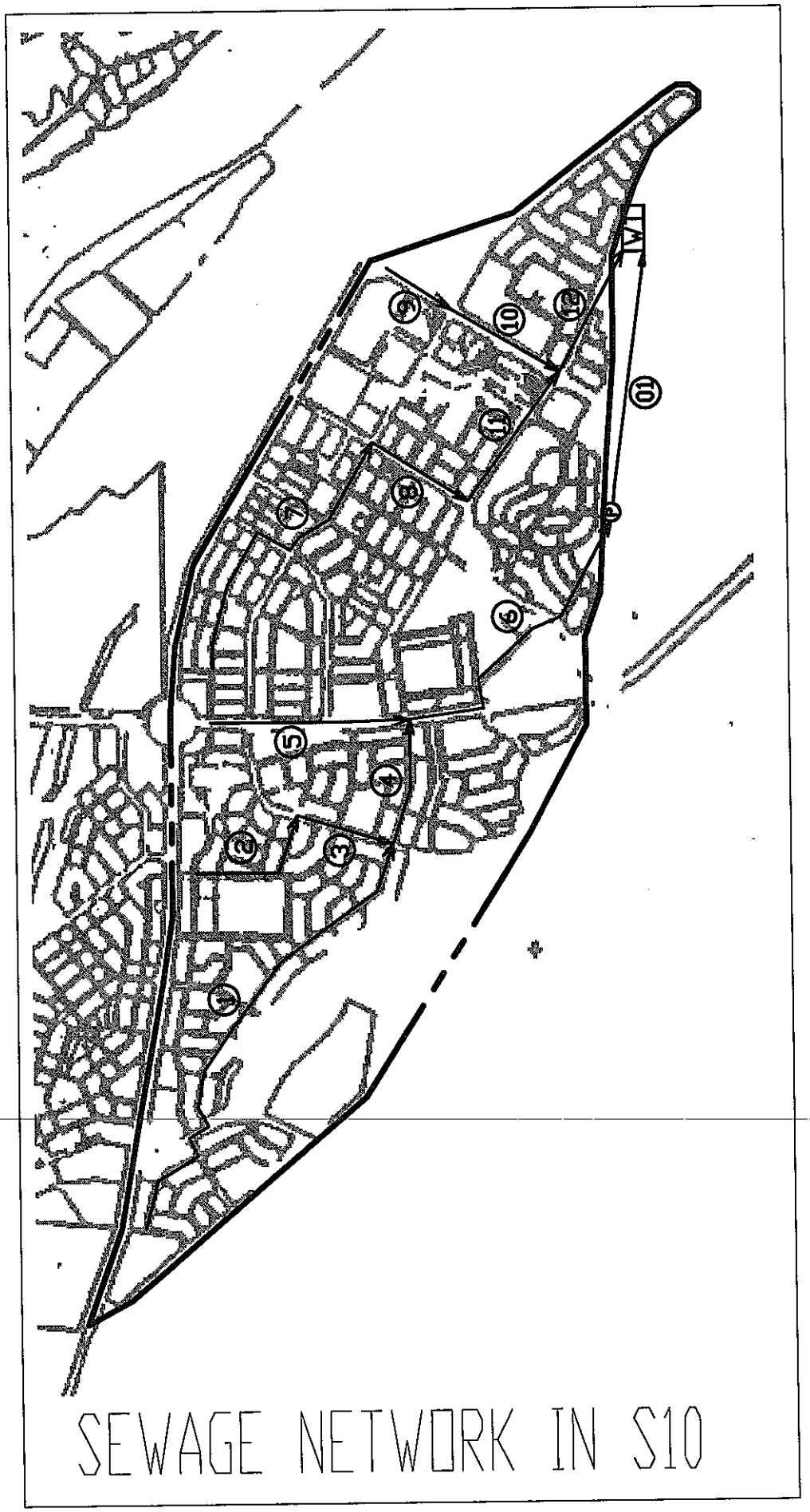
SEWAGE NETWORK IN S8

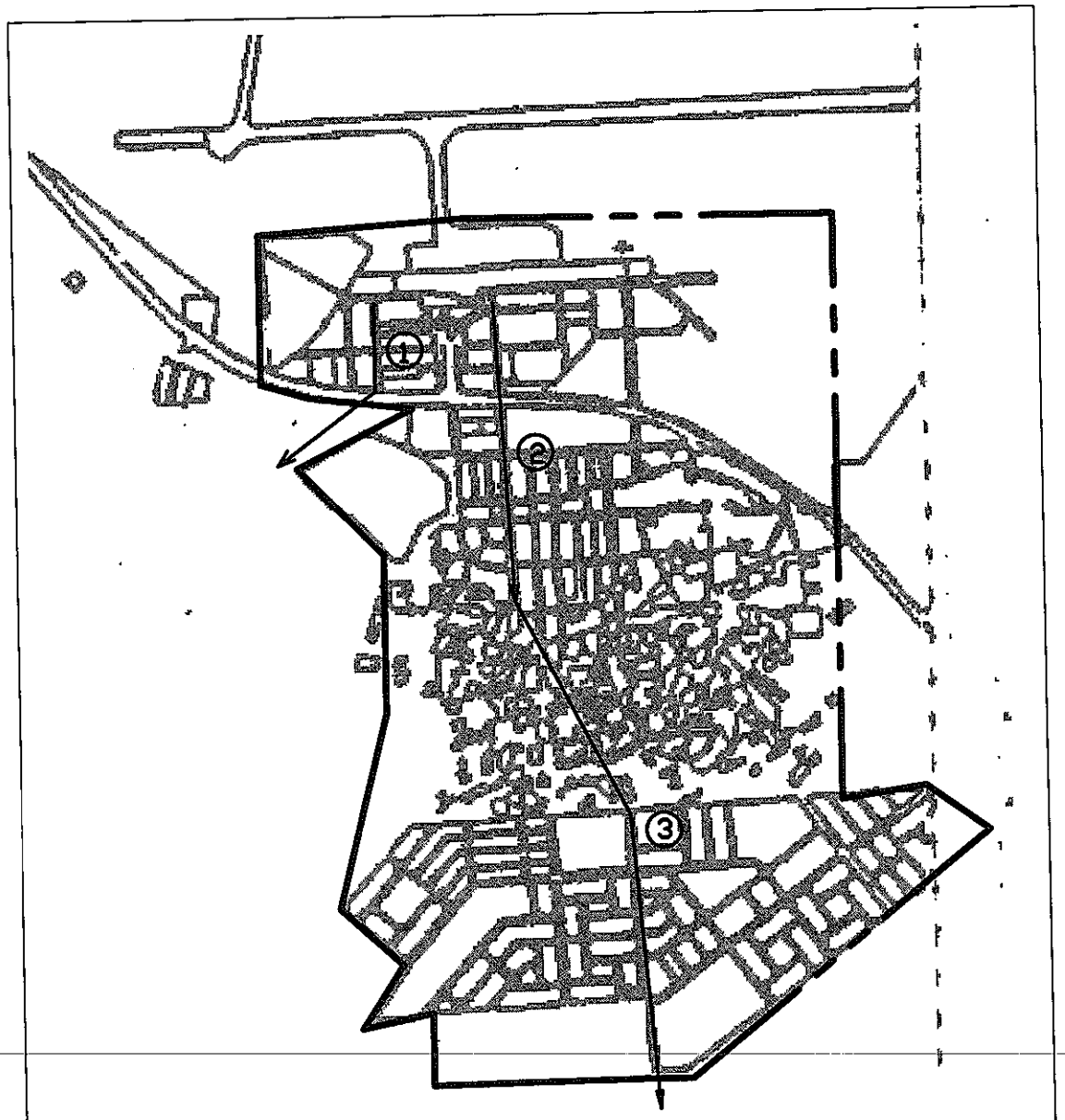

DRAINAGE NETWORK IN S9



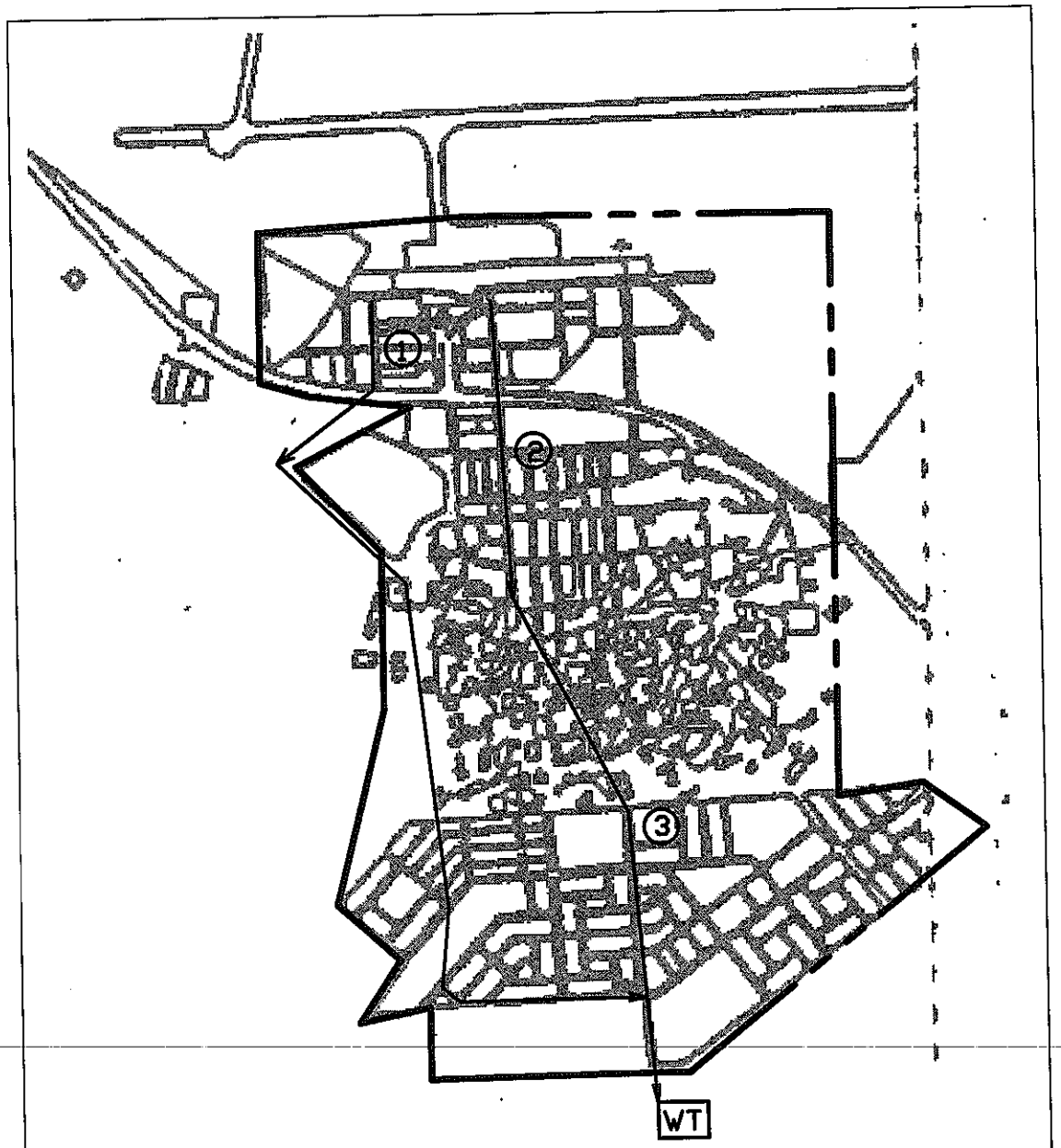
SEWAGE NETWORK IN S9

DRAINAGE NETWORK IN S10


SEWAGE NETWORK IN S10



DRAINAGE NETWORK IN S11



SEWAGE NETWORK IN S11

APPENDIX J: SOLID WASTE MANAGEMENT

APPENDIX J-1: ALTERNATIVE STUDY FOR COLLECTION AND TRANSPORT

Introduction of Alternative Study

In the beginning, the required number of truck has been studied per different system and type of vehicle as follows. The number of truck is valuable factor for capital cost and operation and maintenance (O&M) cost. Generally, it is assumed that large number of truck requires more capital and O&M cost.

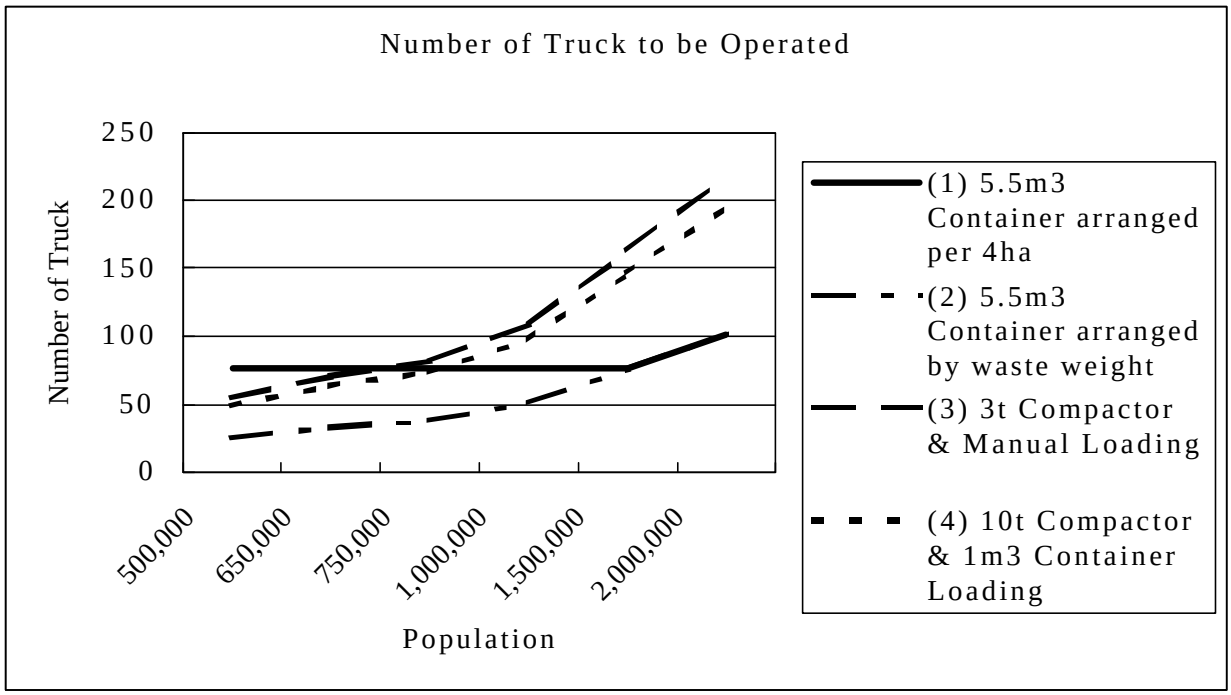
System (1)
The same type of container and container truck as present is applied. But one container is put at least per 4ha to keep the resident's accessibility. In this case, most of resident can get a container within about 100m and it is expected that the resident discharges the waste properly in the container and the waste scattered in streets is decreased. However the system requires more containers than its waste storing capacity. Provided one container transported once a week, the capacity is too large in areas whose population density is less than 130 persons/ha. In result, CUN and Communes shall prepare the containers and truck more than capacity and operate it.

System (2)
The system (1) is modified as System (2). System (2) is to prepare the containers according to waste generation amount and not to consider the resident's accessibility. In this case, the number of container and truck meets to the waste amount. The required number of container and truck is much less than System (1), however the resident's effort is required especially in lower population density area. Provided that the capacity of one container is 2.87 t (5.5m^3 x 90% / 0.58t/m^3) and it is transported daily, one container can cover about 3,800 persons. Although higher population density (200/ha) areas require one per 20ha for example, only one container is put per 76ha in lower density (50/ha) areas. And it seems that these container provided rates are not accessible for the resident in Niamey, even one per 20ha. Therefore the pre-collection is necessary to help the resident's discharge.

System (3)
Compactor truck that is one kind of developed equipment for waste collection and transport is applied. This system is not done through pre-collection. The truck shall collect the waste discharged directly by the resident. Although the collection points shall be provided per 4ha, the equipment capacity meets to the generated waste amount since the large volume containers are not applied. The System (3) applies 3t (6m^3) compactor truck (3 trips / truck) and its loading is done by manual way. Taking into account the actual discharge habit by the resident, daily collection service is required.

System (4)
This system is to collect the waste through smaller (1m^3) container and compactor truck. To lift the containers up, larger compactor truck is required. So 5t (10m^3) compactor truck (2 trips / day) is applied. 1m^3 container shall be provided per 4ha. The amount transported by one truck is generally more than the System (3).

Assuming the population of Niamey is equally distributed in urbanized area (in about 11,000ha), the required number of truck increases according to the total population as following figure.



The System (2) which is helped by the resident's effort for pre-collection requires always lower number of truck. And the system (3) and (4) which apply the compactor trucks require lower number than System (1) in the period of lower population. When the population reaches at approx. 2,000,000 in Niamey and the population density become higher, the System (1) and (2) require the same number of truck. And the system (1) seems that it is most effective for larger population density, however its container collection frequency is only once a week. The system (1) shall keep the waste in containers for a week. Therefore the system (3) and (4) which collect the waste every day are much better to keep the city sanitary.

The above calculation has been done, assuming that the population of Niamey is equally distributed in urbanized area. It is therefore possible to apply different system according to population density and characteristics of each area (in higher density area: System (1), in lower density area: System (2) or (3) for example). However unifying the type of truck and container is most important in Niamey to manage the equipment for long time and it is more suitable not to apply compactor trucks whose maintenance is more complicated than present type truck. Taking into account the current financial conditions of CUN and Communes, which can not sufficiency operate the existing 21truck in fuel cost shortage, the system (1) and (2) whose required number of truck is lower at the population level 900,000 are suitable in Niamey. Especially the system (2) requires the resident to help CUN and Communes for minimizing the capital and O&M cost, it is therefore appropriate to increase the waste collection rate at low public expenditure.

As Alternative Study, the systems that the present type of truck and container is applied have been studied.

Alternative Study

1. Basic Data Applying for Alternative Design

No.	Item	Unit	Figure
1	Population	pers.	15,000
2	Population Density in 2015	pers./ha	88.64
3	Area	ha	169
4	Waste Generation Rate	kg/per.day	0.75
5	Sand content of generated waste	% in weight	60%
6	Waste content of generated waste	% in weight	40%
7	Density of waste with sand	t/m^3	0.58
8	Density of waste without sand	t/m^3	0.325
9	Density of sand	t/m^3	1.6
10	Daily Waste Generation	t/day	11
		m^3/day	19
11	Yearly Waste Generation	t/year	4,106
		m^3/year	7,080

2. Alternative Study

2.1 Alternative 1

(1) Required Number of Container Station

No.	Item	Unit	Figure
1	Area	ha	169
2	Rate of container station (covering area by one station)	ha/station	4
3	Required No of container station	stations	43

(2) Capacity of Container

No.	Type of Container	volume	loading rate	capable volume	capable weight
		m^3	%	m^3	t
	For 5.5m^3 Waste Container Truck as present				
1	for Waste with sand	5.5	90%	4.95	2.87

(3) Required Number of Container in Population Wise

No.	Item	Unit	Collection days/week: fq= 6	Collection days/week: fq= 2	Collection days/week: fq= 1
1	Population in area	pers	15,000	15,000	15,000
2	Days to store the waste for	days	2	4	7
3	Serving population to store for	pers.days	30,000	60,000	105,000
4	Serving waste to store	t	23	45	79
5	Required No of container	pcs	8	16	28

(4) Required Number of Container in Area Wise

No.	Item	Unit	Collection days/week: fq= 6	Collection days/week: fq= 2	Collection days/week: fq= 1
1	Required No of container	pcs	43	43	43

(5) Evaluated Number of Container

No.	Item	Unit	Collection days/week: fq= 6	Collection days/week: fq= 2	Collection days/week: fq= 1
1	Required No of container	pcs	43	43	43

Note: The number in area wise is applied.

(6) Required Number of Container Truck

No.	Item	Unit	Collection days/week: fq= 6	Collection days/week: fq= 2	Collection days/week: fq= 1
For 5.5m^3 Waste Container Truck as present					
1	No of container to collect in a working day				
1-1	No of container to provide	pcs	43	43	43
1-2	No of collection division	nos	1	3	6
1-3	No of container to collect / day	pcs/working day	43	15	8
2	No of container truck in a working day				
2-1	Capable No of container	pcs/truck.day	6	6	6
2-2	Required No of truck		7.2	2.5	1.3

(7) Summary of Equipment

No.	Item	Unit	Collection days/week: fq= 6	Collection days/week: fq= 2	Collection days/week: fq= 1
1	Container				
	Required No.	pcs	43	43	43
	Spare container by truck	pcs	7	3	1
	Total No of container to provide	pcs	50	46	44
2	Container Truck				
	5.5m^3 Waste Container Truck	truck	7.2	2.5	1.3

(8) Investment Cost Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
FQ=6					
1	Container (5.5m^3 for waste with sand)	pcs	3,000,000	50	150,000,000
2	5.5m^3 Waste Container Truck	truck	36,000,000	7.2	258,000,000
3	Total				408,000,000
FQ=2					
1	Container (5.5m^3 for waste with sand)	pcs	3,000,000	46	138,000,000
2	5.5m^3 Waste Container Truck	truck	36,000,000	2.5	90,000,000
3	Total				228,000,000
FQ=1					
1	Container (5.5m^3 for waste with sand)	pcs	3,000,000	44	132,000,000
2	5.5m^3 Waste Container Truck	truck	36,000,000	1.3	48,000,000
3	Total				180,000,000

(9) Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
FQ=6					
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	1,500	2,243	3,364,750
1-2	Worker: 2/truck, 313 days/year	per.day	1,100	4,486	4,934,967
1-3	Total	LS			8,299,717
2	Operation				
2-1	Fuel (61.4lit/day.truck)	lit/year	380	137,730	52,337,565
2-2	Oil (20% of fuel)	LS			10,467,513
2-3	Total				62,805,078
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			12,900,000
3-2	For container (2% of purchase cost)	LS			3,000,000
3-3	Repair for accident (0.8% of pur. cost)	LS			2,064,000
3-4	Total				17,964,000
4	Administration (5% of 1,2,3)	LS			4,453,440
5	**Grand Total**				93,522,234

No.	Item	Unit	Unit Cost	Quantity	Amount
FQ=2					
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	1,500	783	1,173,750
1-2	Worker: 2/truck, 313 days/year	per.day	1,100	1,565	1,721,500
1-3	Total	LS			2,895,250
2	Operation				
2-1	Fuel (61.4lit/day.truck)	lit/year	380	48,046	18,257,290
2-2	Oil (20% of fuel)	LS			3,651,458
2-3	Total				21,908,748
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			4,500,000
3-2	For container (2% of purchase cost)	LS			2,760,000
3-3	Repair for accident (0.8% of pur. cost)	LS			720,000
3-4	Total				7,980,000
4	Administration (5% of 1,2,3)	LS			1,639,200
5	**Grand Total**				34,423,198
FQ=1					
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	1,500	417	626,000
1-2	Worker: 2/truck, 313 days/year	per.day	1,100	835	918,133
1-3	Total	LS			1,544,133
2	Operation				
2-1	Fuel (61.4lit/day.truck)	lit/year	380	25,624	9,737,221
2-2	Oil (20% of fuel)	LS			1,947,444
2-3	Total				11,684,666
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			2,400,000
3-2	For container (2% of purchase cost)	LS			2,640,000
3-3	Repair for accident (0.8% of pur. cost)	LS			384,000
3-4	Total				5,424,000
4	Administration (5% of 1,2,3)	LS			932,640
5	**Grand Total**				19,585,439

2.2 Alternative 2

(1) Expected Discharged and Pre-collected Waste Amount

No.	Item	Unit	Figure
1	Discharged rate into container by resident	%	0%
2	Discharged amount into container by resident	t/year	0
3	Pre-collected rate	%	100%
4	Pre-collected amount	t/year	4,106
5	Improperly discharged rate	%	0%
6	Improperly discharged amount	t/year	0

(2) Required Number of Collection Center

No.	Item	Unit	Figure
1	Area	ha	169
2	Rate of collection center (covering area by one center)	ha/center	100
3	Required No of collection center	center	2

(3) Capacity of Container

No.	Type of Container	volume	loading rate	capable volume	capable weight
		m^3	%	m^3	t
	For 5.5m^3 Waste Container Truck as present				
1	for Waste with sand	5.5	90%	4.95	2.87

(4) Required Number of Container in Population Wise

No.	Item	Unit	Figure
1	Population in area	pers	15,000
2	Generated waste per week	t/week	79
3	Total No of container	pcs/week	28
4	No of working days	days	6
5	Required No of container	pcs	5

(5) Required Number of Container in Area Wise

No.	Item	Unit	Figure
1	Required No of container (collection center)	pcs	2

(6) Evaluated Number of Container

No.	Item	Unit	Figure
1	Required No of container	pcs	5

Note: The number in population wise is larger than area wise.

(7) Required Number of Container Truck

No.	Item	Unit	Figure
For 5.5m^3 Waste Container Truck as present			
1	No of container to collect / day	pcs/working day	5
2	No of container truck in a working day		
2-1	Number of trip	pcs/truck.day	6
2-2	Required No of truck		0.8

(8) Summary of Equipment

Case: 5.5m^3 Waste Container Truck applied as present

No.	Item	Unit	Figure
1	Container		
	Required No.	pcs	5
	Spare container by truck	pcs	1
	Total No of container to provide	pcs	6
2	Container Truck		
	5.5m^3 Waste Container Truck	truck	0.8

(9) Investment Cost Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Container (5.5m^3 for waste with sand)	pcs	3,000,000	6	18,000,000
2	5.5m^3 Waste Container Truck	truck	36,000,000	0.8	30,000,000
3	Total				48,000,000

(10) Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	1,500	261	391,250
1-2	Worker: 2/truck, 313 days/year	per.day	1,100	522	573,833
1-3	Total	LS			965,083
2	Operation				
2-1	Fuel (61.4lit/day.truck)	lit/year	380	16,015	6,085,763
2-2	Oil (20% of fuel)	LS			1,217,153
2-3	Total				7,302,916
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			1,500,000
3-2	For container (2% of purchase cost)	LS			360,000
3-3	Repair for accident (0.8% of pur. cost)	LS			240,000
3-4	Total				2,100,000
4	Administration (5% of 1,2,3)	LS			518,400
5	**Grand Total**				10,886,399

2.3 Alternative 3

(1) Expected Discharged and Pre-collected Waste Amount

No.	Item	Unit	Figure
1	Discharged rate into container by resident	%	0%
2	Discharged amount into container by resident	t/year	0
3	Pre-collected rate	%	100%
4	Pre-collected amount	t/year	4,106
5	Improperly discharged rate	%	0%
6	Improperly discharged amount	t/year	0

(2) Amount of Sand Sorted Out

No.	Item	Unit	Figure
1	Amount of waste pre-collected	t/year	4,106
2	Share of sand in waste	%	60%
3	Amount of sorted sand	t/year	2,464
4	Amount of sand sorted out waste	t/year	1,643

(3) Required Number of Recycle Center

No.	Item	Unit	Figure
1	Area	ha	169
2	Rate of recycle center (covering area by one center)	ha/center	100
3	Required No of recycle center	center	2

(4) Capacity of Container

No.	Type of Container	volume	loading rate	capable volume	capable weight
		m^3	%	m^3	t
	For 5.5m^3 Waste Container Truck as present				
1	for Waste without sand	5.5	90%	4.95	1.61

(5) Required Number of Container in Population Wise

No.	Item	Unit	Figure
1	Population in area	pers	15,000
2	Generated waste per week	t/week	79
3	Waste without sand (sand sorted out)		
3-1	Sorted waste/week	t/week	32
3-2	Total No of container	pcs/week	20
3-3	No of working days	days	6
3-4	Required No of container	pcs	4

(6) Required Number of Container in Area Wise

No.	Item	Unit	Figure
1	Required No of container for waste	pcs	2

(7) Evaluated Number of Container

No.	Item	Unit	Figure
1	Required No of container for waste	pcs	4

Note: The number in population wise is larger than area wise.

(8) Required Number of Container Truck

No.	Item	Unit	Figure
For 5.5m^3 Waste Container Truck as present			
1. For Waste			
1-1	No of container to collect / day	pcs/working day	4
1-2	No of container truck in a working day		
1-3	Number of trip	pcs/truck.day	6
1-4	Required No of truck		0.7

(9) Summary of Equipment

Case: 5.5m^3 Waste Container Truck applied as present

No.	Item	Unit	Collection
1	Container for waste without sand		
	Required No.	pcs	4
	Spare container by truck	pcs	1
	Total No of container to provide	pcs	5
2	Container Truck		
	5.5m^3 Waste Container Truck	truck	0.7

(10) Investment Cost Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
for waste					
1	Container (5.5m^3 for waste w/o sand)	pcs	3,000,000	5	15,000,000
3	5.5m^3 Waste Container Truck	truck	36,000,000	0.7	24,000,000
4	Total				39,000,000

(11) Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
for waste					
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	1,500	209	313,000
1-2	Worker: 2/truck, 313 days/year	per.day	1,100	417	459,067
1-3	Total	LS			772,067
2	Operation				
2-1	Fuel (61.4lit/day.truck)	lit/year	380	12,812	4,868,611
2-2	Oil (20% of fuel)	LS			973,722
2-3	Total				5,842,333
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			1,200,000
3-2	For container (2% of purchase cost)	LS			300,000
3-3	Repair for accident (0.8% of pur. cost)	LS			192,000
3-4	Total				1,692,000
4	Administration (5% of 1,2,3)	LS			415,320
5	**Total**				8,721,719

2.4 Alternative 3: Sand Transport Case 1

(1) Amount of Sand Sorted Out

No.	Item	Unit	Figure
1	Amount of waste pre-collected	t/year	4,106
2	Share of sand in waste	%	60%
3	Amount of sorted sand	t/year	2,464
4	Amount of sand sorted out waste	t/year	1,643

(2) Required Number of Recycle Center

No.	Item	Unit	Figure
1	Area	ha	169
2	Rate of recycle center (covering area by one center)	ha/center	100
3	Required No of recycle center	center	2

(3) Capacity of Container

No.	Type of Container	volume	loading rate	capable volume	capable weight
		m^3	%	m^3	t
	For 5.5m^3 Waste Container Truck as present				
1	for Sand	2.0	90%	1.80	2.88

(4) Required Number of Container in Population Wise

No.	Item	Unit	Figure
1	Population in area	pers	15,000
2	Generated waste per week	t/week	79
3	Sorted sand		
3-1	Sorted sand/week	t/week	47
3-2	Total No of container	pcs/week	17
3-3	No of working days	days	6
3-4	Required No of container	pcs	3

(5) Required Number of Container in Area Wise

No.	Item	Unit	Figure
1	Required No of container for sand	pcs	2

(6) Evaluated Number of Container

No.	Item	Unit	Figure
1	Required No of container for sand	pcs	3

Note: The number in population wise is larger than area wise.

(7) Required Number of Container Truck

No.	Item	Unit	Figure
For 5.5m^3 Waste Container Truck as present			
1. For Sand			
1-1	No of container to collect / day for sand	pcs/working day	3
1-2	No of container to collect / day for waste	pcs/working day	4
1-3	No of container truck in a working day		
1-4	Capable No of container	pcs/truck.day	6
1-5	Required No of truck only for sand		0.5

(8) Summary of Equipment

Case: 5.5m^3 Waste Container Truck applied as present

No.	Item	Unit	Collection
2	Container for sand		
	Required No.	pcs	3
	Spare container by truck	pcs	1
	Total No of container to provide	pcs	4
3	Container Truck		
	5.5m^3 Waste Container Truck	truck	0.5

(9) Investment Cost Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
for sand					
1	Container (2m^3 for sand)	pcs	2,000,000	4	8,000,000
2	5.5m^3 Waste Container Truck	truck	36,000,000	0.5	18,000,000
3	Total				26,000,000

(10) Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
for sand					
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	1,500	157	234,750
1-2	Worker: 2/truck, 313 days/year	per.day	1,100	313	344,300
1-3	Total	LS			579,050
2	Operation				
2-1	Fuel (61.4lit/day.truck)	lit/year	380	9,609	3,651,458
2-2	Oil (20% of fuel)	LS			730,292
2-3	Total				4,381,750
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			900,000
3-2	For container (2% of purchase cost)	LS			160,000
3-3	Repair for accident (0.8% of pur. cost)	LS			144,000
3-4	Total				1,204,000
4	Administration (5% of 1,2,3)	LS			308,240
5	**Total**				6,473,040

2.5 Alternative 3: Sand Transport Case 2

(1) Amount of Sand Sorted Out

No.	Item	Unit	Figure
1	Amount of waste pre-collected	t/year	4,106
2	Share of sand in waste	%	60%
3	Amount of sorted sand	t/year	2,464
4	Amount of sand sorted out waste	t/year	1,643

(2) Required Number of Recycle Center

No.	Item	Unit	Figure
1	Area	ha	169
2	Rate of recycle center (covering area by one center)	ha/center	100
3	Required No of recycle center	center	2

(3) Capacity of Dump Truck

No.	Type of Container	volume	loading rate	capable volume	capable weight
		m^3	%	m^3	t
	For 15t Truck				
1	for Sand				15.00

(4) Required Number of Dump Truck in Population Wise

No.	Item	Unit	Figure
1	Population in area	pers	15,000
2	Generated waste per week	t/week	79
3	Sorted sand		
3-1	Sorted sand/week	t/week	47
3-2	Total Trip No of dump truck	trip/week	4
3-3	No of working days	days	6
3-4	Required No of trip /day	trip/day	0.7

(5) Required Number of Dump Truck in Population Wise

No.	Item	Unit	Figure
For 15t Dump Truck			
1. For Sand			
1-1	Required Trip No of dump truck /day	trip/day	0.7
1-3	Capable No of Trip by one truck	trip/truck.day	4
1-4	Required No of truck		0.2

(6) Analysis of Number of Dump Truck in Area Wise

No.	Item	Unit	Figure
1	Sorted sand in one recycle center	t/week	24
2	Required Trip No for a center	trip/week	2
3	Total Trip No necessary in Area	trip/week	4
4	No of working days	days	6
5	Required No of trip /day	trip/day	0.7
6	Capable No of Trip by one truck	trip/truck.day	4
7	Required No of truck	truck	0.2

Note: The center shall keep the sand for a week.

(7) Required Number of Dump Truck

No.	Item	Unit	Figure
1	Required No of truck	truck	0.2

(8) Required Number of Wheel Loader

No.	Item	Unit	Figure
1	Required No of truck	truck	0.2
2	Rate of Wheel Loader	loader/truck	0.5
3	Required No of wheel loader	loader	0.1

Note: Forming the team consisting of one loader and two trucks is required.

(9) Summary of Equipment

No.	Item	Unit	Collection
1	15t Dump Truck	truck	0.2
2	$2m^3$ Wheel Loader	loader	0.1

(10) Investment Cost Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
for sand					
1	15t Dump Truck	truck	48,000,000	0.2	8,000,000
2	$2m^3$ Wheel Loader	loader	90,000,000	0.1	7,500,000
3	Total				15,500,000

(11) Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
for sand					
1	Labor Cost				
1-1	Driver: 1/truck, 313 days/year	per.day	2,500	52	130,417
1-2	Operator: 1/loader, 313 days/year	per.day	2,700	26	70,425
1-3	Total	LS			200,842
2	Operation				
2-1	Fuel for dump truck (122.9lit/day.truck)	lit/year	380	6,411	2,436,288
2-2	Oil for dump truck (20% of fuel)	LS			487,258
2-3	Fuel for loader (110.4lit/day.truck)	lit/year	380	2,880	1,094,248
2-4	Oil for loader (20% of fuel)	LS			218,850
2-3	Total				2,923,545
3	Maintenance				
3-1	For truck (5% of purchase cost)	LS			400,000
3-2	For loader (5% of purchase cost)	LS			375,000
3-3	Repair for accident (0.8% of pur. cost)	LS			124,000
3-4	Total				899,000
4	Administration (5% of 1,2,3)	LS			201,169
5	**Total**				4,224,556

2.6 Alternative 2: Pre-Collection

(1) Expected Discharged and Pre-collected Waste Amount

No.	Item	Unit	Figure
1	Discharged rate into container by resident	%	0%
2	Discharged amount into container by resident	t/year	0
3	Pre-collected rate	%	100%
4	Pre-collected amount	t/year	4,106
5	Improperly discharged rate	%	0%
6	Improperly discharged amount	t/year	0

(2) Required Number of Pre-collector by Center

No.	Item	Unit	Figure
1	Assumed pre-collected amount (whole)	t/year	4,106
2	No of center in Area	center	2
3	Assumed pre-collected amount (center)	t/year	2,053
4	Productivity of pre-collector	kg/per.day	500
5	Required No of pre-collector (year)	per.day/year	4,106
6	Required No of pre-collector (day)	per./day	13

(3) Investment Cost by Center Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Fence	m	25,000	74	1,850,000
2	Gate	m	200,000	6	1,200,000
3	Lodge	m^2	40,000	6	240,000
4	Store	m^2	80,000	0	0
5	Toilette	m^2	600,000	2	1,200,000
6	Concrete Floor (30.25m2 x 10cm)	m^3	36,000	0.00	0
7	Total				4,490,000

(4) Tool and Equipment Cost by worker Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Working uniform	LS	30,000	0.5	15,000
2	Shovel	pcs	2,500	0.5	1,250
3	Rake	pcs	2,600	0.5	1,300
4	Boom/Brush	pcs	1,500	0.5	750
5	Sieve	pcs	5,000	0.0	0
6	Cart	pcs	150,000	0.5	75,000
7	Total				93,300

(5) Operation and Maintenance Cost by Center Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
1-1	Pre-collector (Worker 13 by center)	per.day/year	1,100	4,069	4,475,900
1-2	Foreman (2 by center)	per.day/year	3,000	626	1,878,000
1-3	Tool & Equipment by worker	set	93,300	13	1,212,900
1-4	Pre-Collection Management (10% of Labor Cost)	LS			635,390
1-5	Total	LS			8,202,190

(6) Total Required Investment Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Collection Center	center	4,490,000	2	8,980,000
2	Total				8,980,000

(7) Total Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
1-1	Operation and Maintenance Cost	center	8,202,190	2	16,404,380
1-2	Total	LS			16,404,380

2.7 Alternative 3: Pre-Collection and Sand Sorting Out

(1) Expected Discharged and Pre-collected Waste Amount

No.	Item	Unit	Figure
1	Discharged rate into container by resident	%	0%
2	Discharged amount into container by resident	t/year	0
3	Pre-collected rate	%	100%
4	Pre-collected amount	t/year	4,106
5	Improperly discharged rate	%	0%
6	Improperly discharged amount	t/year	0

(2) Amount of Sand Sorted Out

No.	Item	Unit	Figure
1	Amount of waste pre-collected	t/year	4,106
2	Share of sand in waste	%	60%
3	Amount of sorted sand	t/year	2,464

(3) Required Number of Pre-collector by Center

No.	Item	Unit	Figure
1	Assumed pre-collected amount (whole)	t/year	4,106
2	No of center in Area	center	2
3	Assumed pre-collected amount (center)	t/year	2,053
4	Productivity of pre-collector	kg/per.day	500
5	Required No of pre-collector (year)	per.day/year	4,106
6	Required No of pre-collector (day)	per./day	13

(4) Investment Cost by Center Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Fence	m	25,000	74	1,850,000
2	Gate	m	200,000	6	1,200,000
3	Lodge	m^2	40,000	6	240,000
4	Store	m^2	80,000	6	480,000
5	Toilette	m^2	600,000	2	1,200,000
6	Concrete Floor (30.25m2 x 10cm)	m^3	36,000	3.03	108,900
7	Total				5,078,900

(5) Tool and Equipment Cost by worker Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Working uniform	LS	30,000	0.5	15,000
2	Shovel	pcs	2,500	0.5	1,250
3	Rake	pcs	2,600	0.5	1,300
4	Boom/Brush	pcs	1,500	0.5	750
5	Sieve	pcs	5,000	0.5	2,500
6	Cart	pcs	150,000	0.5	75,000
7	Total				95,800

(6) Operation and Maintenance Cost by Center Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
1-1	Pre-collector (Worker 13 by center)	per.day/year	1,100	4,069	4,475,900
1-2	Foreman (2 by center)	per.day/year	3,000	626	1,878,000
1-3	Clerk (1 by center)	per.day/year	1,600	313	500,800
1-4	Tool & Equipment by worker	set	95,800	13	1,245,400
1-5	Pre-Collection Management (10% of Labor Cost)	LS			685,470
1-6	Total	LS			8,785,570

(7) Total Required Investment Unit: CFA

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Collection Center	center	5,078,900	2	10,157,800
2	Total				10,157,800

(8) Total Operation and Maintenance Cost Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
1-1	Operation and Maintenance Cost	center	8,785,570	2	17,571,140
1-2	Total	LS			17,571,140

(9) Income from Sand Sorted out Unit: CFA/year

No.	Item	Unit	Unit Cost	Quantity	Amount
1	Expected amount of sand	t		2,464	
2	Amount of sand capable to sell	t/year		2,464	
3	Income from sand selling	t	2,400	2,464	5,913,000

Appendix J-2 TIME AND MOTION OF CONTAINER TRUCK

1. Model Time and Motion of a detachable container truck

No.	Action	Place	Time		Assumed Distance (km)
1	Daily Instruction	Garage	--	7:30	--
2	Equipment Inspection	Garage	--	7:45	--
3	Starting from Garage	Garage	Dep.	8:00	6.0
4	Container 1 Picking up	Container 1	Arr.	8:15	
			Dep.	8:20	10.0
5	Container 1 Dumping	Disposal site	Arr.	8:40	
			Dep.	8:45	10.0
6	Container 1 Resetting	Container 1	Arr.	9:05	
			Dep.	9:10	1.0
7	Container 2 Picking up	Container 2	Arr.	9:15	
			Dep.	9:20	10.0
8	Container 2 Dumping	Disposal site	Arr.	9:40	
			Dep.	9:45	10.0
9	Container 2 Resetting	Container 2	Arr.	10:05	
			Dep.	10:10	1.0
10	Container 3 Picking up	Container 3	Arr.	10:15	
			Dep.	10:20	10.0
11	Container 3 Dumping	Disposal site	Arr.	10:40	
			Dep.	10:45	10.0
12	Container 3 Resetting	Container 3	Arr.	11:05	
			Dep.	11:10	1.0
13	Container 4 Picking up	Container 4	Arr.	11:15	
			Dep.	11:20	10.0
14	Container 4 Dumping	Disposal site	Arr.	11:40	
			Dep.	11:45	10.0
15	Container 4 Resetting	Container 4	Arr.	12:05	
	Rest				--
			Dep.	12:35	1.0
16	Container 5 Picking up	Container 5	Arr.	12:40	
			Dep.	12:45	10.0
17	Container 5 Dumping	Disposal site	Arr.	13:05	
			Dep.	13:10	10.0
18	Container 5 Resetting	Container 5	Arr.	13:30	
			Dep.	13:35	1.0
19	Container 6 Picking up	Container 6	Arr.	13:40	
			Dep.	13:45	10.0
20	Container 6 Dumping	Disposal site	Arr.	14:05	
			Dep.	14:10	10.0
21	Container 6 Resetting	Container 6	Arr.	14:30	
			Dep.	14:35	6.0
22	Arriving Garage	Garage	Arr.	14:50	
23	Equipment Inspection	Garage	from	14:45	--
			to	15:00	--

2. Time & Motion Survey

Date 16-Jan-01

Commune 1 Container Truck (5.5 m^3 Multi Loader Truck)

Point No	Place	Activity	Time		Time spent	Distance (km)	Remark
1	Garage	Commencement	Dep.	8:50		2.3	Time is estimated.
2	Container 1	Picking-up	Arr.	9:05	0:15		Time is estimated.
			Dep.	9:08	0:03	6.4	Time is estimated.
3	Disposal point 1	Dumping	Arr.	9:20	0:12		Point 1 is near the old disposal site.
			Dep.	9:24	0:04	6.4	
4	Container 1	Re-setting	Arr.	9:35	0:11		Behind Ground Marche
			Dep.	9:38	0:03	0.7	
5	Container 2	Picking-up	Arr.	9:41	0:03		Beside Ground Marche
			Dep.	9:45	0:04	6.6	
6	Disposal point 1	Dumping	Arr.	9:59	0:14		
			Dep.	10:02	0:03	6.6	
7	Container 2	Re-setting	Arr.	10:14	0:12		
			Dep.	10:15	0:01	0	
8	Container 3	Picking-up	Arr.	10:15	0:00		Same as Container 1
			Dep.	10:17	0:02	6.6	
9	Disposal point 1	Dumping	Arr.	10:33	0:16		
			Dep.	10:35	0:02	6.6	
10	Container 3	Re-setting	Arr.	10:47	0:12		
			Dep.	10:49	0:02	0.9	
11	Container 4	Picking-up	Arr.	10:52	0:03		Behind Petit Marche
			Dep.	10:57	0:05	8.4	
12	Disposal point 2	Dumping	Arr.	11:18	0:21		Point 2 is near the proposed site by UNICEF.
			Dep.	11:19	0:01	8.4	
13	Container 4	Re-setting	Arr.	11:38	0:19		

Point No	Place	Activity	Time		Time spent	Distance (km)	Remark
			Dep.	11:40	0:02	3.6	
14	Garage	End	Arr.	11:52	0:12		
Total	No of Container: 4 nos				3:02	63.5	
	No of Dumping: 4 nos						

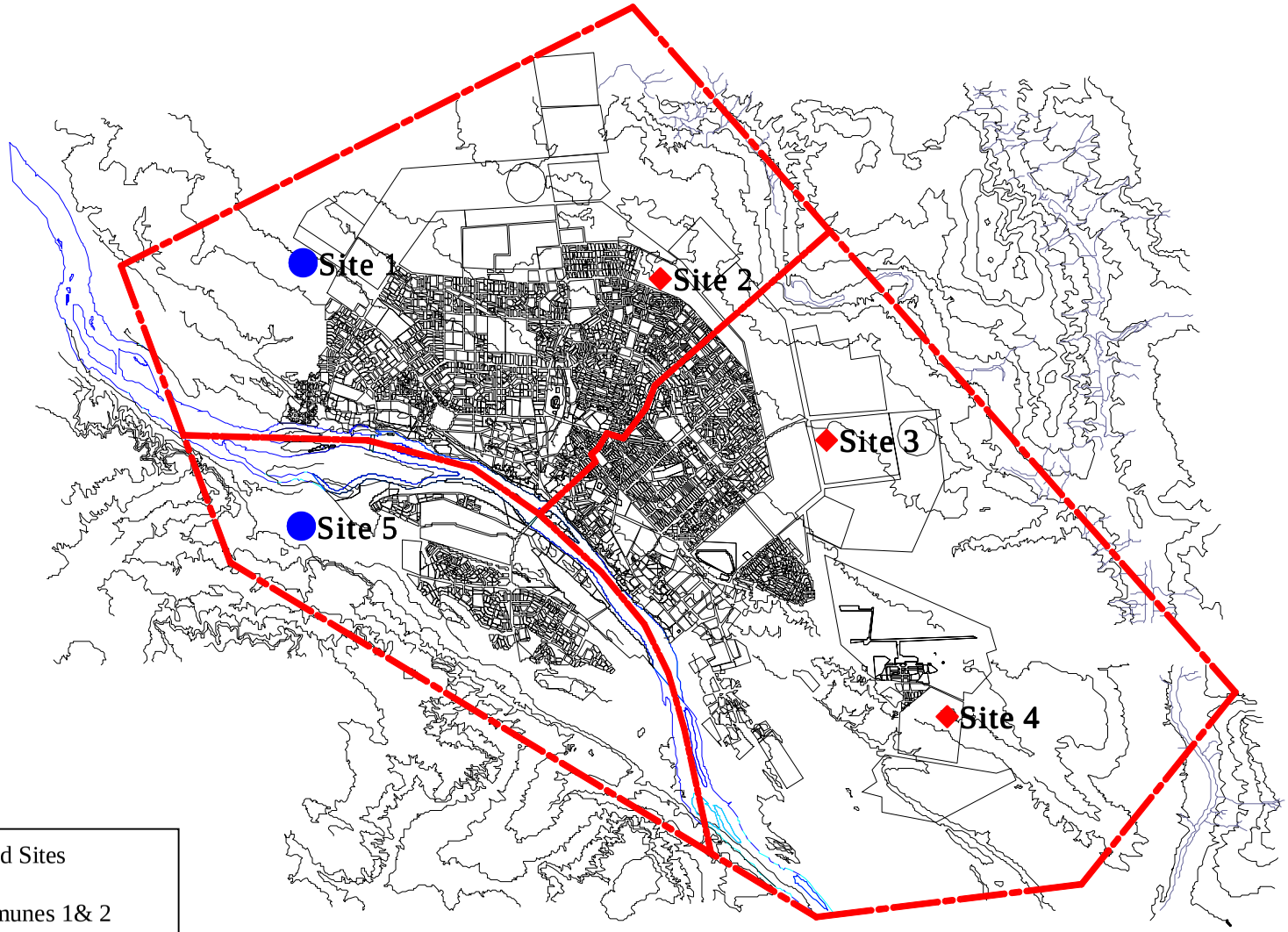
Date 19-Jan-01

Commune 2 Container Truck (5.5 m^3 Multi Loader Truck)

Point No	Place	Activity	Time		Time spent	Distance (km)	Remark
1	Office of Commune 2	Commencement	Dep.	9:00		0.6	
2	Container 1	Picking-up	Arr.	9:04	0:04		
			Dep.	9:08	0:04	2.9	
3	Fuel Station		Arr.	9:15	0:07		
			Dep.	9:17	0:02	1	
4	Disposal point 1	Dumping	Arr.	9:20	0:03		
			Dep.	9:22	0:02	1	
5	Fuel Station	Refueling	Arr.	9:25	0:03		
			Dep.	9:33	0:08	2.9	
6	Container 1	Re-setting	Arr.	9:40	0:07		
			Dep.	9:42	0:02	0.5	
7	Container 2	Picking-up	Arr.	9:45	0:03		
			Dep.	9:47	0:02	4.7	
8	Disposal point 2	Dumping	Arr.	9:59	0:12		
			Dep.	10:02	0:03	4.4	
9	Container 2(2)	Re-setting	Arr.	10:12	0:10		Not same as original location
			Dep.	10:14	0:02	0.4	

Point No	Place	Activity	Time		Time spent	Distance (km)	Remark
10	Container 3	Picking-up	Arr.	10:16	0:02		
			Dep.	10:18	0:02	0.3	
11	Container 3(2)	Re-setting	Arr.	10:20	0:02		Re-location to be loaded more
			Dep.	10:28	0:08	1.7	
12	Container 4	Picking-up	Arr.	10:33	0:05		
			Dep.	10:36	0:03	4.9	
13	Damping point 2	Dumping	Arr.	10:49	0:13		
			Dep.	10:53	0:04	3	
14	Container 4(2)	Re-setting	Arr.	11:01	0:08		Not same as original location
			Dep.	11:05	0:04	1.7	
15	Container 1	Picking-up	Arr.	11:10	0:05		Second picking-up
			Dep.	11:16	0:06	0.5	
16	Container 1(2)	Re-setting	Arr.	11:19	0:03		Re-location to be loaded more
			Dep.	11:24	0:05	0.4	
17	Container 3(2)	Picking-up	Arr.	11:25	0:01		
			Dep.	11:28	0:03	4.4	
18	Dumping point 2	Dumping	Arr.	11:38	0:10		
			Dep.	11:40	0:02	4.5	
19	Container 3(3)	Re-setting	Arr.	11:52	0:12		Not same as original and previous location
			Dep.	11:54	0:02	1.3	
20	Container 2(2)	Picking-up	Arr.	11:59	0:05		
			Dep.	12:02	0:03	0.7	
21	Container 2(3)	Re-setting	Arr.	12:05	0:03		Re-location to be loaded more
			Dep.	12:07	0:02	1.1	
22	Container 1(2)	Picking-up	Arr.	12:12	0:05		
			Dep.	12:20	0:08	4.1	
23	Dumping point 2	Dumping	Arr.	12:30	0:10		
			Dep.	12:32	0:02	4.5	

Point No	Place	Activity	Time		Time spent	Distance (km)	Remark
24	Container 1	Re-setting	Arr.	12:42	0:10		Original location of Container 1
			Dep.	12:46	0:04	1.6	
25	Container 4(2)	Picking-up	Arr.	12:52	0:06		
			Dep.	12:54	0:02	3	
26	Dumping point 2	Dumping	Arr.	13:02	0:08		
			Dep.	13:05	0:03	4.9	
27	Container 4	Re-setting	Arr.	13:15	0:10		Original location of Container 4
			Dep.	13:18	0:03	0.8	
28	Container 3(3)	Picking-up	Arr.	13:22	0:04		
			Dep.	13:25	0:03	4.5	
29	Dumping point 2	Dumping	Arr.	13:36	0:11		
			Dep.	13:38	0:02	4.8	
30	Container 3(4), original place of Container 2	Re-setting	Arr.	13:48	0:10		Original location of Container 2
			Dep.	13:50	0:02	1.7	
31	Container 2(3)	Picking-up	Arr.	13:56	0:06		
			Dep.	13:58	0:02	4.1	
32	Dumping point 2	Dumping	Arr.	14:08	0:10		
			Dep.	14:10	0:02	1.7	
33	Container 2(4), place of Container 3(2)	Picking-up	Arr.	14:20	0:10		Location of Container 3(2)
			Dep.	14:22	0:02	5	
34	Garage	End	Arr.	14:40	0:18		
Total	No of Container: 4 nos				5:40	83.6	
	No of Dumping: 8 nos						



●: Selected as Designated Sites

Site 1: Serve for Communes 1& 2
Site CU1&2

Site 2: Serve for Commune 3
Site CU3

The Study on Sanitation Improvement for the Niamey City in the Republic of Niger

LOCATION OF PROPOSED DISPOSAL SITES

Appendix

J-3

APPENDIX J-4: LIST OF QUARTIER FOR THE NEW SYSTEM (1/2)[1]

CU	ID	Quartier	Type	Area(ha)	2005		2010		2015	
					Population served	Density	Population served	Density	Population served	Density
High Income Class										
1	2	Ambassades	MDQ	121		12		12	1,414	12
1	24	Kouara Kano	MDQ	167	3,284	20	3,256	19	3,261	19
1	1	Plateau I	MDQ	221		29		29	6,470	29
1	25	Ext. Kouara Kano	MDQ	89	4,370	49	4,334	49	4,340	49
1	20	Plateau II	MDQ	303	26,711	88	26,488	88	26,523	88
1	30	Yantala Haut	MDQ	170	20,831	123	20,658	122	20,685	122
2	54	Niamey Bas	MDQ	62		20		19	1,203	19
2	53	Terminus	MDQ	75		52	3,884	52	3,889	52
2	69	Cite Faycal	MDQ	30		59	1,724	58	1,726	58
2	70	Poudriere	MDQ	186	12,745	69	12,639	68	12,656	68
		Total introduced Popu.			67,941		72,983		82,167	
		Total Popu in class			82,747		82,058		82,167	
		Intriduction Rate			82%		89%		100%	
Middle Income Class										
1	52	ZAC	PLN	435		10		19		49
1	43	Taiwan	NWQ	87		49	6,784	78	8,492	97
1	44	Bobiel	NWQ	91		49	7,043	78	9,697	107
1	45	Ouest Faisceau 1	NWQ	77		49		68	8,200	107
1	46	Ouest Faisceau 2	NWQ	156		49		68	15,227	97
1	47	Nord Faisceau	NWQ	105		49	8,136	78	10,184	97
1	48	SONUCI	NWQ	61		49	4,717	78	5,904	97
1	49	Koura Kano Nord	NWQ	82		49	6,371	78	8,773	107
1	50	Ext. Kouara Kano Nord	NWQ	133		49		68	11,635	88
1	51	Ext. Kouara Tegui	NWQ	154		49	11,954	78	14,962	97
1	42	Nord Lazaret	NWQ	140		59	10,889	78	16,356	117
1	36	Banizoumbou II	PRP2	120		98	13,952	117	20,955	175
1	37	Baghdad	PRP2	164		98	22,324	136	28,740	175
1	28	Dar Es Salam	PRP2	286	33,648	118	38,929	136	50,118	175
1	27	Kouara Me	PRP2	147	20,203	137	21,466	146	25,793	175
1	26	Courronne Nord	PRP2	58	8,584	147	10,214	175	11,364	195
1	32	Cite CNSS	PRP2	18	2,720	147	2,697	146	2,701	146
1	33	Bani Fandou II	PRP2	121	19,011	157	21,209	175	23,598	195
1	31	Bani Fandou I	PRP2	104	20,474	196	20,304	194	20,331	195
2	86	Sari-Koubou	PLN	450		10		44	26,289	58
2	85	Aviation 2	NWQ	310		29		39		49
2	82	Ext. Saga	PRP2	104		39		49	6,059	58
2	80	Ext. Talladje	NWQ	124		49	9,636	78	12,061	97
2	84	Aviation 1	PRP2	320		59		68	23,337	73
2	73	Route de Filingue	PRP2	207	30,425	147	36,206	175	40,283	195
2	74	Ext. Route de Flingue	PRP2	162	23,782	147	28,301	175	31,487	195

[1] No figure in "Population served" means not introduced and to be collected by the present system.

APPENDIX J-4: LIST OF QUARTIER FOR THE NEW SYSTEM (2/2)[1]

CU	ID	Quartier	Type	Area(ha)	2005		2010		2015	
					Population served	Density	Population served	Density	Population served	Density
2	72	Madina	PRP2	110	19,486	176	20,397	185	21,499	195
3	96	Banga Bana	PRP2	208	20,416	98	30,368	146	40,544	195
3	91	Karadje	PRP2	160	23,585	147	28,066	175	31,226	195
3	92	Pont Kennedy	PRP2	37	5,481	147	6,523	175	7,257	195
3	93	Gawaye	PRP2	45	6,547	147	7,792	175	8,668	195
3	95	Ext. Kirkissoye	PRP2	135	19,901	147	23,683	175	26,349	195
		Total introduced Popu.			254,263		397,961		568,089	
		Total Popu in class			383,319		489,841		604,336	
		Intriduction Rate			66%		81%		94%	
Low Income Class										
1	41	Kouara Tegui	SPT	155		127		136		146
1	23	Goudel	UVL	83		176		194		195
1	8	Zongo	TRD	20		196	4,454	224	4,848	243
1	15	Boukoki I	PRP1	41		196	7,954	194	7,965	195
1	16	Boukoki II	PRP1	47		196	9,073	194	9,085	195
1	17	Boukoki III	PRP1	35		196	6,714	194	6,723	195
1	18	Boukoki IV	PRP1	99		196		194	19,269	195
1	35	Lazaret	PRP1	153		196		194		195
1	9	Maourey	TRD	15		245	3,838	253	3,991	263
1	21	Yantala	UVL	59		363		350		341
1	6	Kombo	TRD	4		373		340		292
1	10	Gandacthe	TRD	13		373	4,506	340	3,867	292
1	11	Deizebon	TRD	19		373	6,489	340	5,569	292
2	81	Saga	UVL	146		98		107		117
2	56	Kalley Centre	TRD	8		196	1,591	195	1,593	195
2	58	Kalley Sud	TRD	35		196	7,432	214	8,118	234
2	61	Abidjan	TRD	37		196	7,896	214	8,625	234
2	62	Sabongari	TRD	64		196		224		243
2	63	Nouveau Marche	TRD	49		196	10,920	224	11,885	243
2	75	Gamkalle Sabanguye	UVL	67		196		194		195
2	76	Gamkalle Golleye	UVL	38		196		194		195
2	79	Talladje	PRP1	164		196		194		195
2	60	Banizoumbou I	TRD	24		216	5,346	224	5,820	243
2	57	Kalley Est	TRD	49		226	11,482	233	11,976	243
2	59	Lacouroussou	TRD	16		255	4,136	253	4,142	253
3	87	Lamorde	UVL	53		118		136		156
3	88	Nogare	UVL	35		118		136		156
3	94	Kirkissoye	UVL	26		196		194		195
		Total introduced Popu.			0		91,831		113,476	
		Total Popu in class			291,125		299,447		307,221	
		Intriduction Rate			0%		31%		37%	

[1] No figure in "Population served" means not introduced and to be collected by the present system.

APPENDIX J-5: POPULATION CONSIDERED FOR THE NEW SYSTEM (1/2)

CU	ID	Quartier	Type	2005		2010		2015	
				Considered population	Served population	Considered population	Served population	Considered population	Served population
High Income Class									
1	2	Ambassades	MDQ					1,414	1,273
1	24	Kouara Kano	MDQ	3,284	2,627	3,256	2,768	3,261	2,935
1	1	Plateau I	MDQ					6,470	5,823
1	25	Ext. Kouara Kano	MDQ	4,370	3,496	4,334	3,684	4,340	3,906
1	20	Plateau II	MDQ	26,711	21,369	26,488	22,515	26,523	23,871
1	30	Yantala Haut	MDQ	20,831	16,665	20,658	17,559	20,685	18,617
2	54	Niamey Bas	MDQ					1,203	1,083
2	53	Terminus	MDQ			3,884	3,301	3,889	3,500
2	69	Cite Faycal	MDQ			1,724	1,465	1,726	1,553
2	70	Poudriere	MDQ	12,745	10,196	12,639	10,743	12,656	11,390
		Total Popu in Class		82,747		82,058		82,167	
		Total introduced and join popu.		67,941	54,353	72,983	62,036	82,167	73,950
Middle Income Class									
1	43	Taiwan	NWQ			6,784	4,070	8,492	6,369
1	44	Bobiel	NWQ			7,043	4,226	9,697	7,273
1	45	Ouest Faisceau 1	NWQ					8,200	6,150
1	46	Ouest Faisceau 2	NWQ					15,227	11,420
1	47	Nord Faisceau	NWQ			8,136	4,882	10,184	7,638
1	48	SONUCI	NWQ			4,717	2,830	5,904	4,428
1	49	Koura Kano Nord	NWQ			6,371	3,823	8,773	6,580
1	50	Ext. Kouara Kano Nord	NWQ					11,635	8,726
1	51	Ext. Kouara Tegui	NWQ			11,954	7,172	14,962	11,222
1	42	Nord Lazaret	NWQ			10,889	6,533	16,356	12,267
1	36	Banizoumbou II	PRP2			13,952	8,371	20,955	15,716
1	37	Baghdad	PRP2			22,324	13,394	28,740	21,555
1	28	Dar Es Salam	PRP2	33,648	15,142	38,929	23,357	50,118	37,589
1	27	Kouara Me	PRP2	20,203	9,091	21,466	12,880	25,793	19,345
1	26	Courronne Nord	PRP2	8,584	3,863	10,214	6,128	11,364	8,523
1	32	Cite CNSS	PRP2	2,720	1,224	2,697	1,618	2,701	2,026
1	33	Bani Fandou II	PRP2	19,011	8,555	21,209	12,725	23,598	17,699
1	31	Bani Fandou I	PRP2	20,474	9,213	20,304	12,182	20,331	15,248
2	86	Sari-Koubou	PLN					26,289	19,717
2	82	Ext. Saga	PRP2					6,059	4,544
2	80	Ext. Talladje	NWQ			9,636	5,782	12,061	9,046
2	84	Aviation 1	PRP2					23,337	17,503
2	73	Route de Filingue	PRP2	30,425	13,691	36,206	21,724	40,283	30,212
2	74	Ext. Route de Flingue	PRP2	23,782	10,702	28,301	16,981	31,487	23,615
2	72	Madina	PRP2	19,486	8,769	20,397	12,238	21,499	16,124
3	96	Banga Bana	PRP2	20,416	9,187	30,368	18,221	40,544	30,408

APPENDIX J-5: POPULATION CONSIDERED FOR THE NEW SYSTEM (2/2)

CU	ID	Quartier	Type	2005		2010		2015	
				Considered population	Served population	Considered population	Served population	Considered population	Served population
3	91	Karadje	PRP2	23,585	10,613	28,066	16,840	31,226	23,420
3	92	Pont Kennedy	PRP2	5,481	2,466	6,523	3,914	7,257	5,443
3	93	Gawaye	PRP2	6,547	2,946	7,792	4,675	8,668	6,501
3	95	Ext. Kirkissoye	PRP2	19,901	8,955	23,683	14,210	26,349	19,762
		Total Popu in Class		383,319		489,841		604,336	
		Total introduced and join popu.		254,263	114,418	397,961	238,777	568,089	426,067
Low Income Class									
1	8	Zongo	TRD			4,454	1,782	4,848	2,424
1	15	Boukoki I	PRP1			7,954	3,182	7,965	3,983
1	16	Boukoki II	PRP1			9,073	3,629	9,085	4,543
1	17	Boukoki III	PRP1			6,714	2,686	6,723	3,362
1	18	Boukoki IV	PRP1					19,269	9,635
1	9	Maourey	TRD			3,838	1,535	3,991	1,996
1	10	Gandacthe	TRD			4,506	1,802	3,867	1,934
1	11	Deizebon	TRD			6,489	2,596	5,569	2,785
2	56	Kalley Centre	TRD			1,591	636	1,593	797
2	58	Kalley Sud	TRD			7,432	2,973	8,118	4,059
2	61	Abidjan	TRD			7,896	3,158	8,625	4,313
2	63	Nouveau Marche	TRD			10,920	4,368	11,885	5,943
2	60	Banizoumbou I	TRD			5,346	2,138	5,820	2,910
2	57	Kalley Est	TRD			11,482	4,593	11,976	5,988
2	59	Lacouroussou	TRD			4,136	1,654	4,142	2,071
		Total Popu in Class		291,125		299,447		307,221	
		Total introduced and join popu.		0	0	91,831	36,732	113,476	56,738
		Ground Total Popu.		757,191		871,346		993,724	
		Ground Total introduced and join popu.		322,204	168,771	562,775	337,545	763,732	556,755

APPENDIX J-6: SERVED POPULATION BY PRESENT SYSTEM (1/3)

CU	ID	Quartier	Type	2005		2010		2015	
				Population considered	Served population	Population considered	Served population	Population considered	Served population
High Income Class									
1	2	Ambassades	MDQ	1,424	1,424	1,412	1,412	1,414	141
1	24	Kouara Kano	MDQ	3,284	657	3,256	488	3,261	326
1	1	Plateau I	MDQ	6,516	6,516	6,461	6,461	6,470	647
1	25	Ext. Kouara Kano	MDQ	4,370	874	4,334	650	4,340	434
1	20	Plateau II	MDQ	26,711	5,342	26,488	3,973	26,523	2,652
1	30	Yantala Haut	MDQ	20,831	4,166	20,658	3,099	20,685	2,069
2	54	Niamey Bas	MDQ	1,212	1,212	1,202	1,202	1,203	120
2	53	Terminus	MDQ	3,916	3,916	3,884	583	3,889	389
2	69	Cite Faycal	MDQ	1,738	1,738	1,724	259	1,726	173
2	70	Poudriere	MDQ	12,745	2,549	12,639	1,896	12,656	1,266
		Total Popu in Class		82,747		82,058		82,167	
		Total collected popu.			28,394		20,022		8,217
Middle Income Class									
1	52	ZAC	PLN	4,265	4,265	8,460	8,460	21,177	21,177
1	43	Taiwan	NWQ	4,276	4,276	6,784	2,714	8,492	2,123
1	44	Bobiel	NWQ	4,439	4,439	7,043	2,817	9,697	2,424
1	45	Ouest Faisceau 1	NWQ	3,753	3,753	5,212	5,212	8,200	2,050
1	46	Ouest Faisceau 2	NWQ	7,667	7,667	10,645	10,645	15,227	3,807
1	47	Nord Faisceau	NWQ	5,127	5,127	8,136	3,254	10,184	2,546
1	48	SONUCI	NWQ	2,973	2,973	4,717	1,887	5,904	1,476
1	49	Koura Kano Nord	NWQ	4,015	4,015	6,371	2,548	8,773	2,193
1	50	Ext. Kouara Kano Nord	NWQ	6,510	6,510	9,038	9,038	11,635	2,909
1	51	Ext. Kouara Tegui	NWQ	7,534	7,534	11,954	4,782	14,962	3,741
1	42	Nord Lazaret	NWQ	8,235	8,235	10,889	4,356	16,356	4,089
1	36	Banizoumbou II	PRP2	11,724	11,724	13,952	5,581	20,955	5,239
1	37	Baghdad	PRP2	16,079	16,079	22,324	8,930	28,740	7,185
1	28	Dar Es Salam	PRP2	33,648	18,506	38,929	15,572	50,118	12,530
1	27	Kouara Me	PRP2	20,203	11,112	21,466	8,586	25,793	6,448
1	26	Courronne Nord	PRP2	8,584	4,721	10,214	4,086	11,364	2,841
1	32	Cite CNSS	PRP2	2,720	1,496	2,697	1,079	2,701	675
1	33	Bani Fandou II	PRP2	19,011	10,456	21,209	8,484	23,598	5,900
1	31	Bani Fandou I	PRP2	20,474	11,261	20,304	8,122	20,331	5,083
2	86	Sari-Koubou	PLN	4,412	4,412	19,690	19,690	26,289	6,572
2	85	Aviation 2	NWQ	9,106	9,106	12,040	12,040	15,070	15,070
2	82	Ext. Saga	PRP2	4,068	4,068	5,043	5,043	6,059	1,515
2	80	Ext. Talladje	NWQ	6,072	6,072	9,636	3,854	12,061	3,015
2	84	Aviation 1	PRP2	18,801	18,801	21,752	21,752	23,337	5,834

APPENDIX J-6: SERVED POPULATION BY PRESENT SYSTEM (2/3)

CU	ID	Quartier	Type	2005		2010		2015	
				Population considered	Served population	Population considered	Served population	Population considered	Served population
2	73	Route de Filingue	PRP2	30,425	16,734	36,206	14,482	40,283	10,071
2	74	Ext. Route de Flingue	PRP2	23,782	13,080	28,301	11,320	31,487	7,872
2	72	Madina	PRP2	19,486	10,717	20,397	8,159	21,499	5,375
3	96	Banga Bana	PRP2	20,416	11,229	30,368	12,147	40,544	10,136
3	91	Karadje	PRP2	23,585	12,972	28,066	11,226	31,226	7,807
3	92	Pont Kennedy	PRP2	5,481	3,015	6,523	2,609	7,257	1,814
3	93	Gawaye	PRP2	6,547	3,601	7,792	3,117	8,668	2,167
3	95	Ext. Kirkissoye	PRP2	19,901	10,946	23,683	9,473	26,349	6,587
		Total Popu in Class		383,319		489,841		604,336	
		Total collected popu.			268,901		251,064		178,269
Low Income Class									
1	41	Kouara Tegui	SPT	19,780	19,780	21,125	21,125	22,664	22,664
1	23	Goudel	UVL	14,733	14,733	16,235	16,235	16,256	16,256
1	8	Zongo	TRD	3,905	3,905	4,454	2,672	4,848	2,424
1	15	Boukoki I	PRP1	8,021	8,021	7,954	4,772	7,965	3,983
1	16	Boukoki II	PRP1	9,149	9,149	9,073	5,444	9,085	4,543
1	17	Boukoki III	PRP1	6,771	6,771	6,714	4,028	6,723	3,362
1	18	Boukoki IV	PRP1	19,405	19,405	19,243	19,243	19,269	9,635
1	35	Lazaret	PRP1	30,071	30,071	29,821	29,821	29,860	29,860
1	9	Maourey	TRD	3,721	3,721	3,838	2,303	3,991	1,996
1	21	Yantala	UVL	21,396	21,396	20,644	20,644	20,098	20,098
1	6	Kombo	TRD	1,481	1,481	1,353	1,353	1,161	1,161
1	10	Gandacthe	TRD	4,933	4,933	4,506	2,704	3,867	1,934
1	11	Deizebon	TRD	7,104	7,104	6,489	3,893	5,569	2,785
2	81	Saga	UVL	14,283	14,283	15,580	15,580	17,020	17,020
2	56	Kalley Centre	TRD	1,604	1,604	1,591	955	1,593	797
2	58	Kalley Sud	TRD	6,813	6,813	7,432	4,459	8,118	4,059
2	61	Abidjan	TRD	7,237	7,237	7,896	4,738	8,625	4,313
2	62	Sabongari	TRD	12,467	12,467	14,218	14,218	15,475	15,475
2	63	Nouveau Marche	TRD	9,575	9,575	10,920	6,552	11,885	5,943
2	75	Gamkalle Sabanguye	UVL	13,179	13,179	13,070	13,070	13,087	13,087
2	76	Gamkalle Golleye	UVL	7,438	7,438	7,376	7,376	7,386	7,386
2	79	Talladje	PRP1	32,232	32,232	31,964	31,964	32,006	32,006
2	60	Banizoumbou I	TRD	5,157	5,157	5,346	3,208	5,820	2,910
2	57	Kalley Est	TRD	11,096	11,096	11,482	6,889	11,976	5,988
2	59	Lacouroussou	TRD	4,171	4,171	4,136	2,482	4,142	2,071
3	87	Lamorde	UVL	6,263	6,263	7,245	7,245	8,292	8,292
3	88	Nogare	UVL	4,109	4,109	4,755	4,755	5,441	5,441

APPENDIX J-6: SERVED POPULATION BY PRESENT SYSTEM (3/3)

CU	ID	Quartier	Type	2005		2010		2015	
				Population considered	Served population	Population considered	Served population	Population considered	Served population
3	94	Kirkissoye	UVL	5,031	5,031	4,987	4,987	4,999	4,999
		Total Popu in Class		291,125		299,447		307,221	
		Total collected popu.			291,125		262,715		250,483
		Presen Sys Appl Rate		100%		88%		82%	
		Total Popu. In Niamey		757,191		871,346		993,724	
		Ground total collected			588,420		533,801		436,969

APPENDIX J-7: GROUPING PLAN FOR PRE-COLLECTION AREA (1/3)

CU	Group No	ID	Quartier	Type	Area(ha)	2005 Join Popu.	2010 Join Popu.	2015 Join Popu.
High Income Class								
1	1-1	1	Plateau I-A: (60%)	MDQ	133			3,494
1	1-2	1	Plateau I-B: (40%)	MDQ	88			2,329
		2	Ambassades	MDQ	121			1,273
			1-2 Total		209			3,602
1	1-3	20	Plateau II-A: (33%)	MDQ	101	7,123	7,505	7,957
1	1-4	20	Plateau II-B: (33%)	MDQ	101	7,123	7,505	7,957
1	1-5	20	Plateau II-C: (33%)	MDQ	101	7,123	7,505	7,957
1	1-6	24	Kouara Kano	MDQ	167	2,627	2,768	2,935
1	1-7	25	Ext. Kouara Kano	MDQ	89	3,496	3,684	3,906
1	1-8	30	Yantala Haut	MDQ	170	16,665	17,559	18,617
			Commune I Total			44,157	46,526	56,424
2	2-1	53	Terminus	MDQ	75		3,301	3,500
		54	Niamey Bas	MDQ	62			1,083
			2-1 Total		137		3,301	4,583
2	2-2	69	Cite Faycal	MDQ	30		1,465	1,553
		70	Poudriere-A: (40%)	MDQ	74	4,078	4,297	4,556
			2-2 Total		104	4,078	5,763	6,110
2	2-3	70	Poudriere-B: (60%)	MDQ	112	6,118	6,446	6,834
			Commune II Total			10,196	15,510	17,527
			High Income Total			54,353	62,036	73,950
Middle Income Class								
1	1-9	26	Courronne Nord	PRP2	58	3,863	6,128	8,523
1	1-10	27	Kouara Me	PRP2	147	9,091	12,880	19,345
1	1-11	28	Dar Es Salam-A: (50%)	PRP2	143	7,571	11,679	18,794
1	1-12	28	Dar Es Salam-B: (50%)	PRP2	143	7,571	11,679	18,794
1	1-13	31	Bani Fandou I	PRP2	104	9,213	12,182	15,248
1	1-14	32	Cite CNSS	PRP2	18	1,224	1,618	2,026
		33	Bani Fandou II-A: (40%)	PRP2	48	3,422	5,090	7,079
			1-14 Total		66	4,646	6,708	9,105
1	1-15	33	Bani Fandou II-B: (60%)	PRP2	73	5,133	7,635	10,619
1	1-16	36	Banizoumbou II	PRP2	120		8,371	15,716
1	1-17	37	Baghdad	PRP2	164		13,394	21,555
1	1-18	42	Nord Lazaret	NWQ	140		6,533	12,267
1	1-19	43	Taiwan	NWQ	87		4,070	6,369
1	1-20	44	Bobiel	NWQ	91		4,226	7,273
1	1-21	45	Ouest Faisceau 1	NWQ	77			6,150
1	1-22	46	Ouest Faisceau 2	NWQ	156			11,420

Note: No figure in join population means not the new system introduced.

APPENDIX J-7: GROUPING PLAN FOR PRE-COLLECTION AREA (2/3)

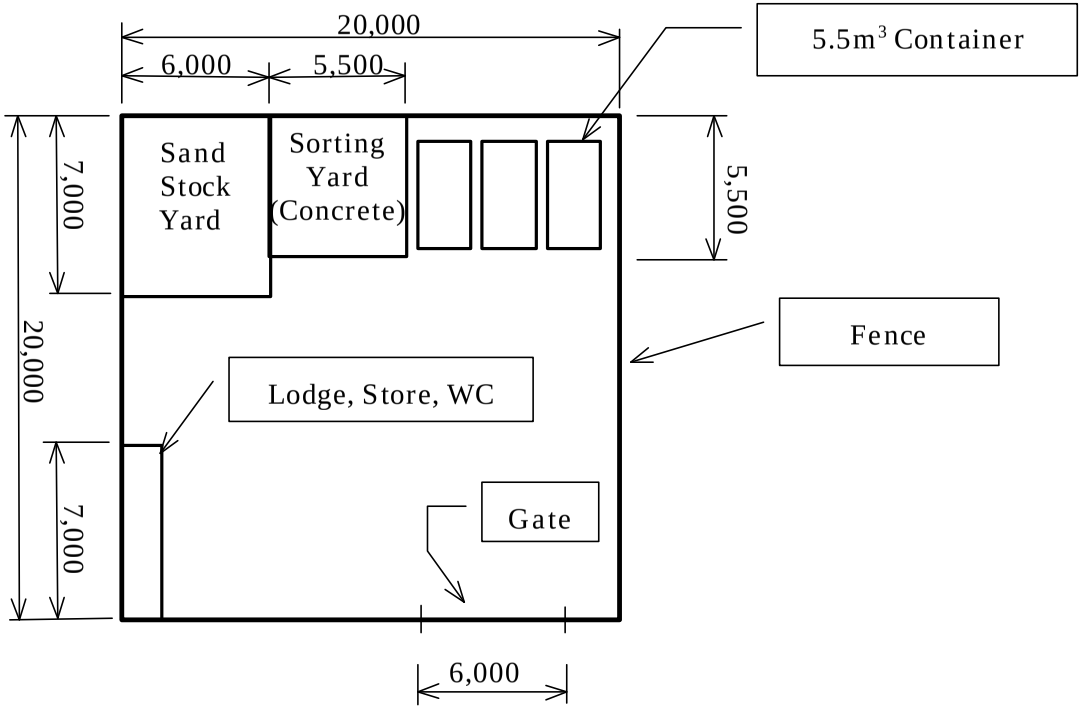
CU	Group No	ID	Quartier	Type	Area(ha)	2005 Join Popu.	2010 Join Popu.	2015 Join Popu.
1	1-23	47	Nord Faisceau	NWQ	105		4,882	7,638
1	1-24	48	SONUCI	NWQ	61		2,830	4,428
		49	Koura Kano Nord	NWQ	82		3,823	6,580
			1-24 Total		143		6,653	11,008
1	1-25	50	Ext. Kouara Kano Nord	NWQ	133			8,726
1	1-26	51	Ext. Kouara Tegui	NWQ	154		7,172	11,222
			Commune I Total			47,088	124,193	219,773
2	2-4	72	Madina	PRP2	110	8,769	12,238	16,124
2	2-5	73	Route de Filingue	PRP2	207	13,691	21,724	30,212
2	2-6	74	Ext. Route de Flingue	PRP2	162	10,702	16,981	23,615
2	2-7	80	Ext. Talladje	NWQ	124		5,782	9,046
2	2-8	82	Ext. Saga	PRP2	104			4,544
2	2-9	84	Aviation 1-A: (50%)	PRP2	160			8,751
2	2-10	84	Aviation 1-B: (50%)	PRP2	160			8,751
2	2-11	86	Sari-Koubou-A: (33%)	PLN	150			6,572
2	2-12	86	Sari-Koubou-B: (33%)	PLN	150			6,572
2	2-13	86	Sari-Koubou-C: (33%)	PLN	150			6,572
			Commune II Total			33,162	56,724	120,761
3	3-1	91	Karadje	PRP2	160	10,613	16,840	23,420
3	3-2	92	Pont Kennedy	PRP2	37	2,466	3,914	5,443
		93	Gawaye	PRP2	45	2,946	4,675	6,501
			3-2 Total		82	5,413	8,589	11,944
3	3-3	95	Ext. Kirkissoye	PRP2	135	8,955	14,210	19,762
3	3-4	96	Banga Bana	PRP2	208	9,187	18,221	30,408
			Commune III Total			34,169	57,859	85,533
			Middle Income Total			114,418	238,777	426,067
Low Income Class								
1	1-27	8	Zongo	TRD	20		1,782	2,424
		9	Maourey	TRD	15		1,535	1,996
		10	Gandacthe	TRD	13		1,802	1,934
		11	Deizebon	TRD	19		2,596	2,785
			1-27 Total		67		7,715	9,138
1	1-28	15	Boukoki I	PRP1	41		3,182	3,983
		16	Boukoki II	PRP1	47		3,629	4,543
		17	Boukoki III	PRP1	35		2,686	3,362
			1-28 Total		123		9,496	11,887
1	1-29	18	Boukoki IV	PRP1	99			9,635
			Commune I Total				17,211	30,659

Note: No figure in join population means not the new system introduced.

APPENDIX J-7: GROUPING PLAN FOR PRE-COLLECTION AREA (3/3)

CU	Group No	ID	Quartier	Type	Area(ha)	2005 Join Popu.	2010 Join Popu.	2015 Join Popu.
2	2-14	56	Kalley Centre	TRD	8		636	797
		58	Kalley Sud	TRD	35		2,973	4,059
		59	Lacouroussou	TRD	16		1,654	2,071
		63	Nouveau Marche	TRD	49		4,368	5,943
			2-14 Total		108		9,632	12,869
2	2-15	57	Kalley Est	TRD	49		4,593	5,988
		60	Banizoumbou I	TRD	24		2,138	2,910
		61	Abidjan	TRD	37		3,158	4,313
			2-15 Total		110		9,890	13,211
			Commune II Total				19,521	26,080
			Low Income Total				36,732	56,738
Grand Total								
			Commune I			91,245	187,930	306,855
			Commune II			43,358	91,755	164,367
			Commune III			34,169	57,859	85,533
			Total			168,771	337,545	556,755

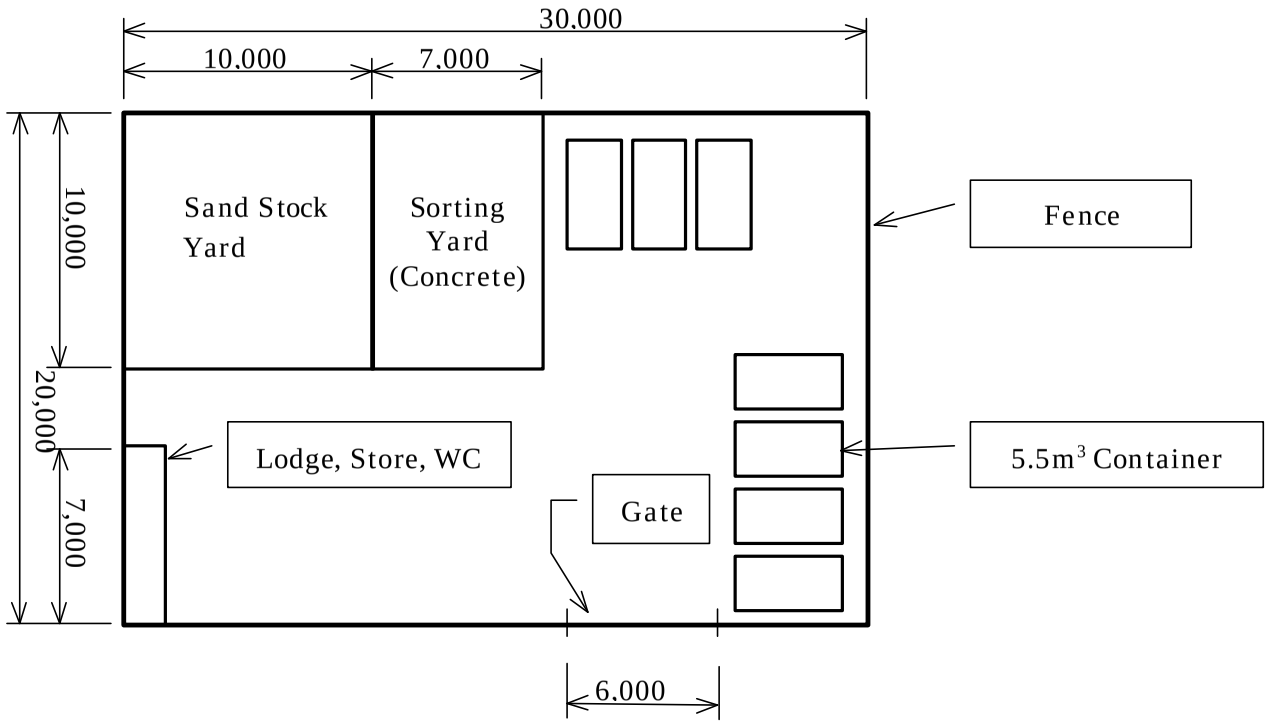
Note: No figure in served population means that the no new system is introduced.



The Study on Sanitation Improvement for the Niamey City in the Republic of Niger

Appendix J-8

LAYOUT OF RECYCLING CENTER: TYPE 1 (1:300)



The Study on Sanitation Improvement for the Niamey City in the Republic of Niger

LAYOUT OF RECYCLING CENTER: TYPE 2 (1:300)

Appendix J-9

APPENDIX J-10:REQUIRED NUMBER OF CONTAINER FOR NEW SYSTEM (1/3)

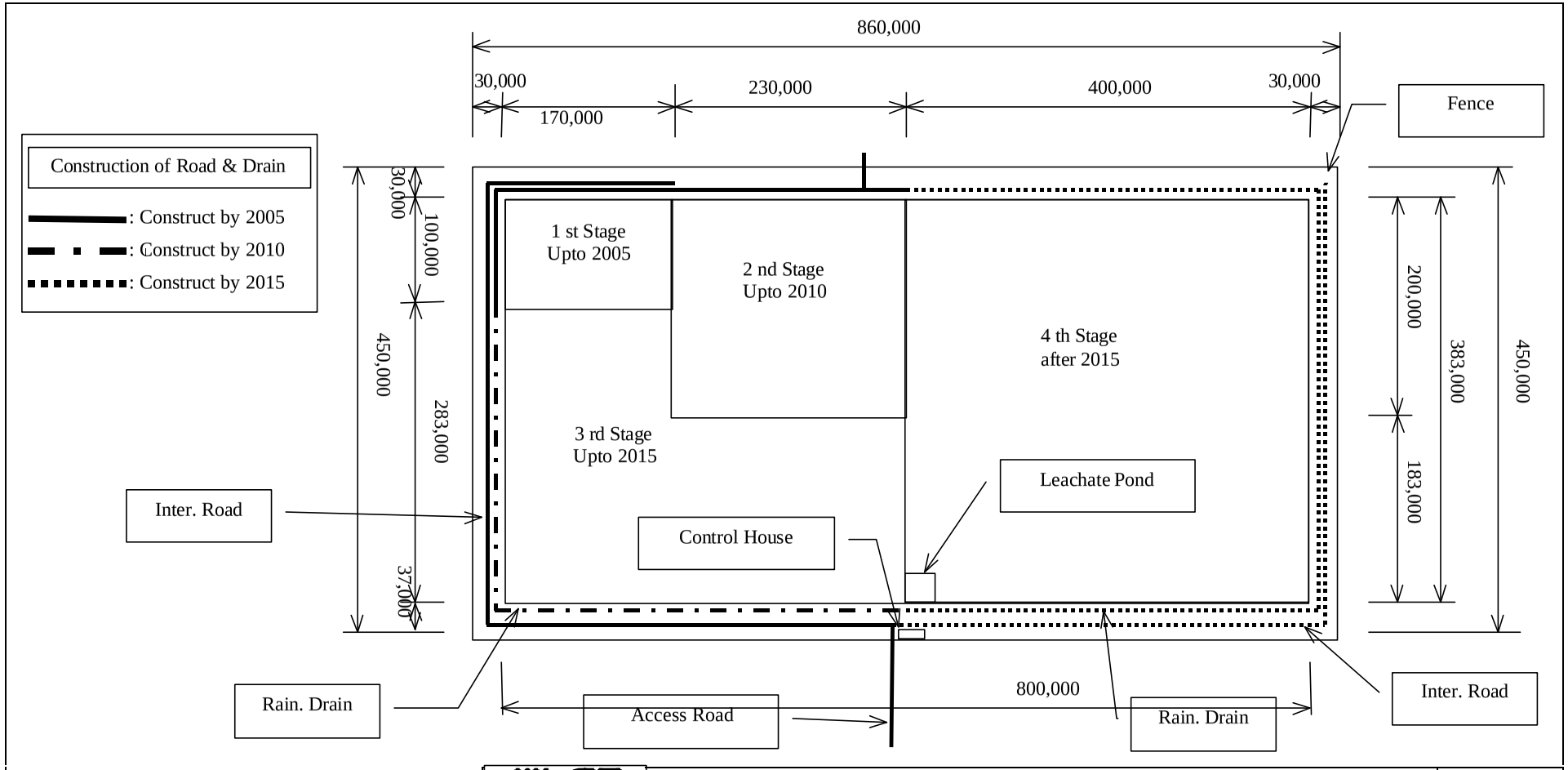
CU	Group No	ID	Quartier	2005			2010			2015		
				Join Popu.	Calculate No of container	Required No of container	Join Popu.	Calculate No of container	Required No of container	Join Popu.	Calculate No of container	Required No of container
				per.	pcs	pcs	per.	pcs	pcs	per.	pcs	pcs
High Income Class												
1	1-1	1	Plateau I-A: (60%)							3,494	0.76	1
1	1-2	1	Plateau I-B: (40%)									
		2	Ambassades									
			1-2 Total							3,602	0.7	1
1	1-3	20	Plateau II-A: (33%)	7,123	1.5	2	7,505	1.6	2	7,957	1.7	2
1	1-4	20	Plateau II-B: (33%)	7,123	1.5	2	7,505	1.6	2	7,957	1.7	2
1	1-5	20	Plateau II-C: (33%)	7,123	1.5	2	7,505	1.6	2	7,957	1.7	2
1	1-6	24	Kouara Kano	2,627	0.5	1	2,768	0.6	1	2,935	0.6	1
1	1-7	25	Ext. Kouara Kano	3,496	0.7	1	3,684	0.8	1	3,906	0.8	1
1	1-8	30	Yantala Haut	16,665	3.6	4	17,559	3.8	4	18,617	4.0	4
2	2-1	53	Terminus									
		54	Niamey Bas									
			2-1 Total				3,301	0.7	1	4,583	0.9	1
2	2-2	69	Cite Faycal									
		70	Poudriere-A: (40%)									
			2-2 Total	4,078	0.8	1	5,763	1.2	2	6,110	1.3	2
2	2-3	70	Poudriere-B: (60%)	6,118	1.3	2	6,446	1.4	2	6,834	1.4	2
Middle Income Class												
1	1-9	26	Courronne Nord	3,863	0.8	1	6,128	1.3	2	8,523	1.8	2
1	1-10	27	Kouara Me	9,091	1.9	2	12,880	2.7	3	19,345	4.2	5
1	1-11	28	Dar Es Salam-A: (50%)	7,571	1.6	2	11,679	2.5	3	18,794	4.0	4
1	1-12	28	Dar Es Salam-B: (50%)	7,571	1.6	2	11,679	2.5	3	18,794	4.0	4
1	1-13	31	Bani Fandou I	9,213	2.0	2	12,182	2.6	3	15,248	3.3	4
1	1-14	32	Cite CNSS									
		33	Bani Fandou II-A: (40%)									
			1-14 Total	4,646	1.0	1	6,708	1.4	2	9,105	1.9	2
1	1-15	33	Bani Fandou II-B: (60%)	5,133	1.1	2	7,635	1.6	2	10,619	2.3	3
1	1-16	36	Banizoumbou II				8,371	1.8	2	15,716	3.4	4
1	1-17	37	Baghdad				13,394	2.9	3	21,555	4.6	5
1	1-18	42	Nord Lazaret				6,533	1.4	2	12,267	2.6	3
1	1-19	43	Taiwan				4,070	0.8	1	6,369	1.3	2
1	1-20	44	Bobiel				4,226	0.9	1	7,273	1.5	2
1	1-21	45	Ouest Faisceau 1							6,150	1.3	2

APPENDIX J-10:REQUIRED NUMBER OF CONTAINER FOR NEW SYSTEM (2/3)

CU	Group No	ID	Quartier	2005			2010			2015		
				Join Popu.	Calculate No of container	Required No of container	Join Popu.	Calculate No of container	Required No of container	Join Popu.	Calculate No of container	Required No of container
				per.	pcs	pcs	per.	pcs	pcs	per.	pcs	pcs
1	1-22	46	Ouest Faisceau 2							11,420	2.4	3
1	1-23	47	Nord Faisceau				4,882	1.0	1	7,638	1.6	2
1	1-24	48	SONUCI									
		49	Koura Kano Nord									
			1-24 Total				6,653	1.4	2	11,008	2.3	3
1	1-25	50	Ext. Kouara Kano Nord							8,726	1.8	2
1	1-26	51	Ext. Kouara Tegui				7,172	1.5	2	11,222	2.4	3
2	2-4	72	Madina	8,769	1.9	2	12,238	2.6	3	16,124	3.5	4
2	2-5	73	Route de Filingue	13,691	2.9	3	21,724	4.7	5	30,212	6.5	7
2	2-6	74	Ext. Route de Flingue	10,702	2.3	3	16,981	3.6	4	23,615	5.1	6
2	2-7	80	Ext. Talladje				5,782	1.2	2	9,046	1.9	2
2	2-8	82	Ext. Saga							4,544	0.9	1
2	2-9	84	Aviation 1-A: (50%)							8,751	1.9	2
2	2-10	84	Aviation 1-B: (50%)							8,751	1.9	2
2	2-11	86	Sari-Koubou-A: (33%)							6,572	1.4	2
2	2-12	86	Sari-Koubou-B: (33%)							6,572	1.4	2
2	2-13	86	Sari-Koubou-C: (33%)							6,572	1.4	2
3	3-1	91	Karadje	10,613	2.3	3	16,840	3.6	4	23,420	5.0	5
3	3-2	92	Pont Kennedy									
		93	Gawaye									
			3-2 Total	5,413	1.1	2	8,589	1.8	2	11,944	2.5	3
3	3-3	95	Ext. Kirkissoye	8,955	1.9	2	14,210	3.0	3	19,762	4.2	5
3	3-4	96	Banga Bana	9,187	1.9	2	18,221	3.9	4	30,408	6.6	7
Low Income Class												
1	1-27	8	Zongo									
		9	Maourey									
		10	Gandacthe									
		11	Deizebon									
			1-27 Total				7,715	1.6	2	9,138	1.9	2
1	1-28	15	Boukoki I									
		16	Boukoki II									
		17	Boukoki III									
			1-28 Total				9,496	2.0	2	11,887	2.5	3
1	1-29	18	Boukoki IV							9,635	2.0	2
2	2-14	56	Kalley Centre									
		58	Kalley Sud									
		59	Lacouroussou									
		63	Nouveau Marche									
			2-14 Total				9,632	2.0	2	12,869	2.7	3

APPENDIX J-10:REQUIRED NUMBER OF CONTAINER FOR NEW SYSTEM (3/3)

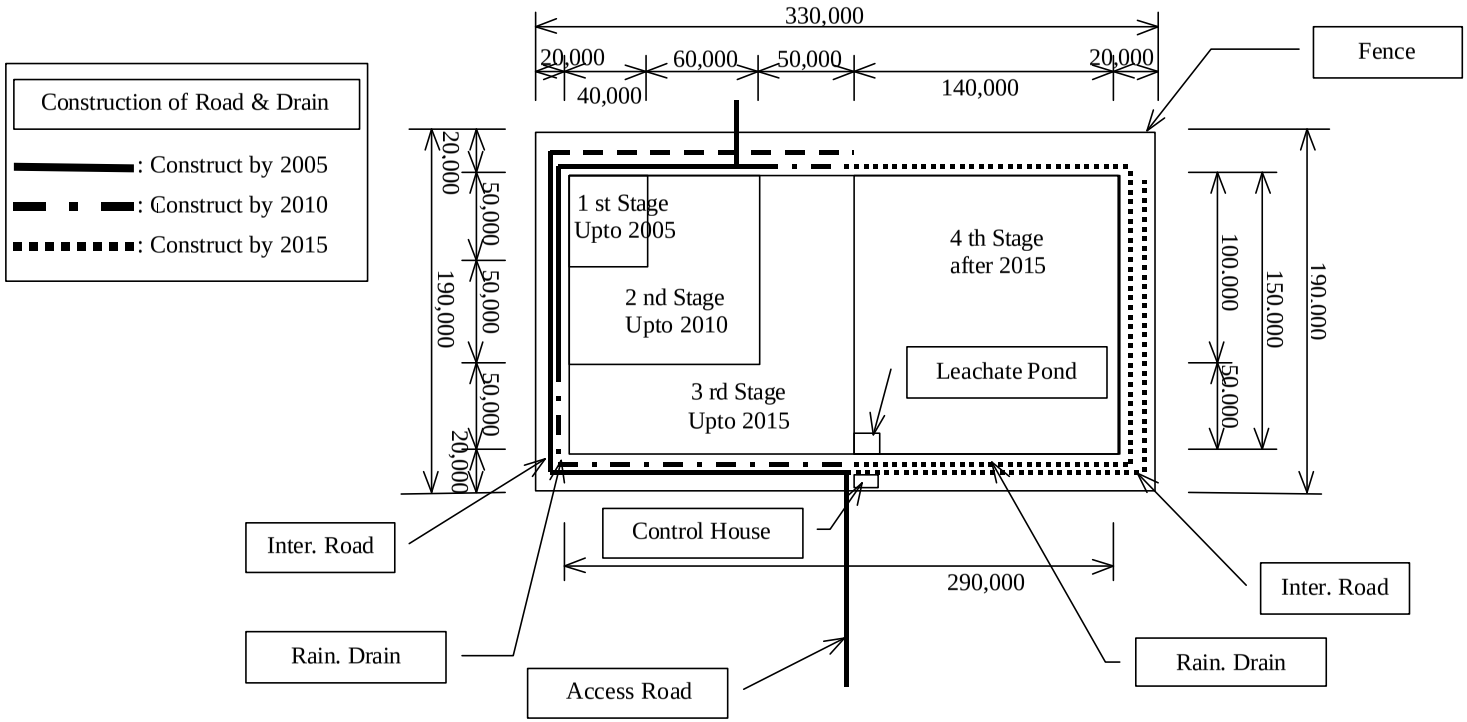
CU	Group No	ID	Quartier	2005			2010			2015		
				Join Popu.	Calculate No of container	Required No of container	Join Popu.	Calculate No of container	Required No of container	Join Popu.	Calculate No of container	Required No of container
				per.	pcs	pcs	per.	pcs	pcs	per.	pcs	pcs
2	2-15	57	Kalley Est									
		60	Banizoumbou I									
		61	Abidjan									
			2-15 Total				9,890	2.1	3	13,211	2.8	3
		Required Number										
			Grand Total	168,771		44	337,545		85	556,755		137
			Breakdown									
			Commune I	91,245	19.30	24	187,930	39.90	48	306,855	65.06	76
			Commune II	43,358	9.20	11	91,755	19.50	24	164,367	35.00	41
			Commune III	34,169	7.20	9	57,859	12.30	13	85,533	18.30	20
			Total	168,771	35.70	44	337,545	71.70	85	556,755	118.36	137
			High Income Class	54,353	11.40	15	62,036	13.30	17	73,950	15.56	19
			Middle Income Class	114,418	24.30	29	238,777	50.70	59	426,067	90.90	105
			Low Income Class				36,732	7.70	9	56,738	11.90	13
			Total	168,771	35.70	44	337,545	71.70	85	556,755	118.36	137
		Required Number to add										
			Commune I			24			24			28
			Commune II			11			13			17
			Commune III			9			4			7
			Total			44			41			52



The Study on Sanitation Improvement for the Niamey City in the Republic of Niger

APPENDIX J-11

LAYOUT OF DISPOSAL SITE CU1&2 (1:6000)



The Study on Sanitation Improvement for the Niamey City in the Republic of Niger

APPENDIX J-12

LAYOUT OF DISPOSAL SITE CU3 (1:4000)

Appendix J-13: REQUIRED EQUIPMENT FOR FINAL DISPOSAL SITES

For final disposal operation, bulldozers are required to compact the waste disposed and cover the waste with soil. The bulldozers required in Niamey have been studied as follows.

1. Design Conditions

The population whose waste is collected in a day is as follows according to the transportation capacity.

Population waste collected by the two ways

Item	Income	2005	2010	2015
Total Population	High	82,747	82,058	82,167
	Middle	383,319	489,841	604,336
	Low	291,125	299,447	307,221
	Total	757,191	871,346	993,724
Collected By New System	High	54,353	62,036	73,950
	Middle	114,418	238,777	426,067
	Low	0	36,732	56,738
	Total	168,771	337,545	556,755
Collected By Present System	High	28,394	20,022	8,217
	Middle	268,901	251,064	178,269
	Low	291,125	262,715	250,483
	Total	588,420	533,801	436,969

From the above population, the amount of waste discharged in a day is calculated as follows. This amount is a base to design the bulldozers.

Quantity of Disposed Waste

Waste Type	Unit	2005	2010	2015
Waste sand sorted	t/day	51	101	167
Waste with sand	t/day	119	137	157
Total	t/day	170	238	324

2. Required Work Volume

The work of bulldozers consists of waste pushing, waste spreading and compacting, soil pushing and soil spreading and compacting. Firstly the quantity of waste and soil in volume is calculated.

In the master plan, the recycle sand is planned to apply as covering soil. The required sand is as follows. The sand shall be 50cm in thickness against 3m of waste compacted. Therefore the final compacted sand volume shall be one-sixth of compacted waste volume.

Calculation of Required Sand to Cover the Waste

Item	Unit	2005	2010	2015
For Waste sand sorted				
Waste sand sorted	t/day	51	101	167
Compacted Volume of waste	m3/day	78	155	257
Required Sand compacted	m3/day	13	26	43
Required Sand	t/day	24	47	77
For Waste with sand				
Waste with sand	t/day	119	137	157
Compacted Volume of waste	m3/day	135	156	178
Required Sand compacted	m3/day	23	26	30
Required Sand	t/day	41	47	54
Total required sand	t/day	64	93	131

According to the planned population to collect and transport the waste, the required volume to push, spread and compact is calculated as follows.

Required Working Volume

Work Item	Unit	2005	2010	2015
Site CU1&2				
Waste Volume				
Waste sand sorted	m3/day	138	273	452
Waste with sand	m3/day	181	208	238
Total	m3/day	238	472	780
Sand Volume	m3/day	35	51	72
Site CU3				
Waste Volume				
Waste sand sorted	m3/day	19	37	62
Waste with sand	m3/day	25	28	32
Total	m3/day	32	64	106
Sand Volume	m3/day	5	7	10

3. Capacity of Bulldozer

The capacity of bulldozer is calculated as follows per different equipment size.

Pushing Waste (m^3/h)

No	Item	Unit	135HP	165HP	230HP	305HP
1	Working time	min.	60	60	60	60
2	Blade width: l	m	3	3.2	3.6	3.9
3	Blade height: h	m	1.4	1.9	2	2.2
4	q=0.6 x l x h x h	m^3	3.53	6.93	8.64	11.33
5	Efficiency: E		0.7	0.7	0.7	0.7
6	Average pushing distance: L	m	30	30	30	30
7	Speed in forward: vf	m/min.	50	50	50	50
8	Speed in reverse: vr	m/min.	50	50	50	50
9	Time for shift loss: tg	min.	0.3	0.3	0.3	0.3
10	Cycle time: Cm	min.	1.5	1.5	1.5	1.5
11	Capable Pushing Vol.: Q	m^3/h	98.78	194.07	241.92	317.12

Cm = L/vf + L/vr + tg

Q = 60 x q x E / Cm

Trash Rack is considered for Blade height.

Pushing Soil (m^3/h)

No	Item	Unit	135HP	165HP	230HP	305HP
1	Working time	min.	60	60	60	60
2	Blade width: l	m	3	3.2	3.6	3.9
3	Blade height: h	m	1	1.4	1.4	1.5
4	q=0.6 x l x h x h	m^3	1.80	3.76	4.23	5.27
5	Efficiency: E		0.7	0.7	0.7	0.7
6	Average pushing distance: L	m	30	30	30	30
7	Speed in forward: vf	m/min.	50	50	50	50
8	Speed in reverse: vr	m/min.	50	50	50	50
9	Time for shift loss: tg	min.	0.3	0.3	0.3	0.3
10	Cycle time: Cm	min.	1.5	1.5	1.5	1.5
11	Capable Pushing Vol.: Q	m^3/h	50.40	105.37	118.54	147.42

Cm = L/vf + L/vr + tg

Q = 60 x q x E / Cm

Trash Rack is not considered for Blade height.

Spreading and Compacting the Waste (m3/h)

No	Item	Unit	135HP	165HP	230HP	305HP
1	Effective blade width: W	m	2.7	2.9	3.3	3.6
2	Speed: V	m/h	5000	5000	5000	5000
3	Thickness for spreading: D	m	1	1	1	1
4	Efficiency: E		0.7	0.7	0.7	0.7
5	Number to compact: P		18	18	18	18
6	Capable Vol.: Q	m^3/h	525.00	563.89	641.67	700.00

Q = W x V x D x E / P

For Blade width, 90% is considered.

Spreading and Compacting the Soil (m3/h)

No	Item	Unit	135HP	165HP	230HP	305HP
1	Effective blade width: W	m	2.7	2.9	3.3	3.6
2	Speed: V	m/h	5000	5000	5000	5000
3	Thickness for spreading: D	m	0.5	0.5	0.5	0.5
4	Efficiency: E		0.7	0.7	0.7	0.7
5	Number to compact: P		12	12	12	12
6	Capable Vol.: Q	m^3/h	393.75	422.92	481.25	525.00

Q = W x V x D x E / P

For Blade width, 90% is considered.

4. Design for Site CU1&2

According to the above required work volume and capacity of bulldozer, the necessary working hours per day of bulldozer are calculated as follows. In 2005, the working hours are a little at about 2 hours. However it will be 6 hours in 2015 when 165HP provided. Provided to prepare the equipment necessary for 2015, one bulldozer of 165HP is appropriate to provide from 2005.

No	Item	Work Vol.	Required Hours to Work		
		m3	165HP	230HP	305HP
1	**2005**				
1-1	Waste Pushing	238	1.23	0.98	0.75
1-2	Waste Spread and Compact	238	0.42	0.37	0.34
1-3	Soil Pushing	35	0.33	0.30	0.24
1-4	Soil Spread and Compact	35	0.08	0.07	0.07
1-5	Total		2.07	1.73	1.40
2	**2010**				
2-1	Waste Pushing	472	2.43	1.95	1.49
2-2	Waste Spread and Compact	472	0.84	0.73	0.67
2-3	Soil Pushing	51	0.49	0.43	0.35
2-4	Soil Spread and Compact	51	0.12	0.11	0.10
2-5	Total		3.87	3.22	2.61
3	**2015**				
3-1	Waste Pushing	780	4.02	3.22	2.46
3-2	Waste Spread and Compact	780	1.38	1.22	1.11
3-3	Soil Pushing	72	0.68	0.61	0.49
3-4	Soil Spread and Compact	72	0.17	0.15	0.14
3-5	Total		6.25	5.19	4.20

5. Design for Site CU3

According to the above required work volume and capacity of bulldozer, the necessary working hours per day of bulldozer are calculated as follows. Since the site CU3 has a little of amount of disposed waste, the required working hours is less than 1 hour per day. In this case, providing 1 bulldozer is much more than enough. Therefore the site CU3 shall utilize the bulldozer of site CU1&2 at 1 day a week although covering with sand can not be done daily but weekly. As the bulldozer of site CU1&2 is required about 4 or 5 hours work per day until 2015, the site CU1&2 can be managed for 5 working days if the bulldozer is sent once a week to the site CU3. However the working hours of the bulldozer for site CU1&2 will reach at more than 6 hours in 2015. Therefore the site CU3 shall be equipped by a small bulldozer of 135HP by 2015.

No	Item	Work Vol.	Required Time to Work		
		m3	135HP	230HP	305HP
1	**2005**				
1-1	Waste Pushing	32	0.33	0.17	0.13
1-2	Waste Spread and Compact	32	0.06	0.06	0.05
1-3	Soil Pushing	5	0.10	0.05	0.04
1-4	Soil Spread and Compact	5	0.01	0.01	0.01
1-5	Total		0.50	0.28	0.24
2	**2010**				
2-1	Waste Pushing	64	0.65	0.33	0.27
2-2	Waste Spread and Compact	64	0.12	0.11	0.10
2-3	Soil Pushing	7	0.14	0.07	0.06
2-4	Soil Spread and Compact	7	0.02	0.02	0.01
2-5	Total		0.93	0.53	0.44
3	**2015**				
3-1	Waste Pushing	106	1.08	0.55	0.44
3-2	Waste Spread and Compact	106	0.20	0.19	0.17
3-3	Soil Pushing	10	0.19	0.09	0.08
3-4	Soil Spread and Compact	10	0.02	0.02	0.02
3-5	Total		1.50	0.85	0.71

APPENDIX J-14: DETAIL PROJECT LIST (1/3)

No	Project	Quantity or Construction			
		By 2005	By 2010	By 2015	Total
1.	**Equipment Purchase for Present Systemto be done by CUN and Communes**				
1-1	**Commune I**				
1)	5.5m3 Container Truck	2	2	1	5
2)	5.5m3 Container		2	28	30
1-2	**Commune II**				
1)	5.5m3 Container Truck	1	2		3
2)	5.5m3 Container	39	17	11	67
1-3	**Commune III**				
1)	5.5m3 Container Truck		1		1
2)	5.5m3 Container	15	9	7	31
Total	**Total**				
1)	**5.5m3 Container Truck**	**3**	**5**	**1**	**9**
2)	**5.5m3 Container**	**54**	**28**	**46**	**128**
2.	**Equipment Purchase for New Systemto be done by CUN and Communes**				
2-1	**Commune I**				
1)	5.5m3 Container Truck	4	4	5	13
2)	5.5m3 Container	28	28	33	89
2-2	**Commune II**				
1)	5.5m3 Container Truck	2	2	3	7
2)	5.5m3 Container	13	15	20	48
2-3	**Commune III**				
1)	5.5m3 Container Truck	2	1	1	4
2)	5.5m3 Container	11	5	8	24
2-4	**CUN**				
1)	15t Dump Truck	2	1	2	5
2)	2m3 Wheel Loader	1	1	1	3
Total					
1)	**5.5m3 Container Truck**	**8**	**7**	**4**	**19**
2)	**5.5m3 Container**	**52**	**48**	**61**	**161**
3)	**15t Dump Truck**	**2**	**1**	**2**	**5**
4)	**2m3 Wheel Loader**	**1**	**1**	**1**	**3**

APPENDIX J-14: DETAIL PROJECT LIST (2/3)

No	Project			Quantity or Construction			
				By 2005	By 2010	By 2015	Total
3.	**Construction of Recycle Center to be done by private pre-collectors**						
	Group	ID	Quartier				
3-1.	**Commune I**						
	1-1	1	Plateau I-A: (60%)			Type 1	
	1-2	1,2	Plateau I-A: (40%) + Ambassades			Type 1	
	1-3	20	Plateau II-A: (33%)	Type 1			
	1-4	20	Plateau II-B: (33%)	Type 1			
	1-5	20	Plateau II-B: (33%)	Type 1			
	1-6	24	Kouara Kano	Type 1			
	1-7	25	Ext. Kouara Kano	Type 1			
	1-8	30	Yantala Haut	Type 2			
	1-9	26	Courronne Nord	Type 1			
	1-10	27	Kouara Me	Type 2			
	1-11	28	Dar Es Salam-A: (50%)	Type 2			
	1-12	28	Dar Es Salam-B: (50%)	Type 2			
	1-13	31	Bani Fandou I	Type 2			
	1-14	32,33	Cite CNSS + Bani Fandou II-A: (40%)	Type 1			
	1-15	33	Bani Fandou II-B: (60%)	Type 1			
	1-16	36	Banizoumbou II		Type 2		
	1-17	37	Baghdad		Type 2		
	1-18	42	Nord Lazaret		Type 1		
	1-19	43	Taiwan		Type 1		
	1-20	44	Bobiel		Type 1		
	1-21	45	Ouest Faisceau 1			Type 1	
	1-22	46	Ouest Faisceau 2			Type 1	
	1-23	47	Nord Faisceau		Type 1		
	1-24	48,49	SONUCI+Koura Kano Nord		Type 1		
	1-25	50	Ext. Kouara Kano Nord			Type 1	
	1-26	51	Ext. Kouara Tegui		Type 1		
	1-27	8,9,10,11	Zongo, Maourey, Gandacthe, Deizebon		Type 1		
	1-28	15,16,17	Boukoki I, II, III		Type 1		
	1-29	18	Boukoki IV			Type 1	
3-2	**Commune II**						
	2-1	53,54	Terminus+Niamey Bas		Type 1		
	2-2	69,70	Cite Faycal+Poudriere-A: (40%)	Type 1			
	2-3	70	Poudriere-B: (60%)	Type 1			
	2-4	72	Madina	Type 2			
	2-5	73	Route de Filingue	Type 2			
	2-6	74	Ext. Route de Flingue	Type 2			
	2-7	80	Ext. Talladje		Type 1		

APPENDIX J-14: DETAIL PROJECT LIST (3/3)

No	Project			Quantity or Construction			
				By 2005	By 2010	By 2015	Total
	2-8	82	Ext. Saga			Type 1	
	2-9	84	Aviation 1-A: (50%)			Type 1	
	2-10	84	Aviation 1-B: (50%)			Type 1	
	2-11	86	Sari-Koubou-A: (33%)			Type 1	
	2-12	86	Sari-Koubou-B: (33%)			Type 1	
	2-13	86	Sari-Koubou-C: (33%)			Type 1	
	2-14	56,58, 59,63	Kalley Centre, Sud + Lacouroussou + Nouveau Marche		Type 1		
	2-15	57,60,61	Kalley Est, Banizoumbou I, Abidjan		Type 1		
3-3	**Commune III**						
	3-1	91	Karadje	Type 2			
	3-2	92,93	Pont Kennedy + Gawaye	Type 1			
	3-3	95	Ext. Kirkissoye	Type 2			
	3-4	96	Banga Bana	Type 2			
4.	**Disposal Site to be done by CUN**						
4-1	Construction of Final Disposal Site CU1&2			Phase 1	Phase 2	Phase 3	
4-2	Construction of Final Disposal Site CU3			Phase 1	Phase 2	Phase 3	
4-2	Equipment Purchase for Disposal (Bulldozer)			1: 165HP		1: 135HP	2
5.	**Industrial Waste to be financed by factories**						
5-1	Purchase of 5.5m^3 Container Truck[1]			0.34			0.34
5-2	Purchase of 5.5m^3 Container			10			10
6.	**Medical Waste to be financed by hospital**						
6-1	Purchase of 5.5m^3 Container Truck			0.66			0.66
6-2	Purchase of 5.5m^3 Container			11			11
6-3	Construction of Incinerator (250kg/h)			1			1

[1] One Container shall be used as well as industrial waste as for hospital waste

APPENDIX K: TOPOGRAPHICAL SURVEY REPORT

TOPOGRAPHIC SURVEY FOR THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

1. LAYOUT PLAN OF JYOKASO PLANT
   Scale = 1:500

2. LAYOUT PLAN OF UASB PLANT
   Scale = 1:500

3. LAYOUT PLAN FOR PROPOSED WWTP SITE
   Scale = 1:500

4. LONGITUDINAL PROFILE OF ROAD CORNICHE UP TO GUERI GUINDE SITE.
   Scales : H = 1:10000
   V = 1:100

BETLAS-GEOMESURE
B.P: 12164 Niamey
Tél : 73-65-60 (B)

October 2000.

BETLAS–GEOMESURE

BUREAU D'EXPERTISE TOPOGRAPHIQUE, DE LEVES AEROSPATIAUX ET DE GEOINFORMATIQUE

Niamey, le 25 Octobre 2000
======

Le Directeur

A

JICA STUDY Team

Objet : CONTRACT AGREEMENT ON TOPOGRAPHIC SURVEY FOR THE STUDY ON SANITATION IMPROVEMENT OF NIAMEY CITY IN THE REPUBLIC OF NIGER.

J'ai l'honneur de vous faire parvenir les résultats des travaux relatifs au Contrat cité en objet.

Vous en souhaitant bonne réception, je vous prie d'agréer l'expression de ma parfaite considération.

P.J :

- *Coordonnées des points d'appui (réference et canevas d'appui)*
- *Plans des trois sites (calque + 3 tirages papier de chaque)*
- *Profil en long du tronçon Rond-Point KENNEDY au site de Guéri Guindé (calque et trois tirages)*
- *Plan de masse de l'ouvrage de DEYZEIBON.*

BETLAS-GEOMESURE LE DIRECTEUR

WAZIRI Maman

GEOMETRE EXPERT AGREE

INGENIEUR CONSEIL ASSERMENTE

K-2

BETLAS-GEOMESURE

B.P : 12164 Niamey - Tél : 73-65-60 (B) – Fax : 73-20-06 – RC: 672/97, TVA : 292135 – CNSS : 31823 NIF : 229

THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LAYOUT PLAN OF JYOKASO PLANT 1:500

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

TOPOGRAPHIC SURVEY
BANDABARI PRIMARY SCHOOL II
(JYOKASO PLANT)

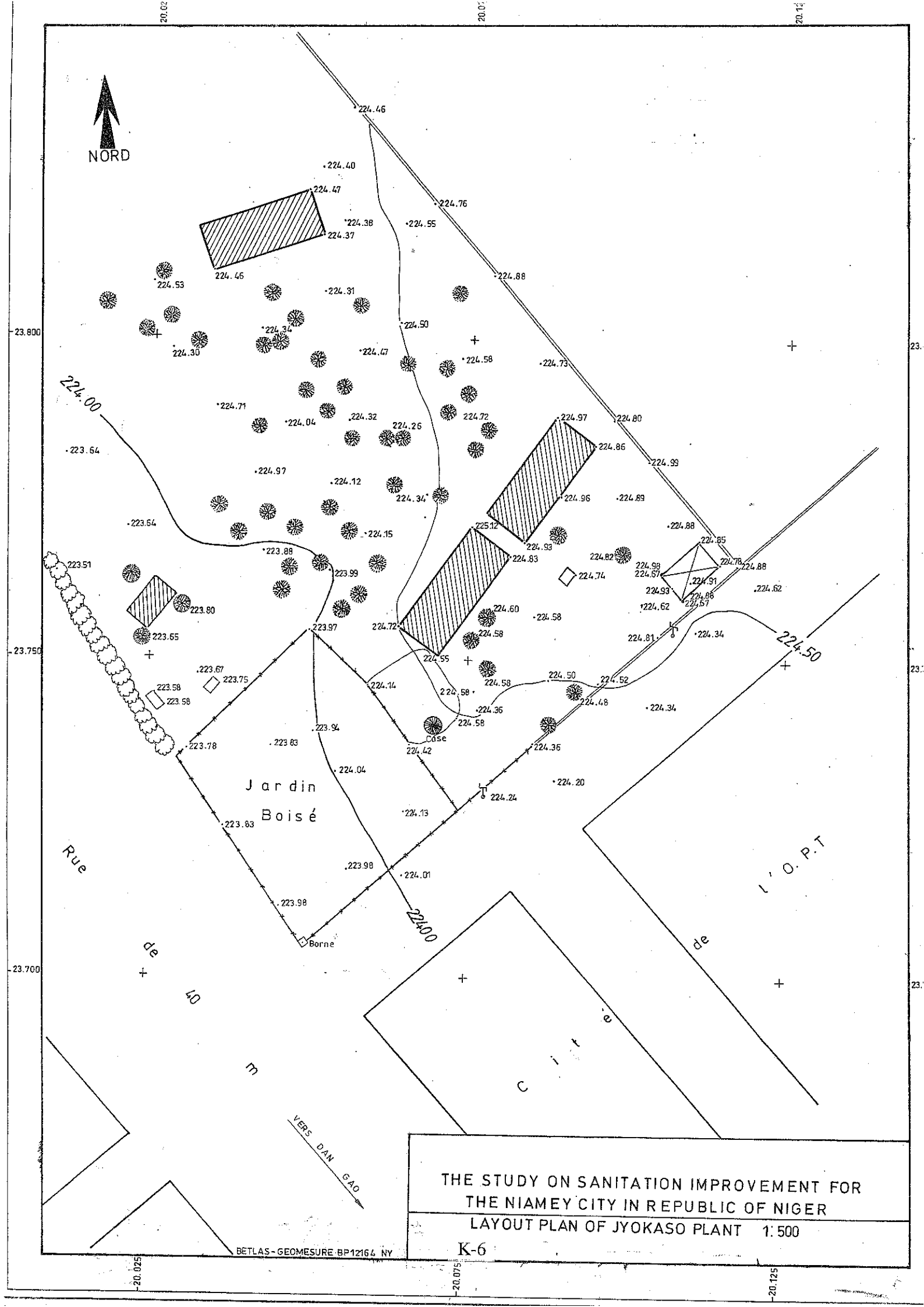
Basic bench marks Coordinates

POINT N°	X	Y	Z
Borne de l'angle de l'école	20049,712	23705,329	
35 (borne de lotissement)	20093,510	23723,557	
RN28			**207,941**

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

BANDABARI II
(JYOKASO PLANT)
New bench marks

POINT N°	X	Y	Z	Observation
P1	20107,223	23773,884	224,958	**Piquet**
P2	20069,525	23809,187	224,730	**Piquet**
P3	20076,565	23724,946	224,271	**Piquet**
P' 2	20075,777	23807,724	224,722	**Piquet**
P' 3	20048,956	23764,962	223,984	**Piquet**



THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LAYOUT PLAN OF JYOKASO PLANT 1:500

K-6

THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LAYOUT PLAN OF UASB PLANT 1:500

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

TOPOGRAPHIC SURVEY DEYZEIBON SITE (UASB PLANT)

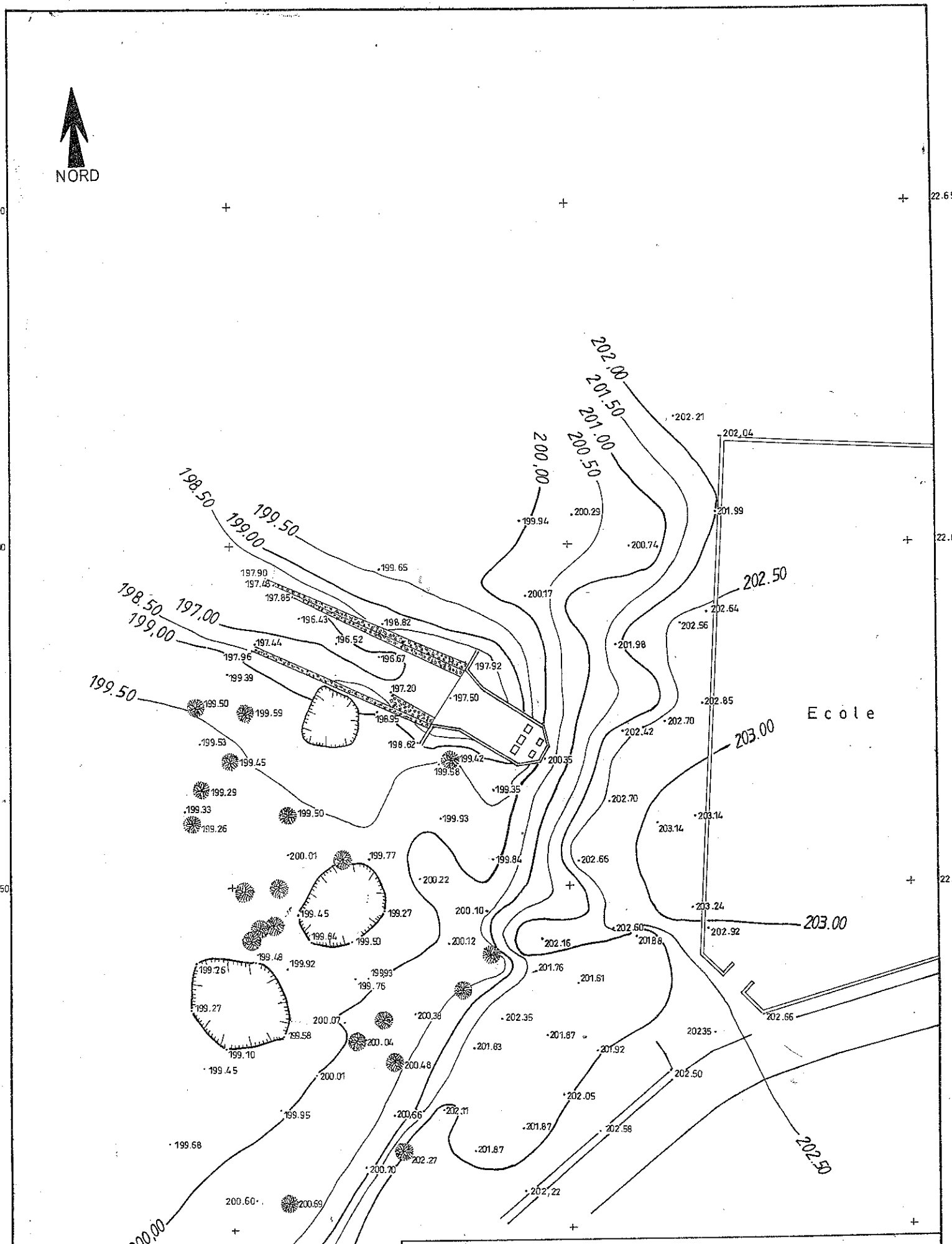
Basic bench marks

POINT N°	X	Y	Z	Observation
P243	16804,61	22626,88	208,943	**Polygo ENA Roundabout**
P591	16857,41	23017,95	211,720	**Polygo**
RN17			205,057	**Altitude reference Bench mark**

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

DEYZEIBON SITE
(UASB PLANT)
New bench marks

POINT N°	X	Y	Z	Observation
P121	17470,704	22570,497	199,299	**Borne** (concrete and iron stick)
P120	17521,632	22615,108	201,964	**Borne** (concrete and Iron stick)
P1	17246,929	22666,421		**Piquet** (Iron stick)
P2	17180,314	22632,192		**Piquet** (Iron stick)
P3	17112,971	22609,783		**Piquet** (iron stick)
P4	17488,921	22521,390	201,861	**Piquet** (iron stick)

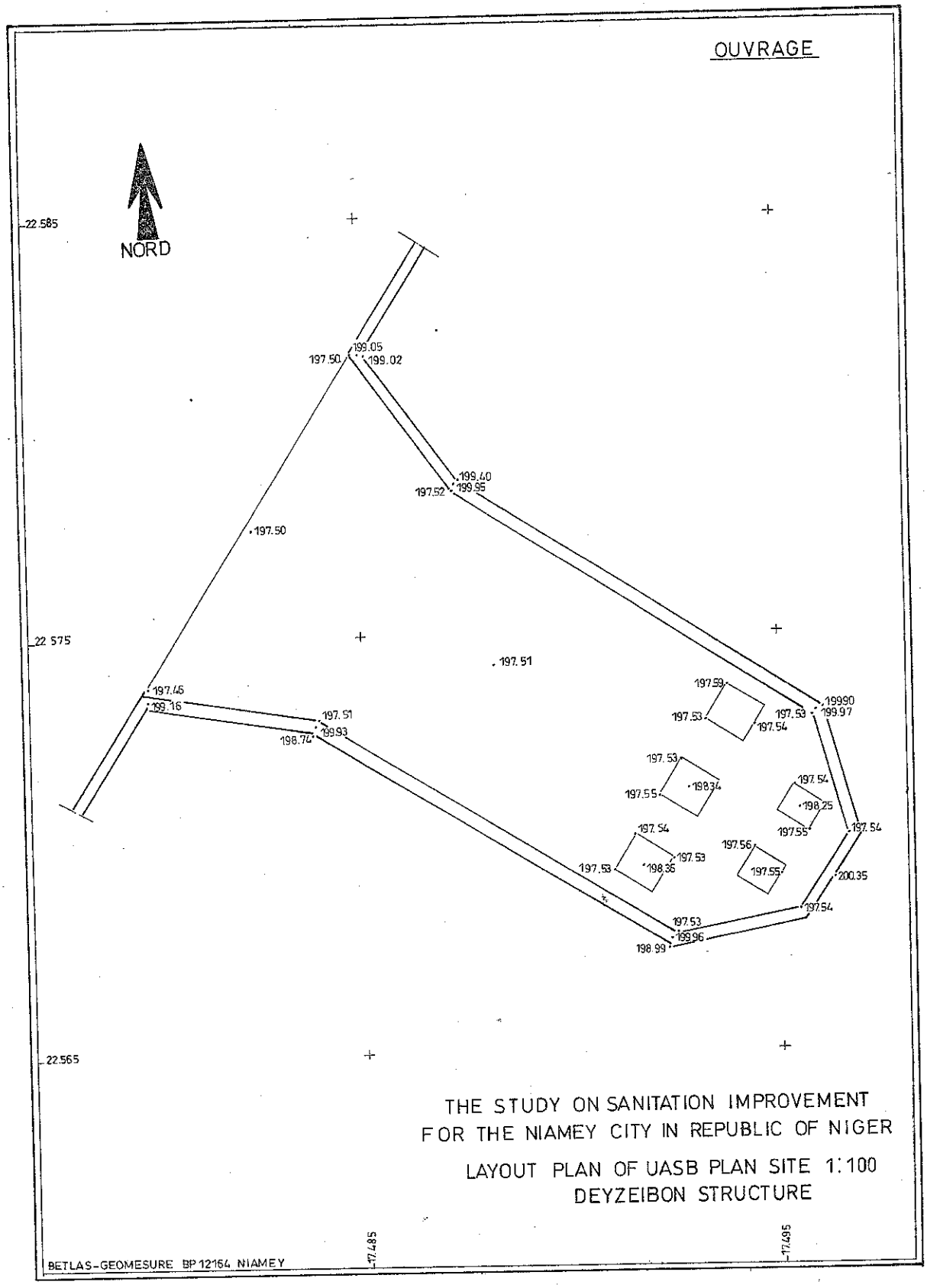


THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LAYOUT PLAN OF UASB PLANT 1: 500

K-10

BETLAS – GEOMESURE BP 12164 NIAMEY



THE STUDY ON SANITATION IMPROVEMENT
FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LAYOUT PLAN OF UASB PLAN SITE 1:100
DEYZEIBON STRUCTURE

THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

TOPOGRAPHIC PLAN FOR PROPOSED WWTP SITE 1:500

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

TOPOGRAPHIC SURVEY
PROPOSED WWTP SITE

Basic bench marks Coordinates

POINT N°	X (m)	Y (m)	Z (m)	Observation
ST 20	410250,99	1487418,19		Triangulation bench mark
Chateau 6 Aeroport Antena	411060,92	1489508,74		
(Leveling network) RN N°34			**181,917**	**Repère de nivellement (Altitude reference)**

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

TOPOGRAPHIC SURVEY
PROPOSED WWTP SITE

New bench marks Coordinates

POINT N°	X (m)	Y (m)	Z (m)	Observation
B 119	409746,125	1487306,880	181,711	**Borne (concrete and iron stick)**
B 118	409724,614	1487245,614	181,353	**Borne (concrete and iron stick)**
B 117			183,036	**Borne (concrete and iron stick)**

STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

TOPOGRAPHIC SURVEY
PROPOSED WWTP SITE

Boring Points Coordinates

POINT N°	X (m)	Y (m)	Z (m)	Observation
Piquet 1	409619,585	1487250,998	181,264	**Iron stick**
Piquet 2	409694,897	1487252,947	181,056	**Iron stick**
Piquet 3	409769,565	1487259,594	180,961	**Iron stick**

THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LONGITUDINAL PROFILE OF ROAD CORNICHE UP TO GUERI GUINDE SITE

H = 1:10.000

V = 1:100

THE STUDY ON SANITATION IMPROVEMENT FOR THE NIAMEY CITY IN REPUBLIC OF NIGER

LONGITUDINAL PROFILE OF ROAD CORNICHE UP TO GUERI GUINDE SITE

H = 1:10.000

V = 1:100

Basic bench mark

POINT N°	X	Y	Z (m)	Observation
RN 34			181,917	Altitude reference KENNEDY BRIDGE

N° des Profils	Altitudes Cheminement I	Altitudes Cheminement II	Moyennes	N° des Profils
P rpt K	186,875	186,877	186,876	P rpt K
P1	186,431	186,433	186,432	P1
P2	186,759	186,761	186,760	P2
P3	183,367	183,371	183,369	P3
P4	182,388	182,398	182,393	P4
P5	182,544	182,553	182,549	P5
P6	182,363	182,370	182,367	P6
P7	182,803	182,810	182,807	P7
P8	182,463	182,470	182,467	P8
P9	182,835	182,842	182,839	P9
P10	182,538	182,544	182,541	P10
P11	182,511	182,518	182,515	P11
P12	183,173	183,178	183,176	P12
P13	183,482	183,488	183,485	P13
P14	182,659	182,663	182,661	P14
P15	182,571	182,575	182,573	P15
P16	182,409	182,414	182,412	P16
P17	183,181	183,185	183,183	P17
P18	183,926	183,929	183,928	P18
P19	183,999	184,003	184,001	P19
P20	184,464	184,468	184,466	P20
P21	186,041	186,046	186,044	P21
P22	186,555	186,561	186,558	P22
P23	186,825	186,830	186,828	P23
P24	186,647	186,653	186,650	P24
P25	186,038	186,046	186,042	P25
P26	186,922	186,926	186,924	P26
P27	187,583	187,589	187,586	P27
P28	188,546	188,552	188,549	P28
P29	186,269	186,274	186,272	P29
P30	183,567	183,573	183,570	P30
P31	182,386	182,393	182,390	P31
P32	182,158	182,165	182,162	P32
P33	183,050	183,055	183,053	P33
P34	185,088	185,095	185,092	P34
P35	187,649	187,656	187,653	P35
P36	190,345	190,353	190,349	P36
P37	193,169	193,176	193,173	P37
P38	195,990	195,996	195,993	P38
P39	198,978	198,985	198,982	P39
P40	201,442	201,449	201,446	P40
P41	202,587	202,594	202,591	P41
P42	200,295	200,302	200,299	P42

N° des Profils	Altitudes Cheminement I	Altitudes Cheminement II	Moyennes	N° des Profils
P43	198,307	198,313	198,310	P43
P44	196,431	196,436	196,434	P44
P45	195,331	195,338	195,335	P45
P46	195,733	195,739	195,736	P46
P47	194,820	194,825	194,823	P47
P48	193,235	193,240	193,238	P48
P49	192,099	192,105	192,102	P49
P50	190,066	190,072	190,069	P50
P51	188,043	188,050	188,047	P51
P52	187,840	187,846	187,843	P52
P53	186,788	186,792	186,790	P53
P54	186,497	186,502	186,500	P54
P55	186,068	186,075	186,072	P55
P56	185,602	185,609	185,606	P56
P57	185,311	185,319	185,315	P57
P58	183,399	183,407	183,403	P58
P59	183,951	183,959	183,955	P59
P60	184,243	184,251	184,247	P60
P61	184,882	184,891	184,887	P61
P62	185,099	185,109	185,104	P62
P63	184,241	184,249	184,245	P63
P64	183,397	183,407	183,402	P64
P65	182,538	182,548	182,543	P65
P66	181,965	181,974	181,970	P66
P67	181,533	181,544	181,539	P67
P68	181,714	181,726	181,720	P68
P69	181,811	181,822	181,817	P69
P70	181,132	181,144	181,138	P70
P71	182,159	182,170	182,165	P71
P72	181,902	181,914	181,908	P72
P73	181,668	181,680	181,674	P73
P74	181,695	181,708	181,702	P74
P75	181,344	181,355	181,350	P75
P76	181,392	181,402	181,397	P76
P77	181,575	181,584	181,580	P77
P78	181,968	181,978	181,973	P78
P79	182,160	182,170	182,165	P79
P80	181,267	181,275	181,271	P80
P81	181,172	181,180	181,176	P81
P82	181,229	181,236	181,233	P82
P83	181,217	181,225	181,221	P83
P84	181,342	181,350	181,346	P84

N° des Profils	Altitudes Cheminement I	Altitudes Cheminement II	Moyennes	N° des Profils
P85	181,367	181,376	181,372	P85
P86	181,426	181,435	181,431	P86
P87	181,648	181,650	181,649	P87
P88	181,830	181,831	181,831	P88
P89	181,857	181,858	181,858	P89
P90	181,816	181,816	181,816	P90
P91	181,317	181,317	181,317	P91
P92	181,079	181,078	181,079	P92
P93	181,075	181,075	181,075	P93
P94	181,040	181,039	181,040	P94
P95	181,137	181,136	181,137	P95
P96	181,284	181,283	181,284	P96
P97	181,407	181,406	181,407	P97
P98	181,468	181,467	181,468	P98
P99	181,351	181,350	181,351	P99
P100	181,466	181,465	181,466	P100
P101	181,412	181,409	181,411	P101
P102	181,364	181,363	181,364	P102
P103	181,315	181,313	181,314	P103
P104	181,324	181,323	181,324	P104
P105	181,227	181,228	181,228	P105
P106	181,488	181,490	181,489	P106
P107	181,923	181,926	181,925	P107
P108	182,148	182,150	182,149	P108
P109	182,486	182,487	182,487	P109
P110	183,523	183,522	183,523	P110
P111	182,970	182,969	182,970	P111
P112	180,593	180,593	180,593	P112
P113	180,015	180,013	180,014	P113
P114	180,035	180,038	180,037	P114
P115	182,271	182,270	182,271	P115
P116	184,352	184,349	184,351	P116
P117	184,893	184,892	184,893	P117
P118	184,942	184,941	184,942	P118
P119	185,560	185,560	185,560	P119
P120	187,894	187,894	187,894	P120
P121	186,864	186,861	186,863	P121
P122	185,931	185,930	185,931	P122
P123	185,712	185,712	185,712	P123
P124	184,128	184,129	184,129	P124
P125	182,033	182,033	182,033	P125
P126	181,171	181,174	181,173	P126
P127	181,332	181,330	181,331	P127
P128	181,391	181,392	181,392	P128

N° des Profils	Altitudes Cheminement I	Altitudes Cheminement II	Moyennes	N° des Profils
P0 117	183,036	183,035	183,036	P0 117
P0 118	181,710	181,711	181,711	P0 118
P0 119	181,353	181,353	181,353	P0 119

APPENDIX L: SOIL INVESTIGATION SURVEY REPORT

REPUBLIC OF NIGER

JICA STUDY TEAM

STUDY ON SANITATION FOR THE NIAMEY CITY

SOIL SURVEY

STUDY ON SANITATION FOR THE NIAMEY CITY IN THE REPUBLIC OF NIGER

- Site of SAGA
- Site of DEIZEBON

REPORT OF SURVEY

SENAGRHY s. a.

NGENIEURS-CONSEILS

en

ENVIRONNEMENT AGRICULTURE HYDRAULIQUE

5, Rue du Sahel (Terminus) Niamey Boite Postale 10.467 Téléphone 73 56 56 Fax 73 35 73

Date: December 2000

REPORT OF SOIL RECOGNITION

I / INTRODUCTION

By contract on September 13, 2000, JICA STUDY TEAM confided to the society of Study for Environment, Agriculture and Hydraulics (SENAGRHY s.a.) the conduct and supervision of studies of soil survey in the setting of the " Project on sanitation improvement of the Niamey City in Republic of Niger ". The recognition of soils and analysis to the laboratory have been realised in subcontract by the National Laboratory of the Public Works and Building (LNTP/B).

Studies concerned sites of SAGA and DEIZEBON retained to this effect. Works consisted to the realization of the mechanical forages with standard penetration test (S P T) in situ, taking of samples and their analysis in the laboratory.

II / MECHANICAL FORAGES AND STANDARD PENETRATION TEST(S P T).

Five (5) forages of thirty meters (30 ms) of depth each, with tests of penetration standard all six (6) meters, have been realised of which three (3) forages (F1, F2 and F3) to the site of SAGA and 2 forages (F4 and F5) to the site of DEIZEBON, with the help of the mechanical drill of NORDMEYER mark. Points of forages implantation are indicated on the joined plans in appendix.

2.1 geological description of sites.

From the geological view point, the formation of basis of the area (according to the geological map of Niger) is an old granite. Forages N° 2 and N° 3 of SAGA confirmed the existence of this rock.

The different met formations are generally the following:
- More clayey sand in certain points,
- Gritty clay and shale in other points.

Soils met at the level of every point of forage and their thickness are represented on the geological cuts of forages.

2.2 nature and description of soils met.

The nature and the description of soils met are joined in appendix and features compiled in the two following boards. A standard penetration test has been realised in the different layers of soil appropriated. Analysis to the laboratory summarize themselves to:

→ granulométry;
→ sédimentométry;
→ limits of ATTERBERG;
→ natural water tenor,
→ essai proctor,

→ essai CBR,
→ essai of shearing
→ essai of consolidation
→ Density
→ etc

Results are compiled in the annexed pictures.

III / CONCLUSION:

Clays met during the execution of forages have an raised resistance. They can be classified in the hard clay family. It will be necessary to take care of the VRD in order to avoid all infiltration of water around works.

GEOGRAPHICAL SITUATION

SUMMARY RESULTS

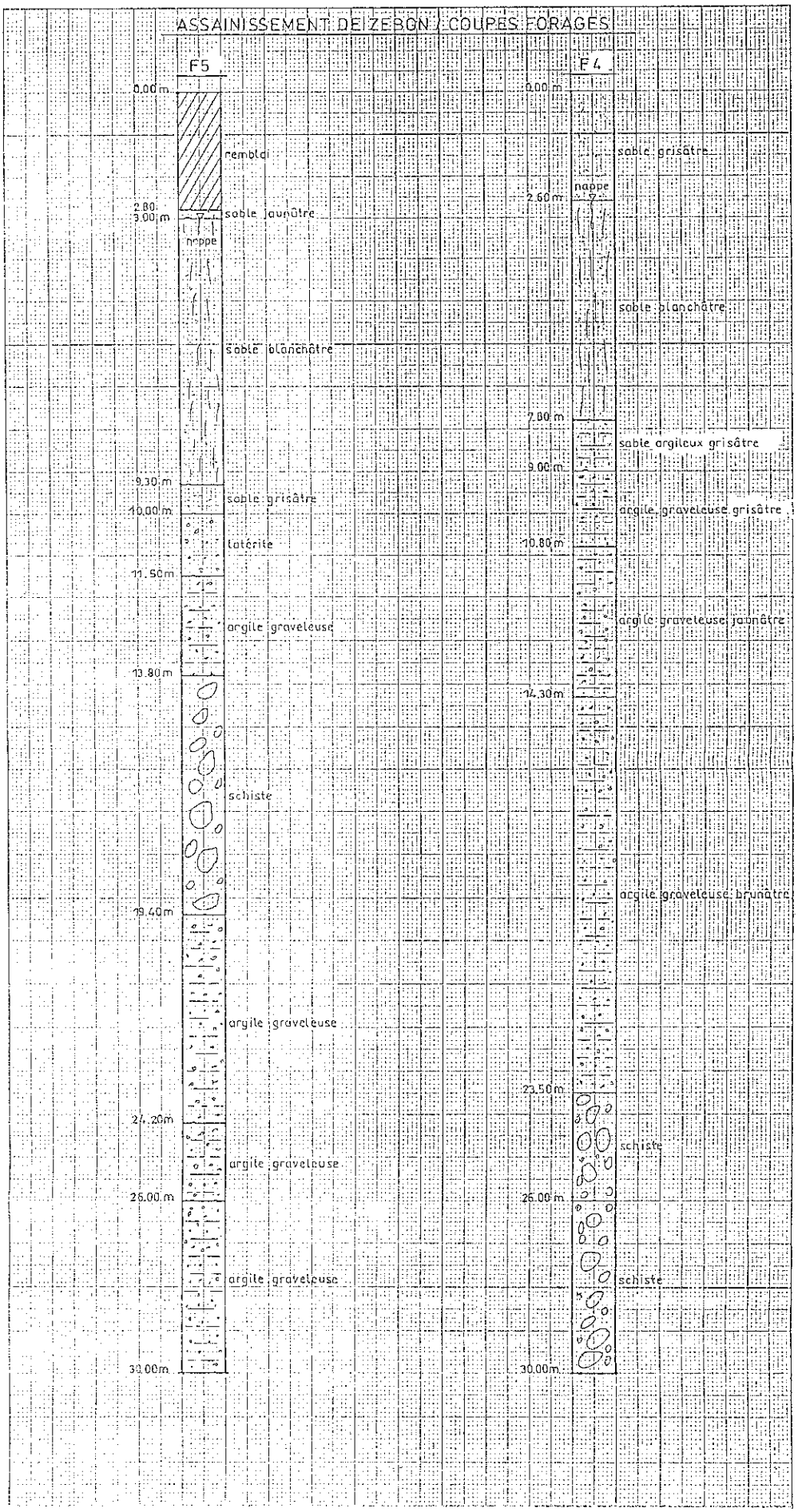
PROJECT SANITATION IMPROVEMENT FOR THE NIAMEY CITY
SUMMARY RESULTS

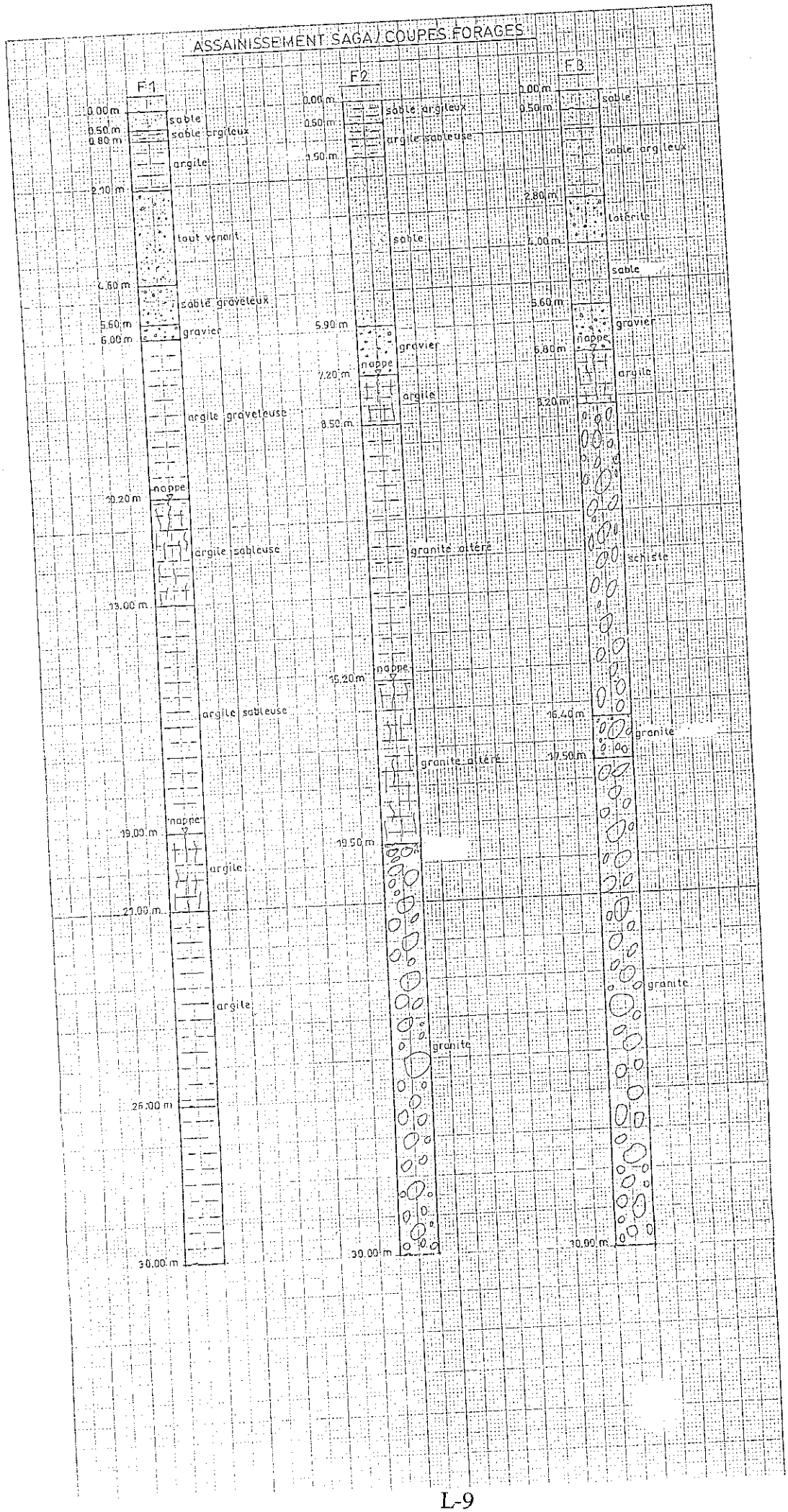
FORAGES	MIDDLE DEPTH	NATURE of SAMPLE	GRANULOMETRY				LIMITES			PROCTOR		CBR		RP		
			< 5 mm	< 2 mm	< 0,4 mm	< 0,08 mm	LL	IP	ES	Ds	W%	98%	95%	N (30 cm)	bars	f/m2
SAGA																
	0,80 - 2,10 m	Clay	100	99	97	58	41	21		1,83	11,2	3	2	69	1,38	13,80
	6,00 - 10,00 m	Gritty clay	100	92	67	47	39	20		2,05	8,7	7	3	60	1,20	12,00
	10,00 - 19,00 m	Sandy clay	98	85	53	29	35	18		1,95	10	11	6	51	1,02	10,20
	21,00 - 26,00 m	Clay	98	89	59	36	37	18		1,86	11,2	8	6	86	1,72	17,20
	26,00 - 30,00 m	Clay	98	89	59	36	37	18		1,86	11,2	8	6	86	1,72	17,20
SAGA	1,50 - 5,90 m	Sand	100	98	62	4			45	1,69	3	10	9	25	2,5	25,0
	6,00 - 15,20 m	Faded granite	80	67	39	22	33	16		2,03	9,3	14	11	63	1,26	12,60
	15,20 - 19,50 m	Faded granite	93	78	46	27	33	17		1,88	10,7	13	9	78	1,56	15,60
	19,50 - 30,00 m	Granite														
SAGA	4,20 - 5,60 m	Gritty sand	100	98	63	3			48					20	2,00	20,00
	6,80 - 8,20 m	Clay	96	91	75	37	30	15		2,02	9,7	18	8	54	1,08	10,80
	8,20 - 16,40 m	Shale	96	90	73	38	28	13		1,95	11,8	10	6	68	1,36	13,60
	16,40 - 30,00 m	Granite														
FORAGE N°4 DEIZEBON																
	2,60 - 7,80 m	Whitish sand	100	100	90	8			21					5	0,50	5,00
	7,80 - 9,00 m	Clayey sand	100	99	85	21	19	7		2	9,7	20	8	11	0,77	7,70
	14,30 - 23,50 m	Gritty clay	100	91	70	59	73	34		1,53	18	1	0	52	1,04	10,40
	23,50 - 30,00 m	Shale	97	93	82	68	62	29		1,53	18,3	3	2	64	1,28	12,80
FORAGE N°5 DEIZEBON																
	3,00 - 9,30 m	Whitish sand	100	100	93	20			25					7	0,70	7,00
	11,50 - 13,80 m	Gritty clay	100	87	68	55	70	36		1,71	13,7	2,5	1	54	1,08	10,80
	13,80 - 19,40 m	Shale	100	88	70	56	80	39		1,43	21,1	2,5	2	68	1,36	13,60
	19,40 - 24,20 m	Gritty clay	100	90	67	48	55	26		1,56	16,3	4	3	42	0,84	8,40
	24,20 - 30,00 m	Gritty clay	100	91	70	54	59	29		1,57	16,5	2,5	1	48	0,96	9,60

PROJECT SANITATION IMPROVEMENT FOR THE NIAMEY CITY
SUMMARY RESULTS

FORAGES	MIDDLE DEPTH	NATURE of SAMPLE	Natural Watter Tenor	Coefficient of Compressibility	shearing		Permeability	Density specific weight
			%	Cc	φu	Cu	K20(cm/s)	γ_s g/cm^3
FORAGE N°1 SAGA								
	0,80 - 2,10 m	Clay	7	0,09	30	0,25	impervious	2,41
	6,00 - 10,00 m	Gritty clay	4,5	0,25	22	0,14	impervious	2,47
	10,00 - 19,00 m	Sandy clay	16,5	0,04	26	0,21	impervious	2,5
	21,00 - 26,00 m	Clay	19	0,09	21	0,59	$3,5*10^{-7}$	2,54
	26,00 - 30,00 m	Clay	19	0,09	21	0,59	$3,5*10^{-7}$	2,54
FORAGE N°2 SAGA	1,50 - 5,90 m	Sand	5	0,03	14	0,12	$4,8*10^{-5}$	2,6
	6,00 - 15,20 m	Faded granite	20	0,03	20	0,63	impervious	2,56
	15,20 - 19,50 m	Faded granite	9	0,14	33	0,2	$4,5*10^{-7}$	2,47
	19,50 - 30,00 m	Granite						
FORAGE N°3 SAGA	4,20 - 5,60 m	Gritty sand	2	0,02	11	0,23	$2,8*10^{-5}$	2,6
	6,80 - 8,20 m	Clay	13,5	0,05	28	0	$2,8*10^{-7}$	2,58
	8,20 - 16,40 m	Shale	22	0,03	21	0,38	$5,5*10^{-7}$	2,78
	16,40 - 30,00 m	Granite						
FORAGE N°4 DEIZEBON								
	2,60 - 7,80 m	Whitish sand	9		33	0,225	$6,6*10^{-6}$	
	7,80 - 9,00 m	Clayey sand	16	0,02	28	0,24	$4,1*10^{-6}$	2,5
	14,30 - 23,50 m	Gritty clay	33,5	0,15	18	0,34	impervious	2,4
	23,50 - 30,00 m	Shale	37	0,08	12,5	0,445	impervious	0,42
FORAGE N°5 DEIZEBON								
	3,00 - 9,30 m	Whitish sand	17	0,02	31	0,26		2,6
	11,50 - 13,80 m	Gritty clay	24,5	0,23	11,5	0,23	impervious	2,58
	13,80 - 19,40 m	Shale	26,5	0,1	20,5	0,23	$7,2*10^{-6}$	2,51
	19,40 - 24,20 m	Gritty clay	29	0,05	22	0,235	$5,5*10^{-7}$	2,45
	24,20 - 30,00 m	Gritty clay	31	0,22	22	0,275	impervious	2,53

GEOLOGICAL CUTS OF FORAGES


ASSAINISSEMENT DE ZEBON / COUPES FORAGES
F5
0.00 m
remblai
2.80
3.00 m
sable jaunâtre
nappe
sable blanchâtre
9.30 m
10.00 m
sable grisâtre
latérite
11.50 m
argile graveleuse
13.80 m
schiste
19.40 m
argile graveleuse
24.20 m
argile graveleuse
26.00 m
argile graveleuse
30.00 m
F4
0.00 m
sable grisâtre
nappe
2.60 m
sable blanchâtre
7.80 m
sable argileux grisâtre
9.00 m
argile graveleuse grisâtre
10.80 m
argile graveleuse jaunâtre
14.30 m
argile graveleuse brunâtre
23.50 m
schiste
26.00 m
schiste
30.00 m


ASSAINISSEMENT SAGA/ COUPES FORAGES
F1
0.00 m
sable
0.50 m
sable argileux
0.80 m
argile
2.10 m
tout venant
4.60 m
sable graveleux
5.60 m
gravier
6.00 m
argile graveleuse
nappe
10.20 m
argile sableuse
13.00 m
argile sableuse
nappe
19.00 m
argile
21.00 m
argile
26.00 m
30.00 m
F2
0.00 m
sable argileux
0.50 m
argile sableuse
1.50 m
sable
5.90 m
gravier
nappe
7.20 m
argile
8.50 m
granite altéré
nappe
15.20 m
granite altéré
19.50 m
granite
30.00 m
F3
0.00 m
sable
0.50 m
sable argileux
2.80 m
latérite
4.00 m
sable
5.60 m
gravier
nappe
6.80 m
argile
8.20 m
schiste
16.40 m
granite
17.50 m
granite
30.00 m

APPENDIX

APPENDIX 1 : FORAGE N°1/SAGA

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov. : ASSAINISSEMENT VILLE NY.

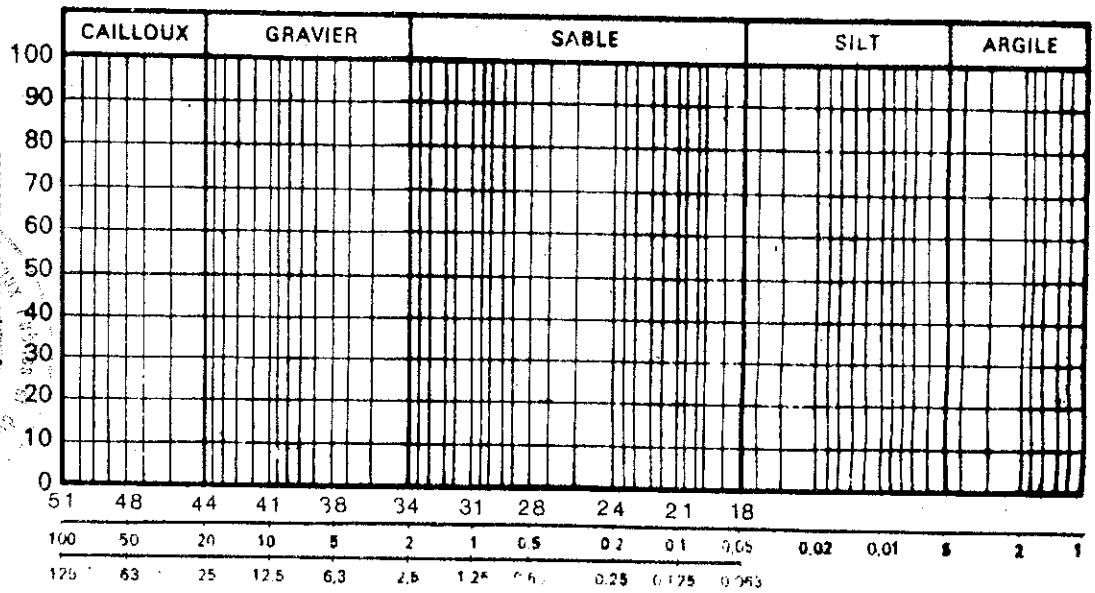
N° ECH.	PROF.	PROFIL	NATURE
F1	0.80 à 2.10 m		Argile

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	IP	Poids spécifique	m - IP	Classification U S	H R B
	41.3	20.2	21.1				

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMÉTRIE



ESSAI PROCTOR

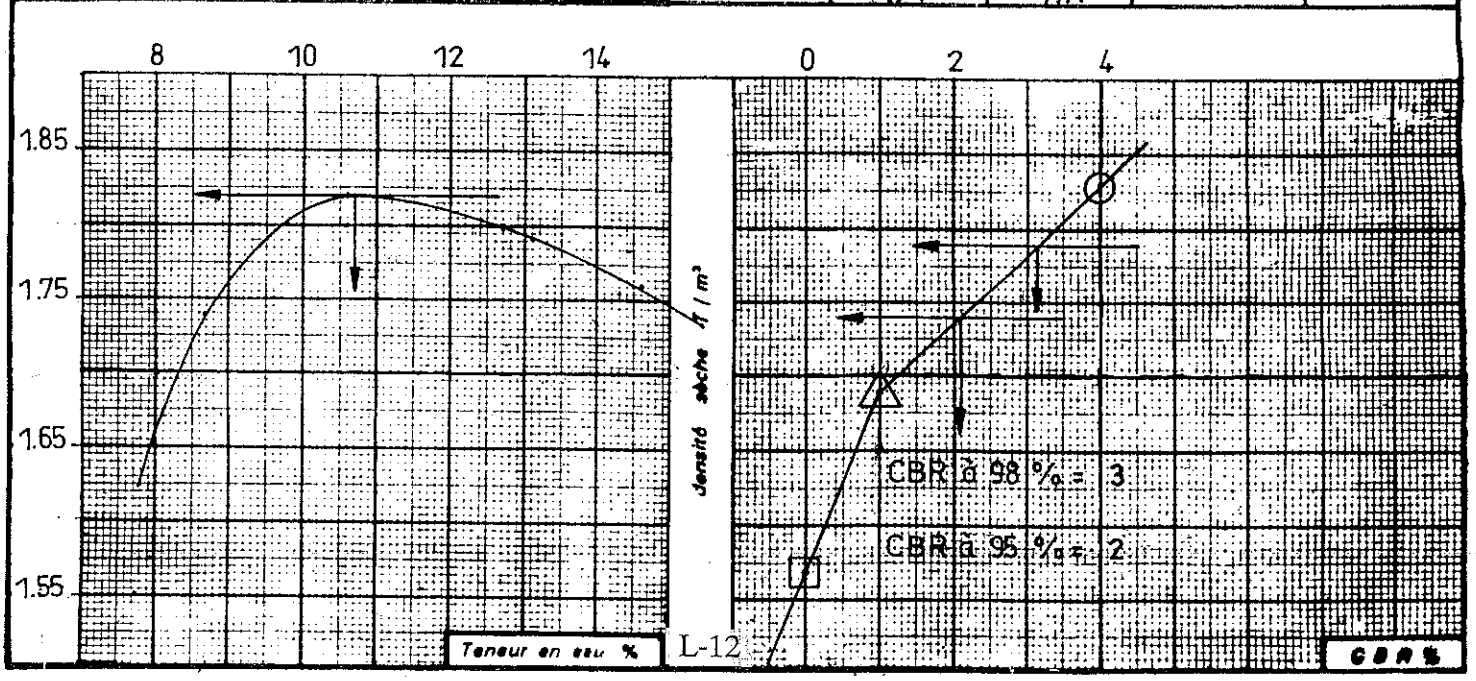
Densité sèche max. 1.82 T / m³

Teneur en eau opt 10.7 %

ESSAI CBR

W % optimale

N coups	γ d T / m³	W % moulage	% après imbib	gonflement %
○ 55	1,83	11.4		
△ 25	1,69	11.4		
□ 10	1,57	11.4		



DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

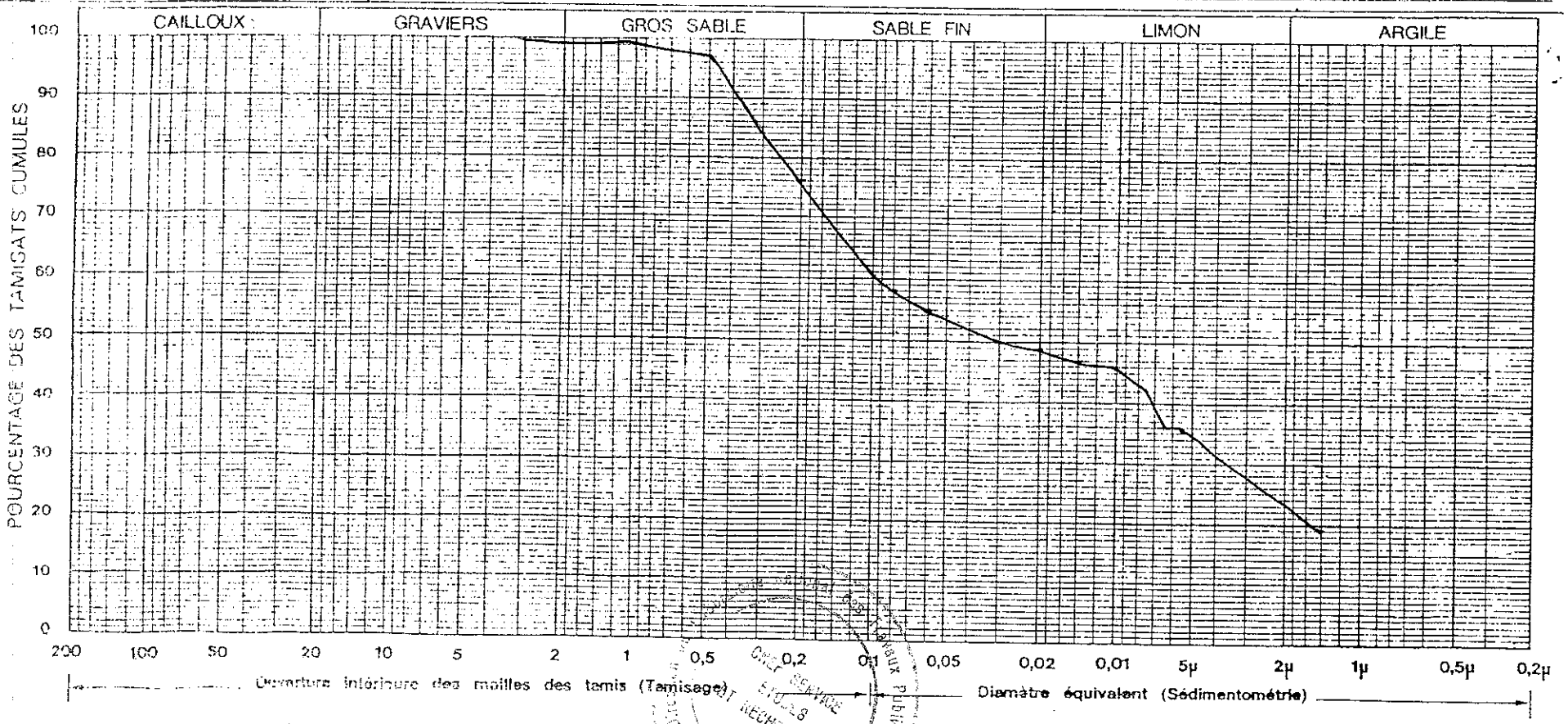
Opérateur: _____

Désignation des échantillons N° _____ N° _____

Provenance: ASSAINISS. VILLE NY.

Echantillon : Argile

F1 / Prél. 0.80 à 2.10m



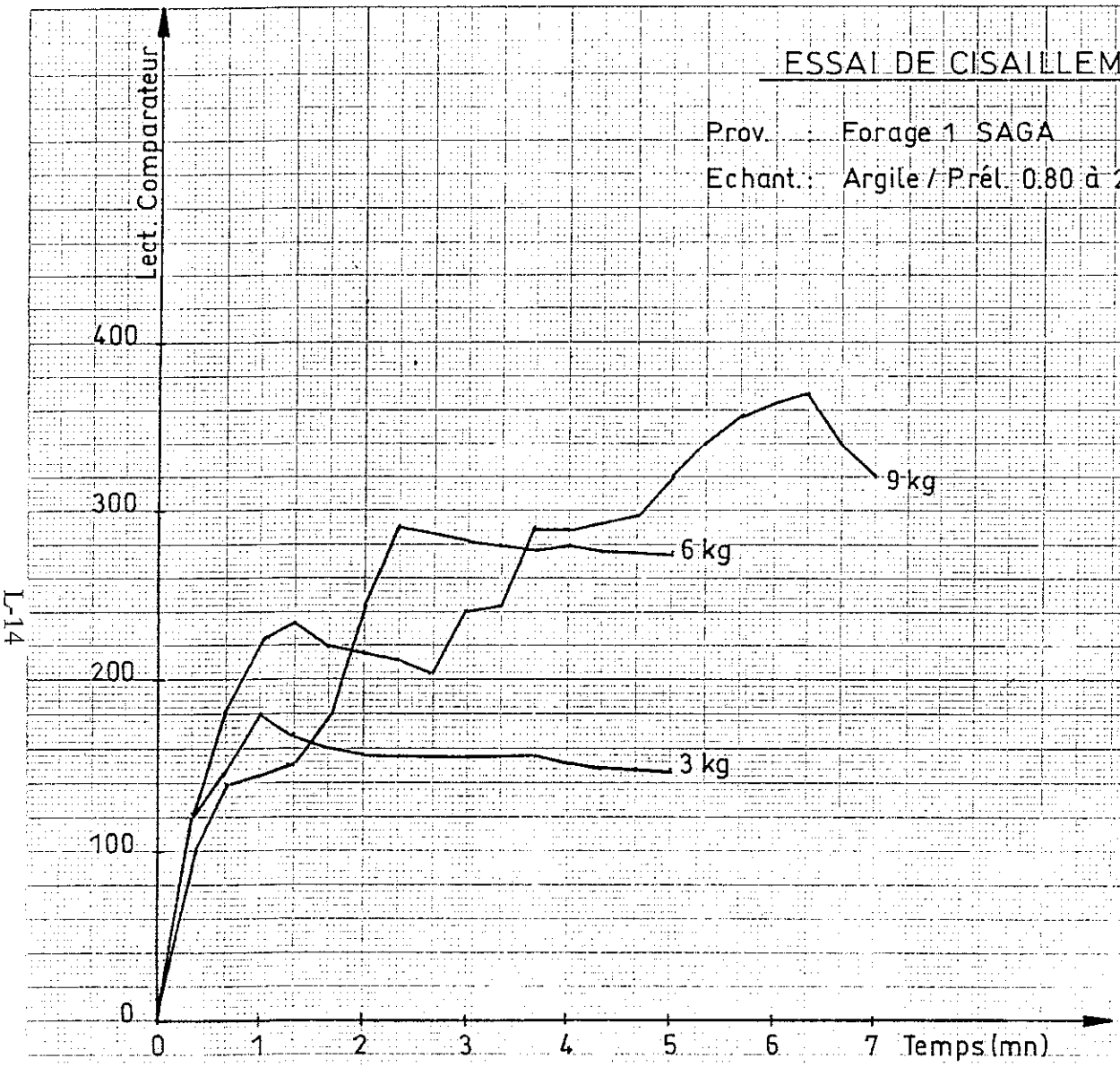
N°	L.L.	I.P.	< 0,08	HRB	F.P.	I.G.	ds max.	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
	41.3	21.1	58 %	A7-6 (10)								

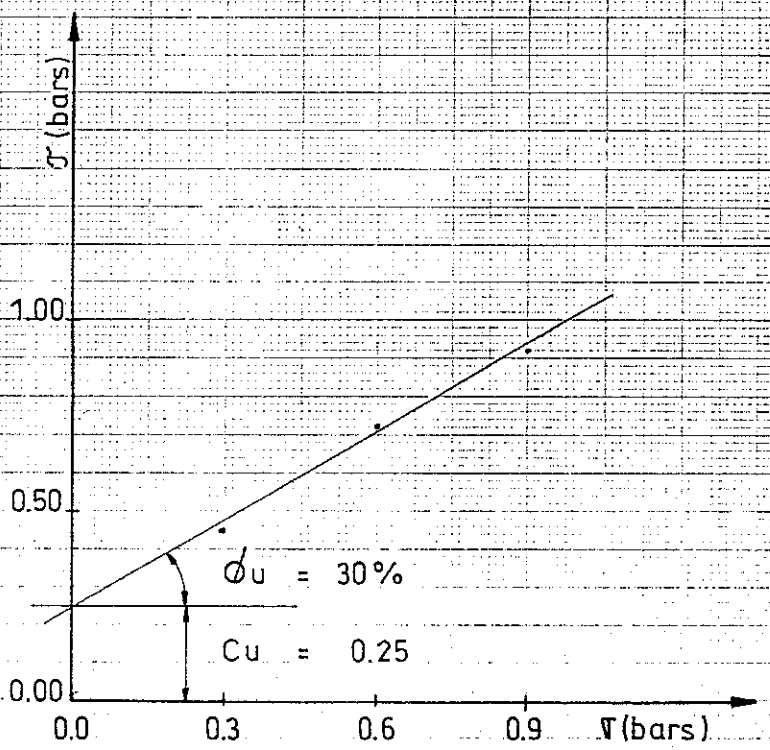
L-13

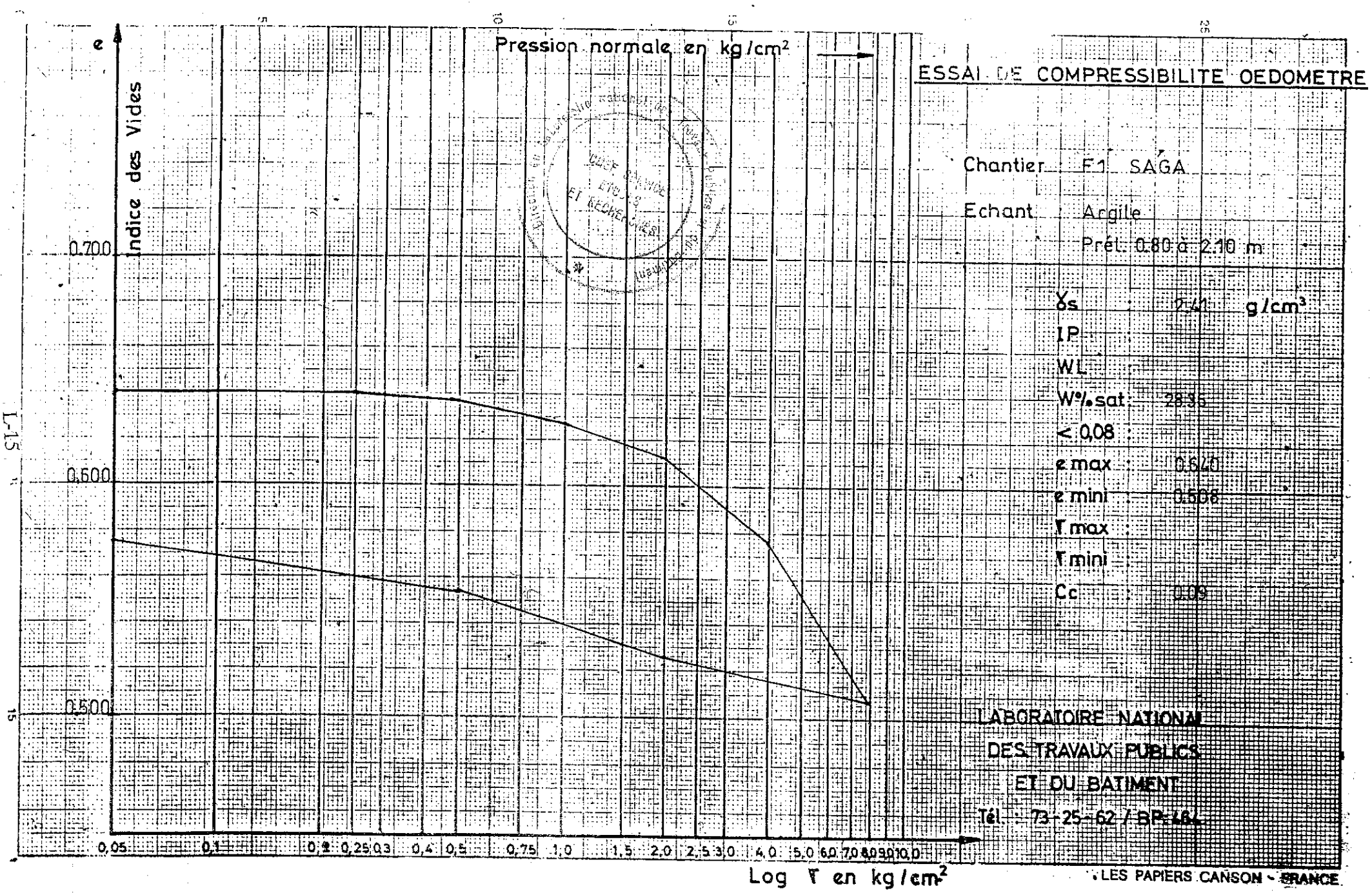
ESSAI DE CISAILLEMENT

Prov. : Forage 1 SAGA

Echant. : Argile / Prél. 0.80 à 2.10 m






ESSAI DE COMPRESSIBILITE OEDOMETRE
Pression normale en kg/cm²
e
Indice des Vides
0.700
0.600
0.500
Chantier F1 SAGA
Echant Argile
Prél. 0.80 à 2.10 m
γs : 2.41 g/cm³
IP
WL
W%.sat : 28.35
< 0,08 :
e max : 0.640
e mini : 0.508
γ max :
γ mini :
Cc : 0.09
LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
Tél. : 73-25-62 / BP 461
0,05 0,1 0,2 0,25 0,3 0,4 0,5 0,75 1,0 1,5 2,0 2,5 3,0 4,0 5,0 6,0 7,0 8,0 9,0 10,0
Log γ en kg/cm²
LES PAPIERS CANSON - FRANCE

L-15

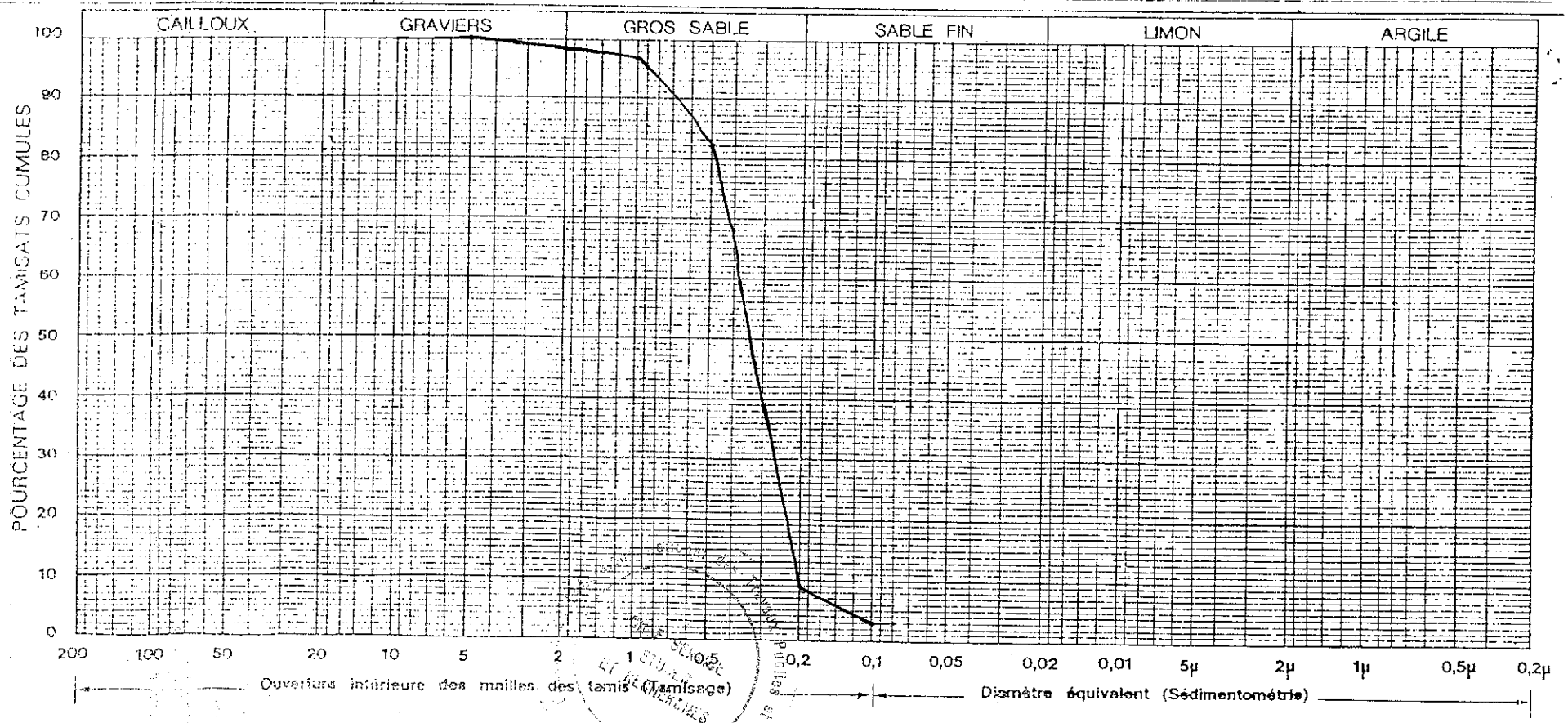
DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

Opérateur :

Désignation des échantillons N°
N°

Provenance : ASSAINISS. VILLE NY.
Echantillon : Sable graveleux
F1 / Prél. 4.00 à 5.60m



N°	L.L.	I.P.	< 0,08	HRB	ES	I.G.	γ_s	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
			3%	A3 (0)	48 %		2.58					

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov. : ASSAINISSEMENT VILLE NY.

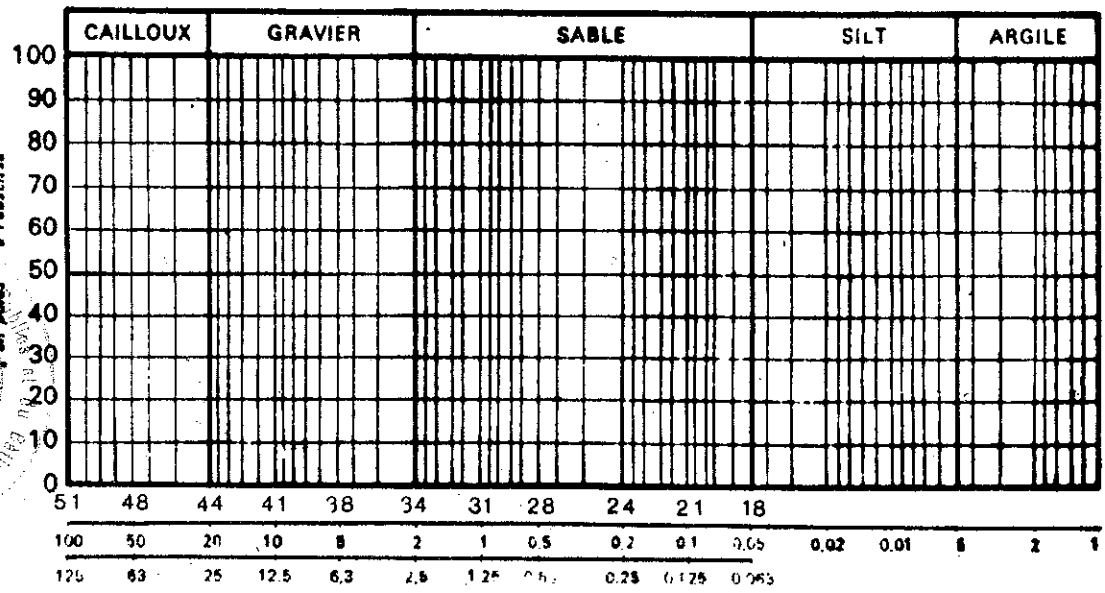
N° ECH.	PROF.	PROFIL	NATURE
F1	6.0 à 10.0 m		Argile graveleuse

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	IP	Poids spécifique	m - IP	Classification U S H R B
	39.4	19.7	19.7			

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMÉTRIE



CHEF SERVICE ETUDES ET RECHERCHES

ESSAI PROCTOR

Densité sèche max. 2.05 T / m³

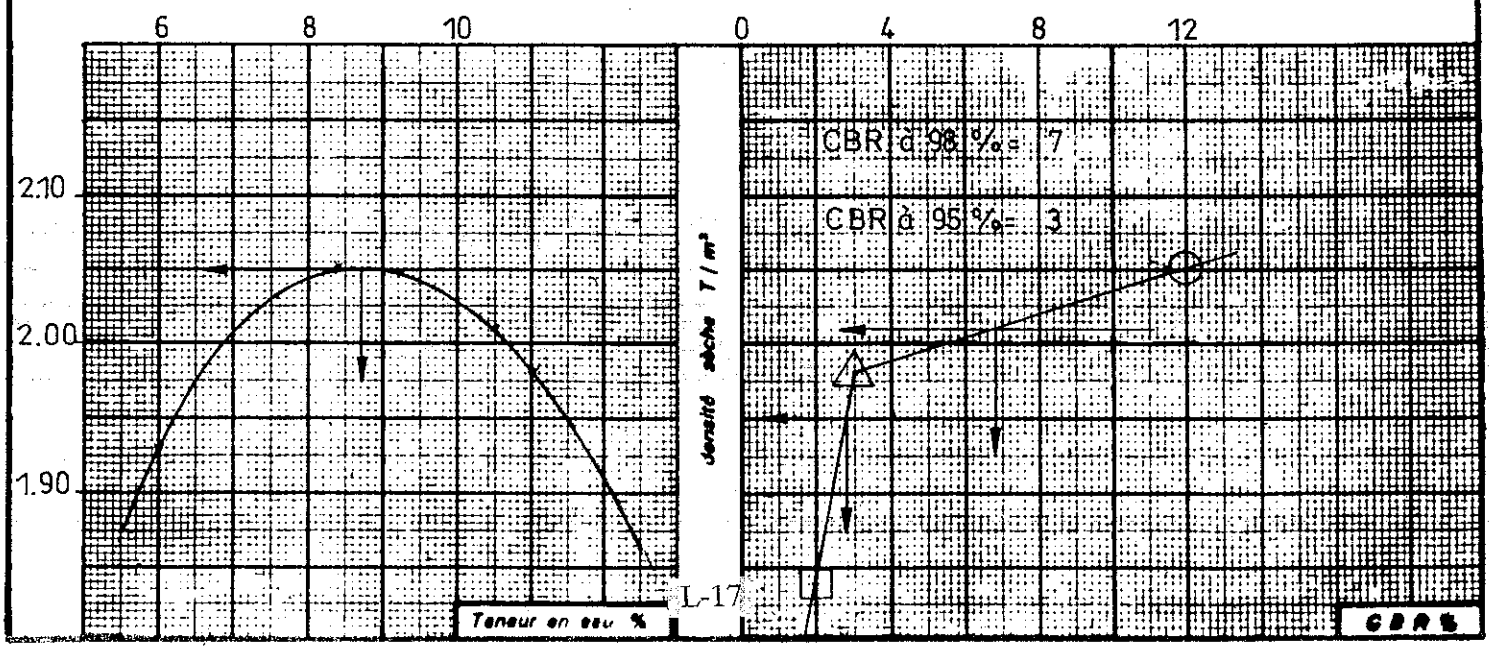
Teneur en eau opt. 8.7 %

ESSAI CBR

W % optimale

Sèches

N coups	γd T / m³	W % gonflage	% après imbib	gonflement %
⊙ 55	2.05	9.0		
△ 25	1.98	9.0		
□ 10	1.84	9.0		



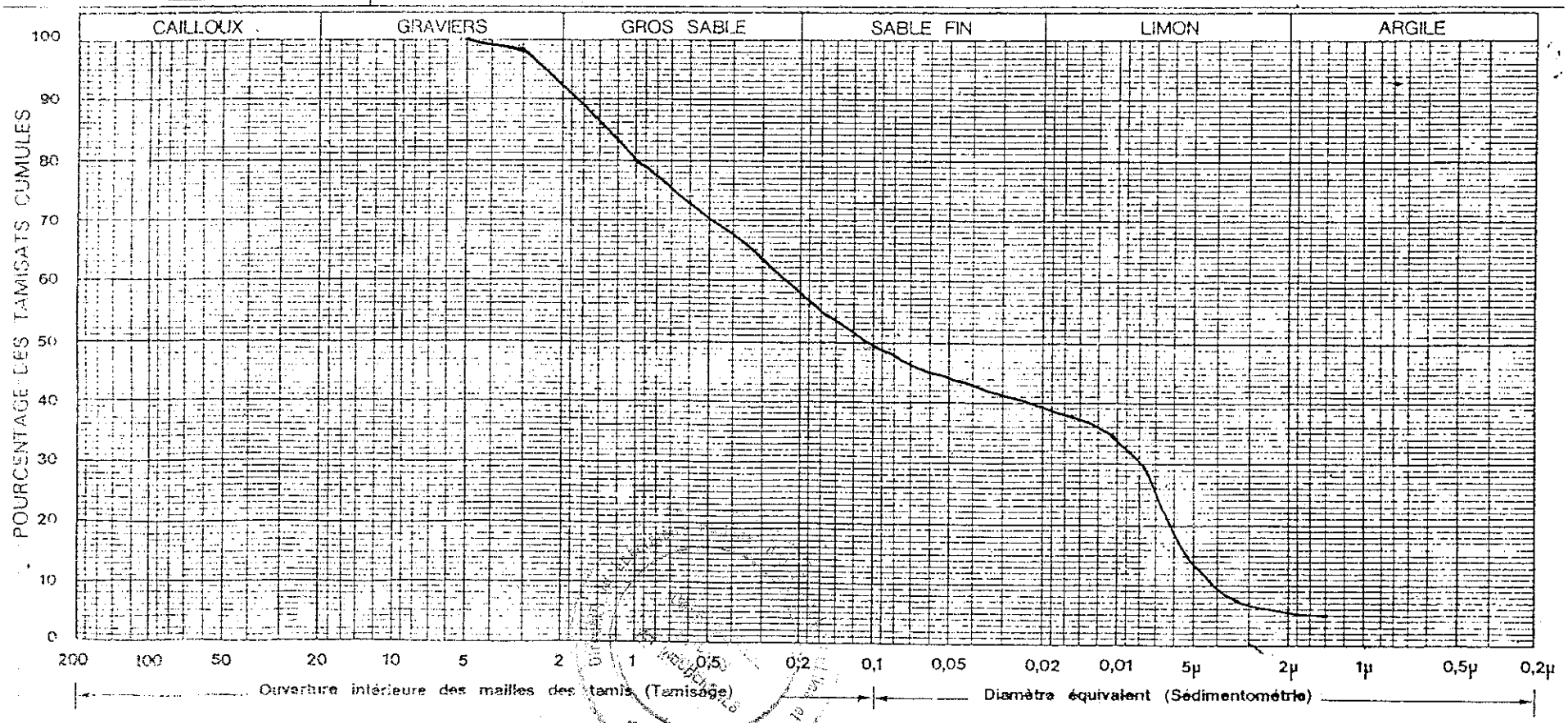
DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

Opérateur : .....

Désignation des échantillons ..... N° .....
..... N° .....

Provenance : ASSAINISS. VILLE NY
Echantillon : Argile graveleuse
F1 / Prél. 6.00 à 10.00 m

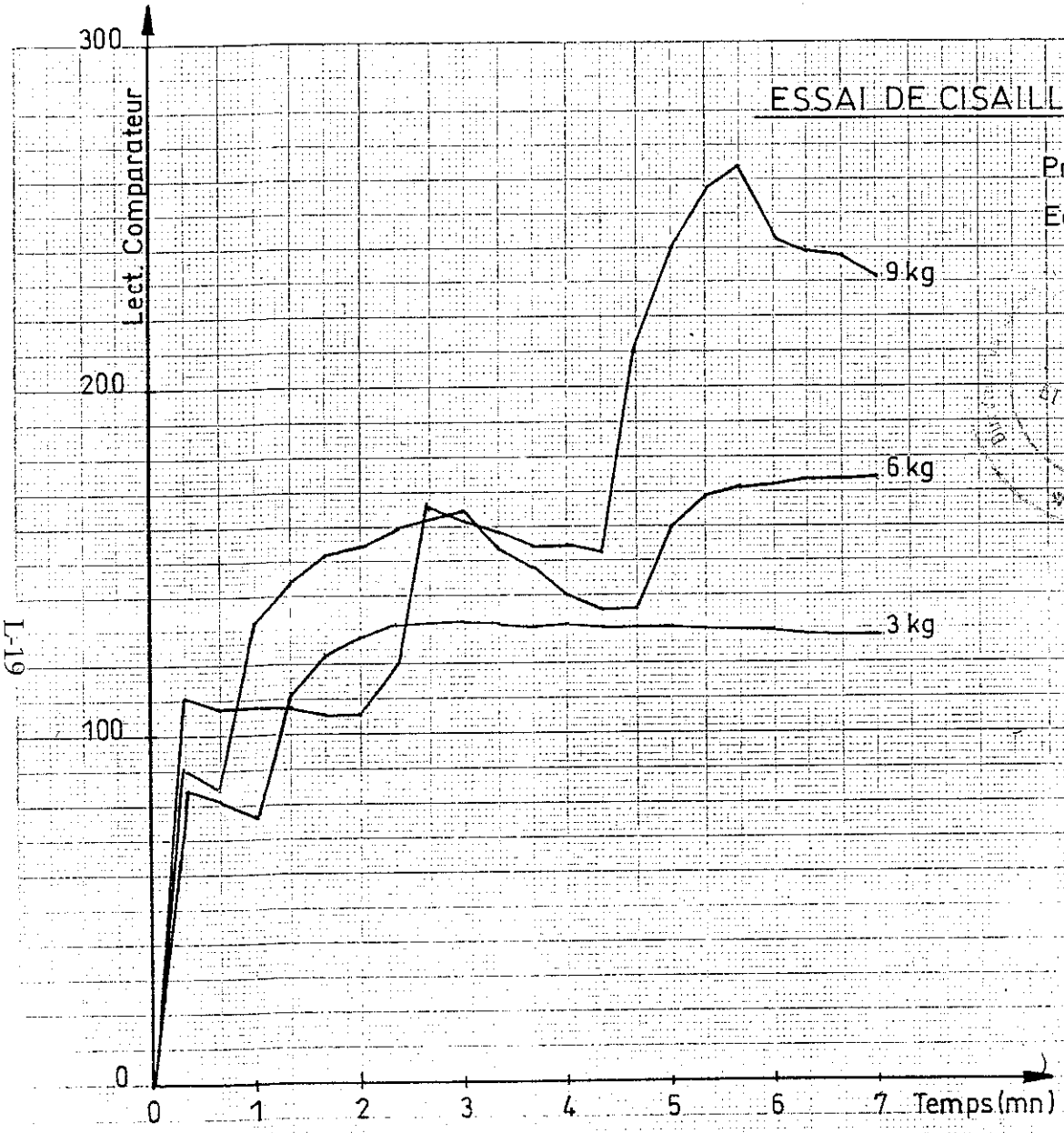


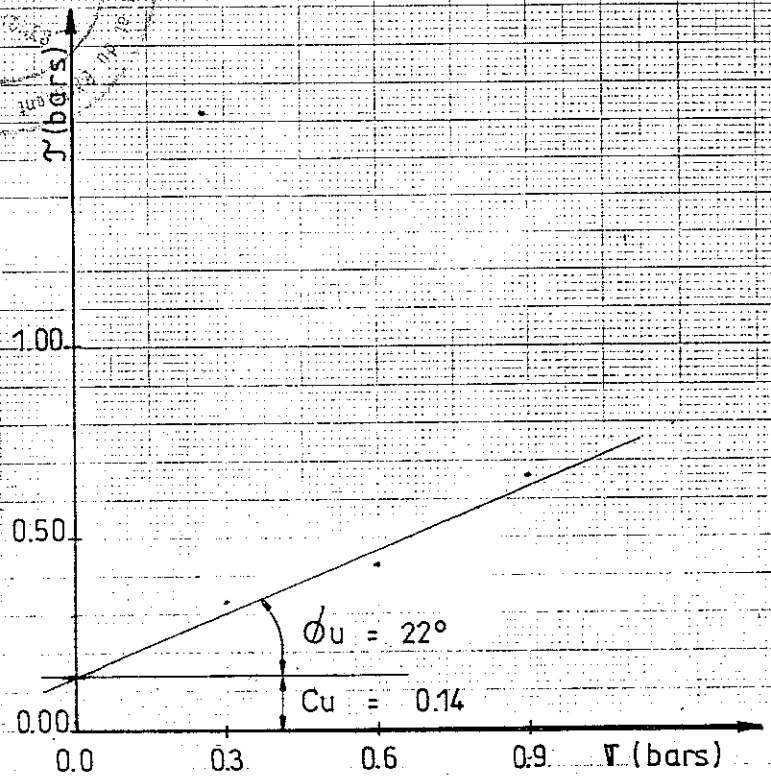
N°	L.L.	I.P.	< 0,08	HRB	F.P.	I.G.	ds max.	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
	39.4	19.7	49%	A-6 (6)								

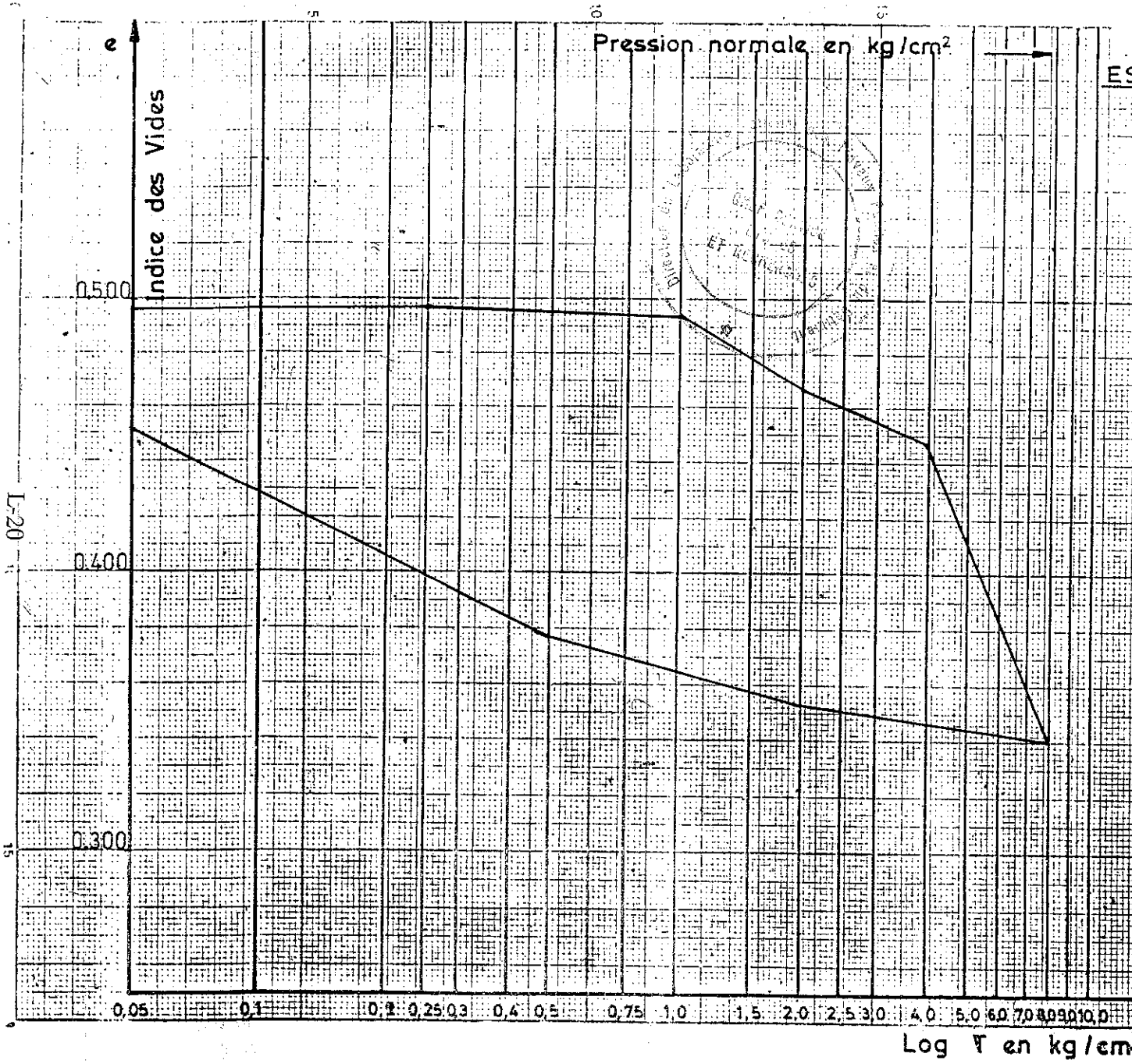
ESSAI DE CISAILLEMENT

Prov. : Forage 1 SAGA

Echant. : Argile graveleuse / Prél. 6.00 à 10.00 m







ESSAI DE COMPRESSIBILITE OEDOMETRE

Chantier : F1 SAGA

Echant : Argile graveleuse

Prél. 6.00 à 10.20 m

γs	:	2.47 g/cm³
IP	:	
WL	:	
W% sat	:	39.00
< 0,08	:	
e max	:	0.497
e mini	:	0.360
σ max	:	
σ mini	:	
Cc	:	0.25

LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
Tél. 73-25-62 / BP 461

LES PAPIERS CANSON - FRANCE

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov. : ASSAINISSEMENT VILLE NY.

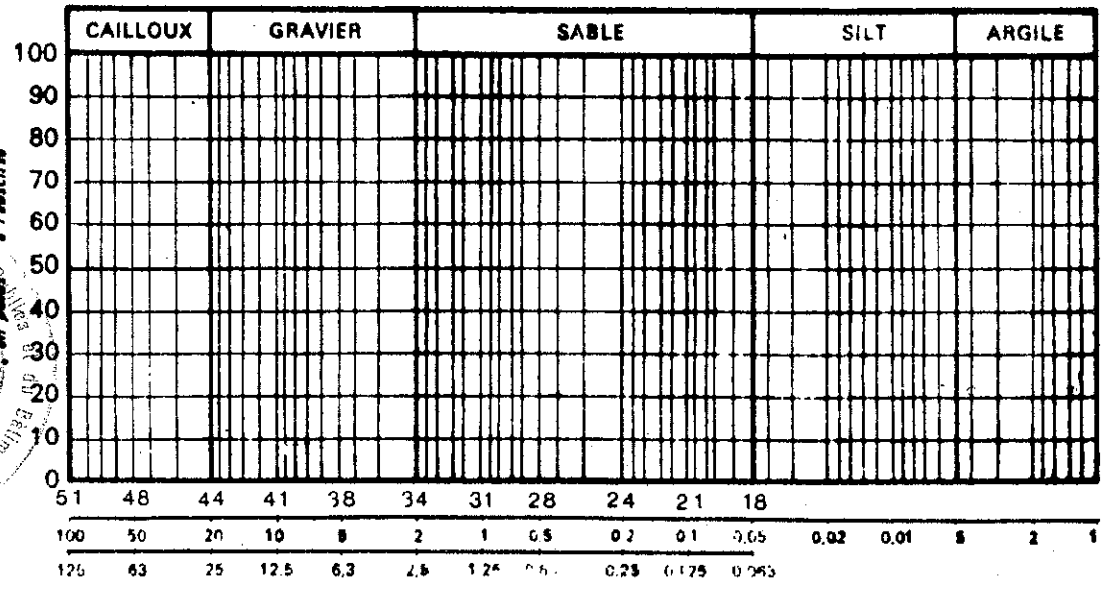
N° ECH.	PROF.	PROFIL	NATURE
F1	10.0 à 19.0 m		Argile sableuse

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	IP	Poids spécifique	m - IP	Classification U S	H R B
	35.2	17.3	17.9				

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMÉTRIE



CHEF SERVICE ESSAIS ET RECHERCHES

ESSAI PROCTOR

Densité sèche max. 1.95 T / m³

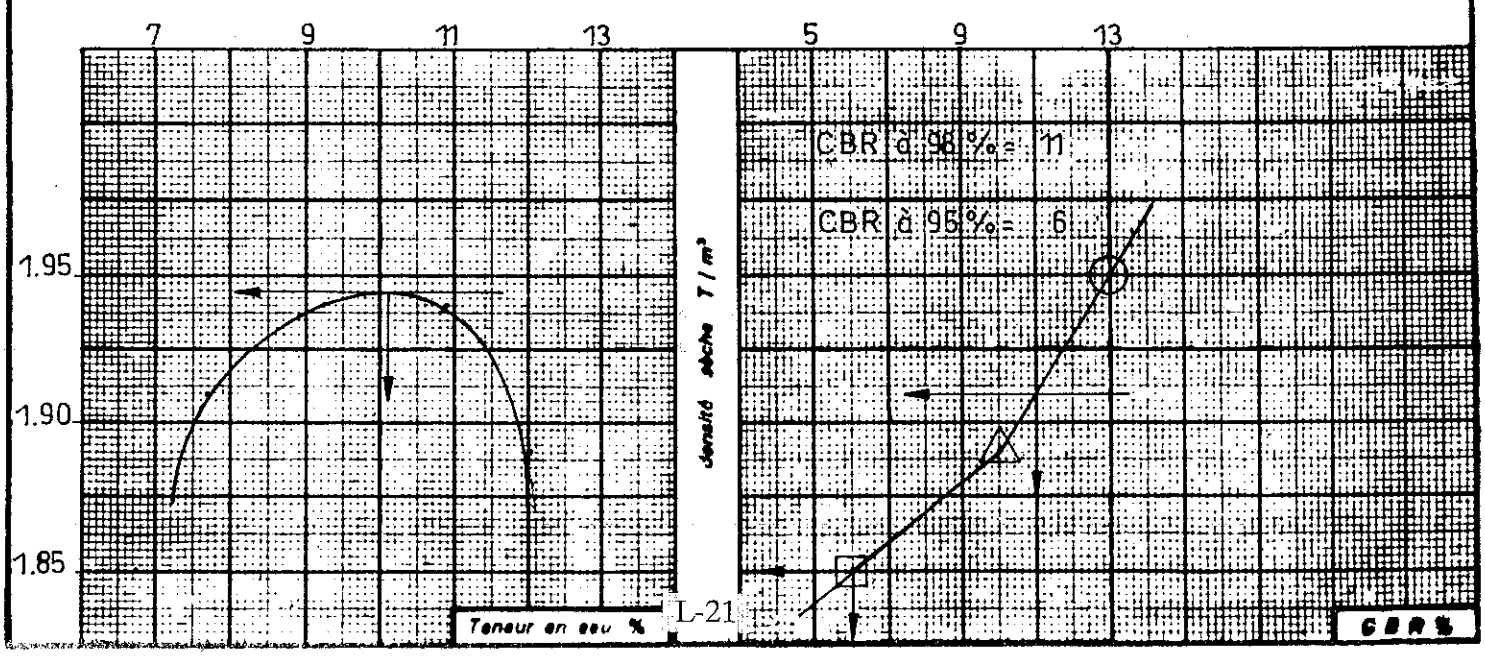
Teneur en eau opt. 10.1 %

ESSAI CBR

W % optimale

S % [illegible]

N coups	γd T / m³	W % [illegible]	% après imbib	gonflement %
⊙ 56	1.95	10.5		
△ 25	1.89	10.5		
□ 10	1.85	10.5		



DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

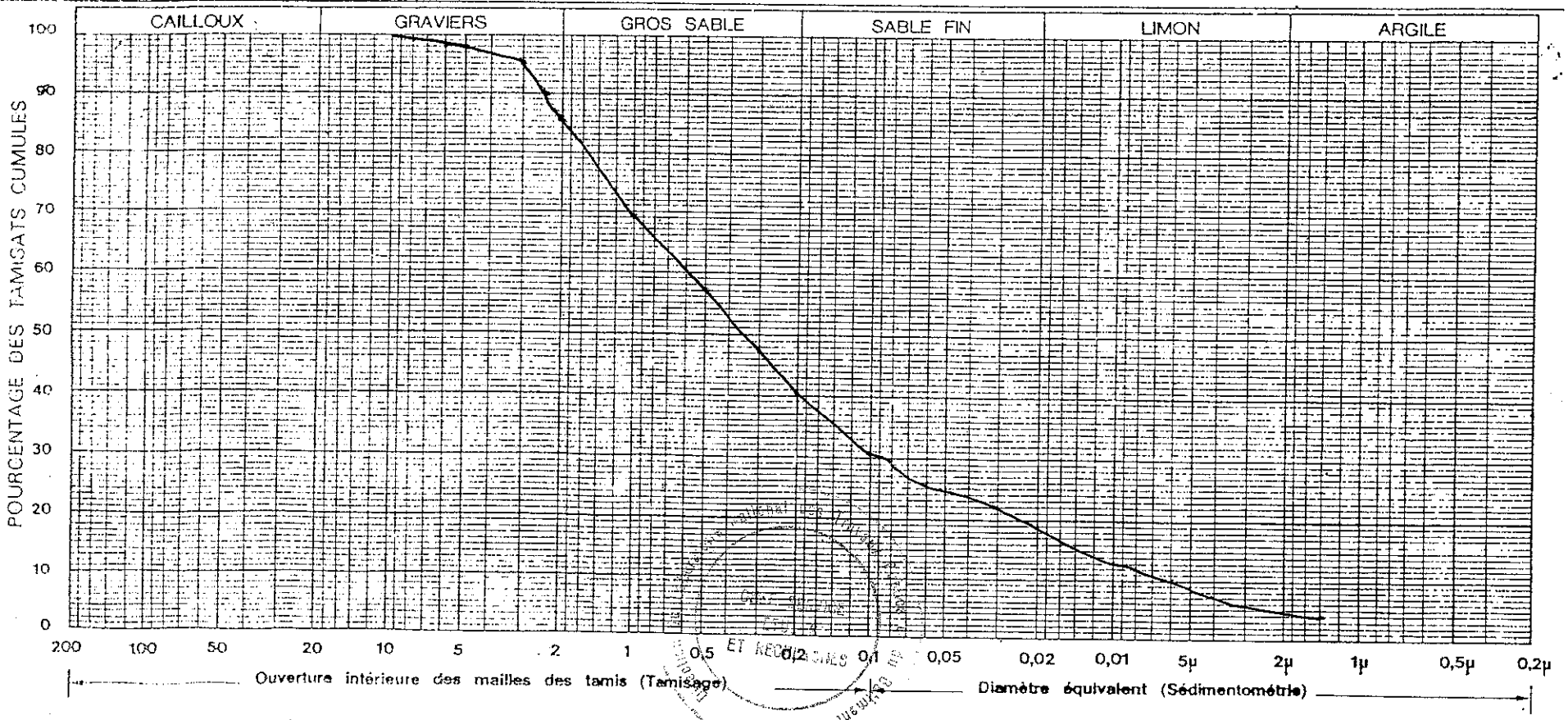
Opérateur: _____

Provenance: ASSAINISS. VILLE NY.

Echantillon : Argile sableuse

Désignation des échantillons N° _____ N° _____

F 1'/ Prél. 10.20 à 19.00 m



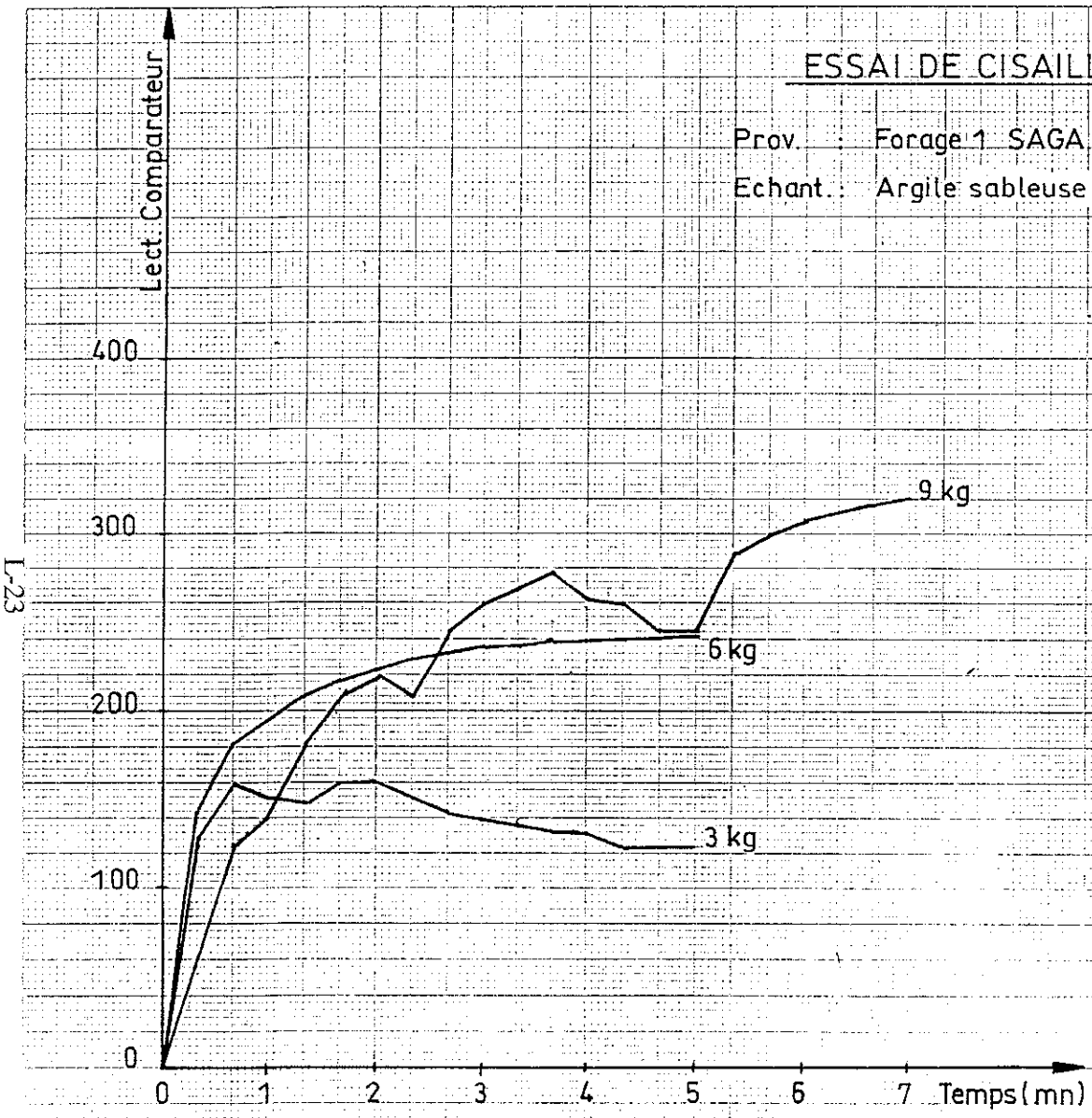
N°	L.L.	I.P.	< 0,08	HRB	F.P.	I.G.	ds max.	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
	35.2	17.9	29%	A2-6 (1)								

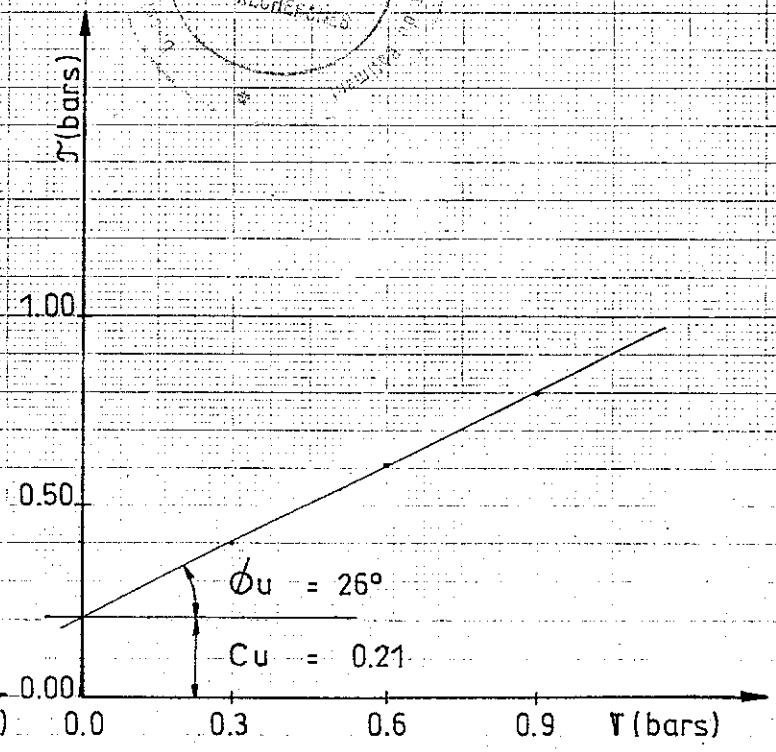
L-22

ESSAI DE CISAILLEMENT

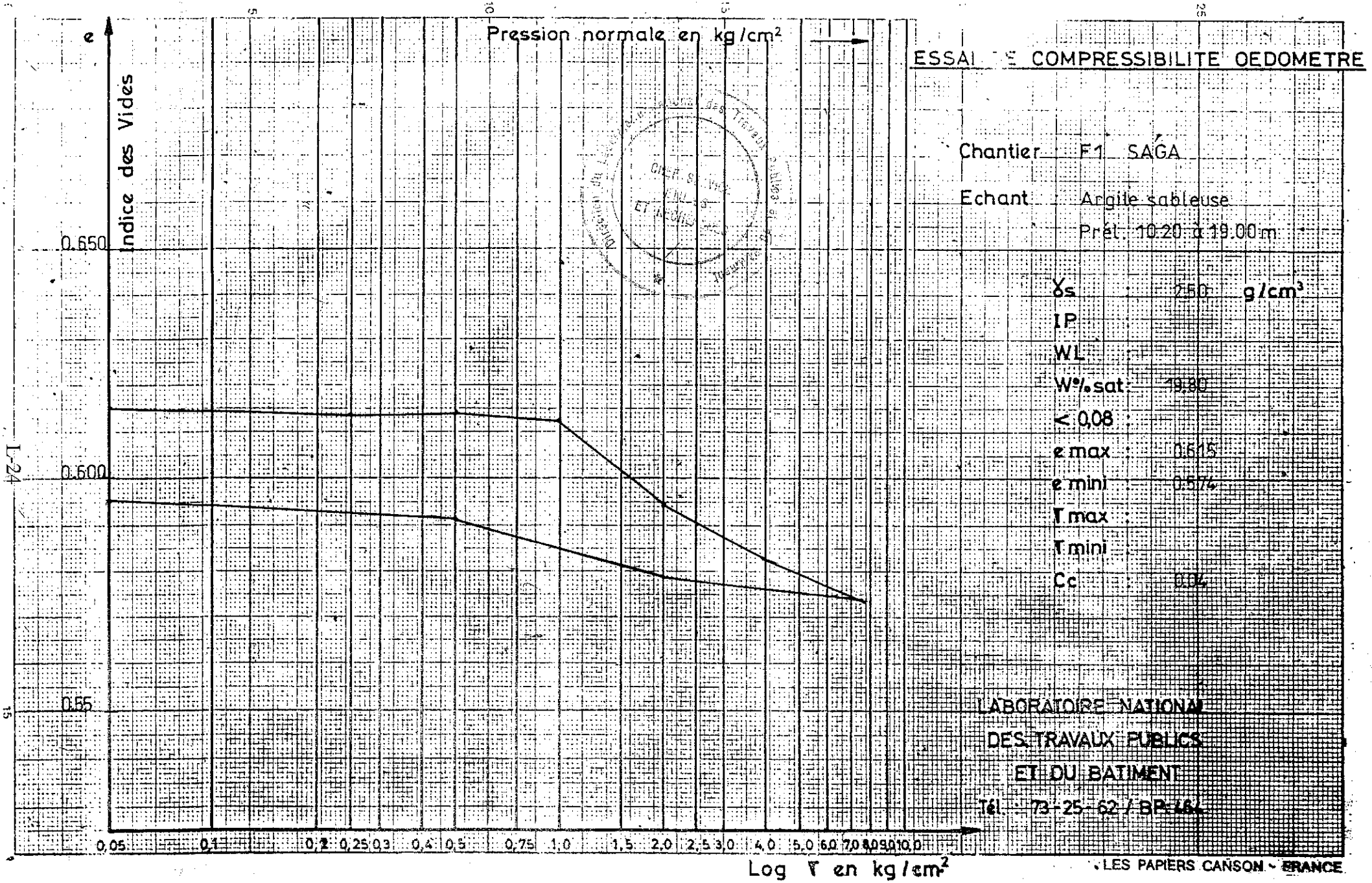
Prov. : Forage 1 SAGA

Echant. : Argile sableuse / Prél. 10.00 à 19.00 m





CHEF SERVICE ETUDES ET RECHERCHES


e
Indice des Vides
Pression normale en kg/cm²
0.650
0.600
0.55
0,05
0,1
0,2
0,25
0,3
0,4
0,5
0,75
1,0
1,5
2,0
2,5
3,0
4,0
5,0
6,0
7,0
8,0
9,0
10,0
Log σ en kg/cm²
ESSAI DE COMPRESSIBILITE OEDOMETRE
Chantier F1 SAGA
Echant : Argile sableuse
Prél. 10.20 à 19.00 m
γs : 2.50 g/cm³
IP
WL
W%sat : 19.80
< 0,08
e max : 0.615
e mini : 0.574
γ max
γ mini
Cc : 0.04
LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
Tél. 73-25-62 / BP 464
LES PAPIERS CANSON - FRANCE

L-24

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov. : ASSAINISSEMENT VILLE NY.

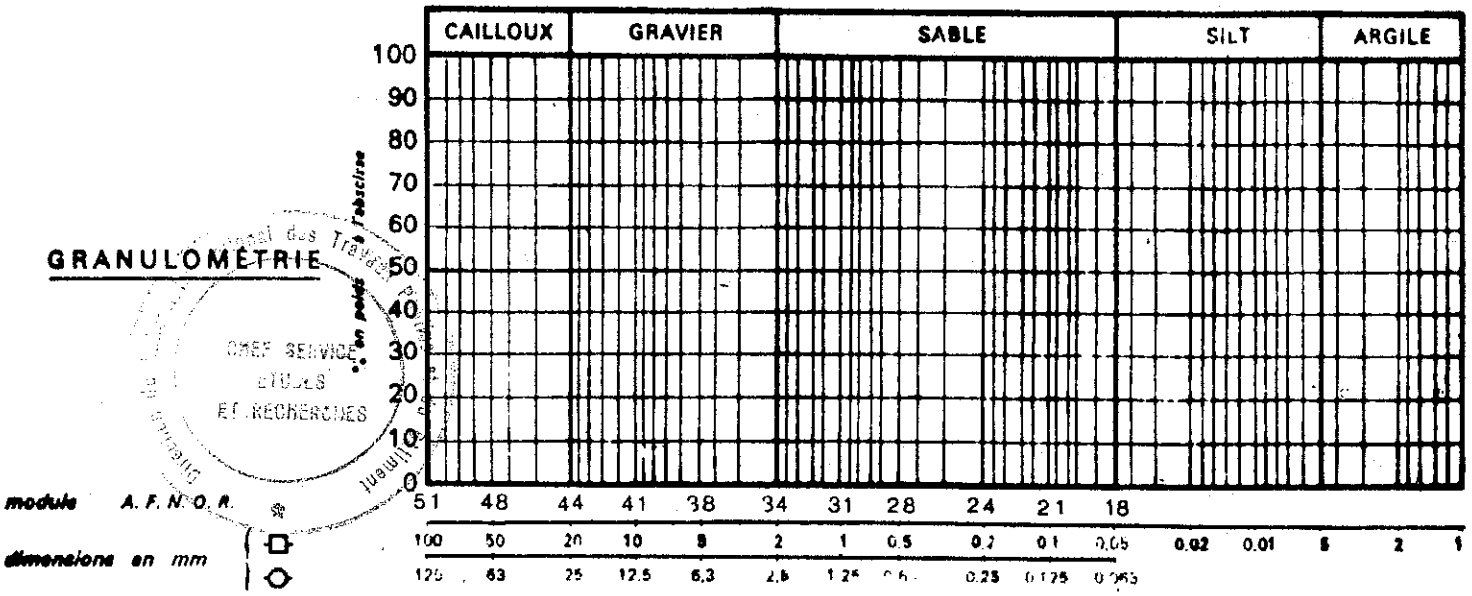
N° ECH.	PROF.	PROFIL	NATURE
F1	21.0 à 26.0 m		Argile

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	IP	Poids spécifique	m - IP	Classification U S	H R B
	36.5	18.5	18.0				

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMETRIE

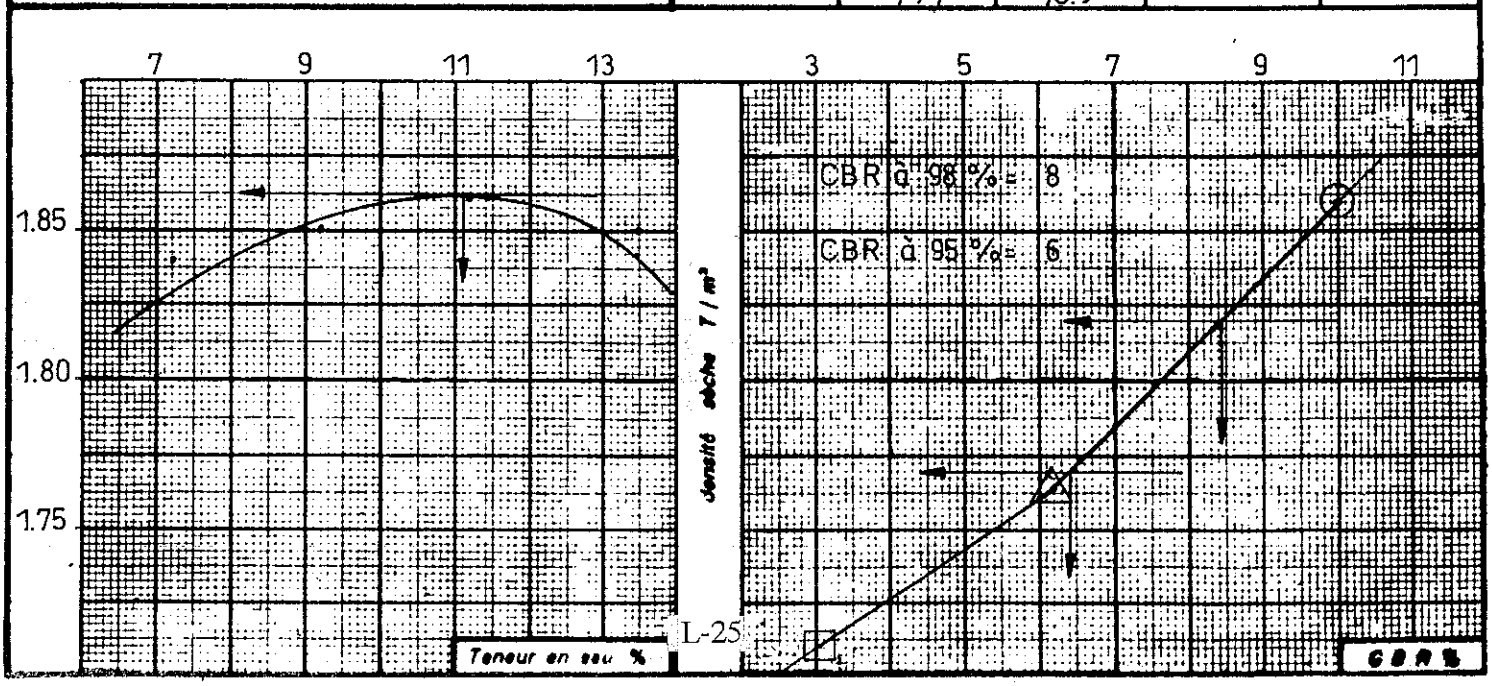


Laboratoire National des Travaux Publics
CHEF SERVICE ETUDES ET RECHERCHES

ESSAI PROCTOR	
Densité sèche max.	1.86 T / m³
Teneur en eau opt.	11.1 %

ESSAI CBR — W % optimale — 95 % OPM

N coups	γ d T / m³	W % moulage	W % après imbib	gonflement %
⊙ 55	1.86	10.9		
△ 25	1.76	10.9		
□ 10	1.71	10.9		



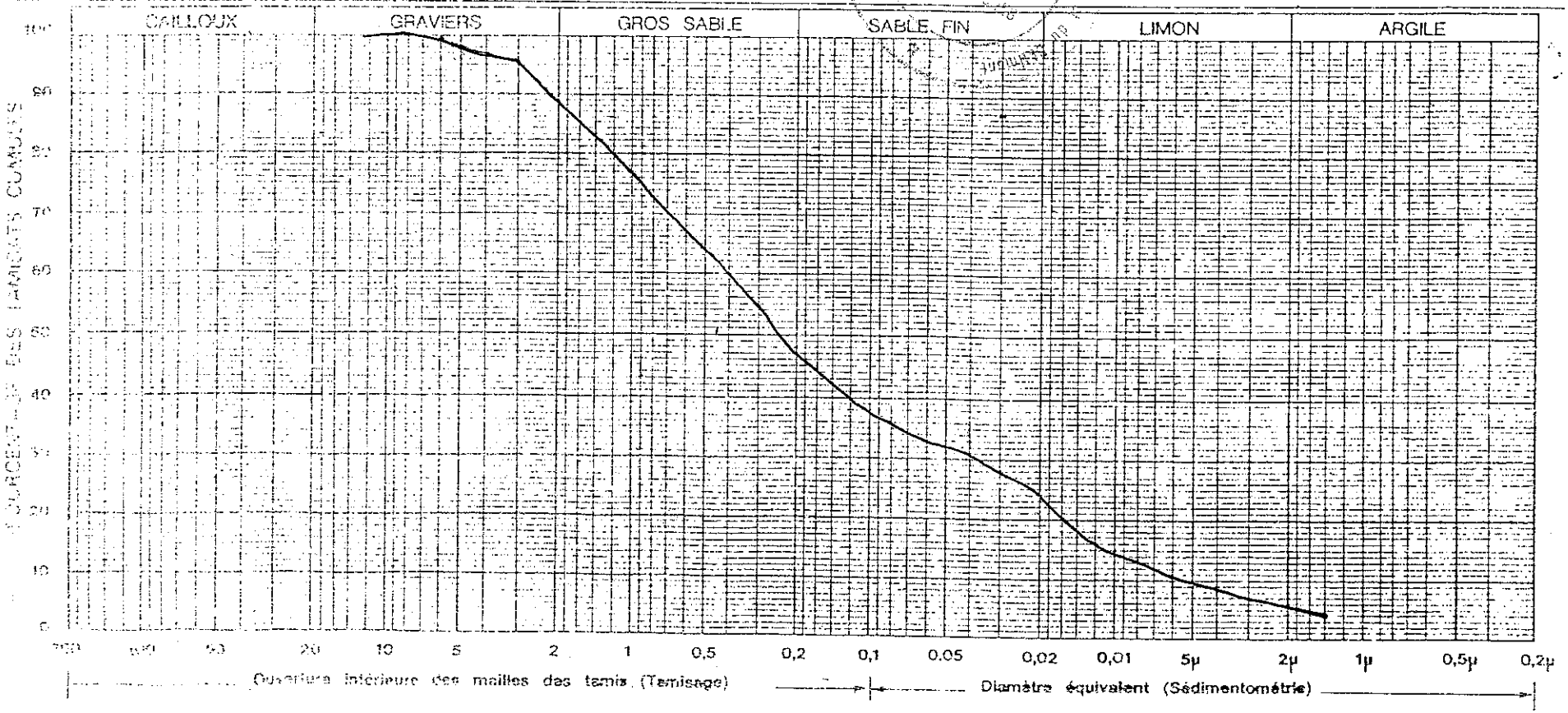
DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B.P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

Opérateur : .....

Désignation des échantillons ..... N° .....
..... N° .....

Provenance : ASSAINISS. VILLE NY.
Echantillon : Argile
F1 / Prél. 21.00 à 26.00 m

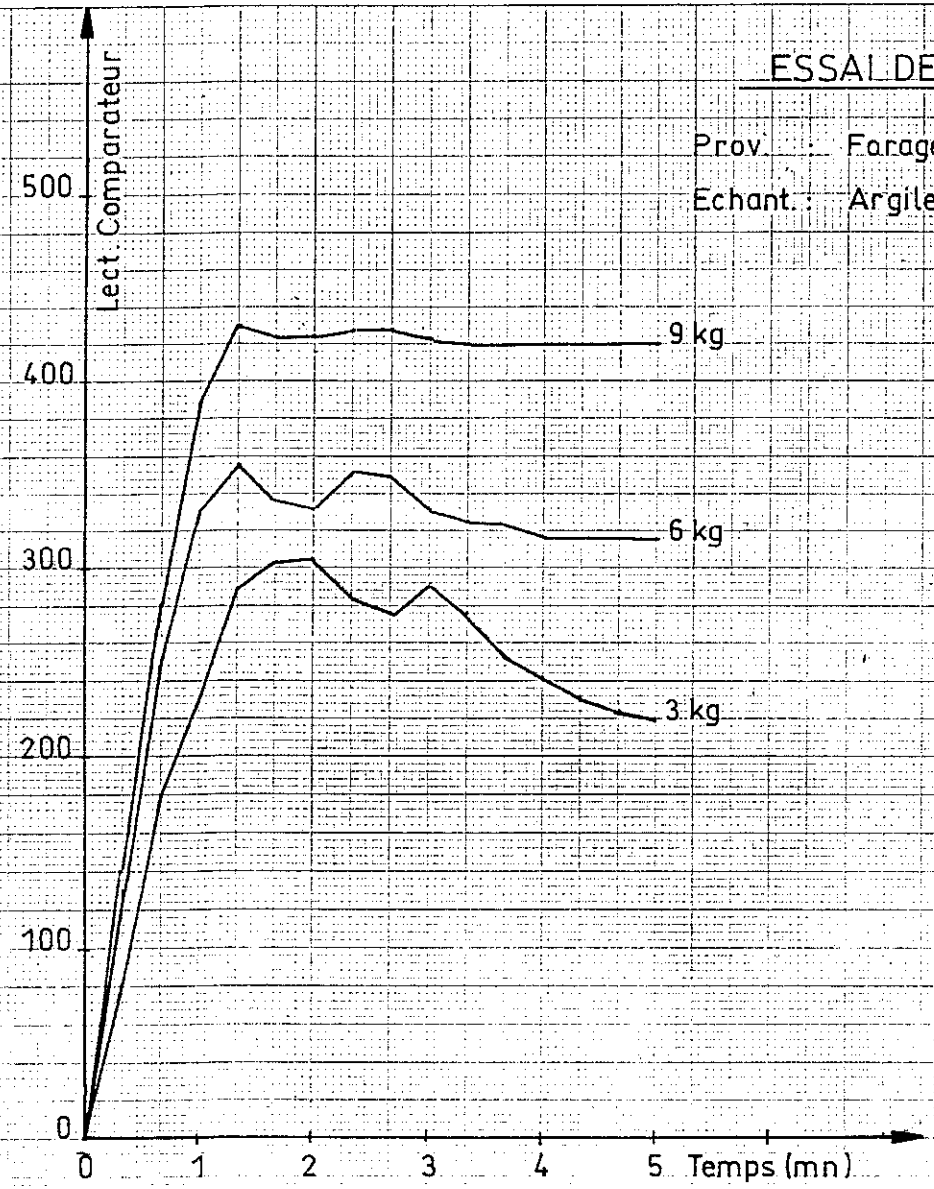


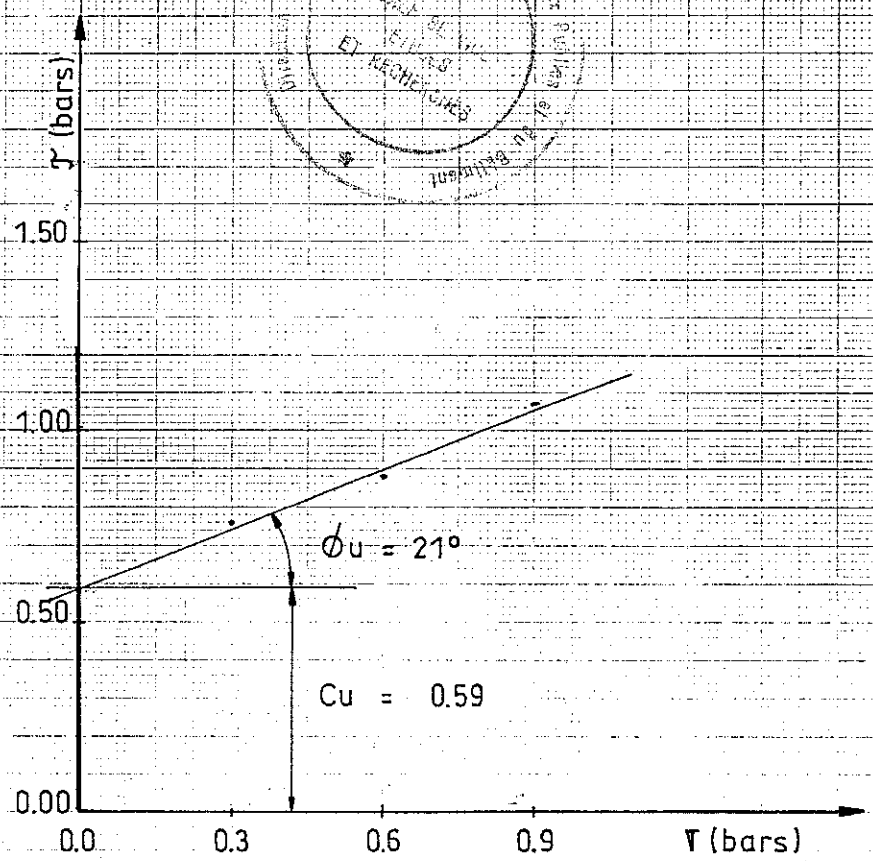
N°	L.L	I.P.	< 0,08	HRB	F.P.	I.G.	γs	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
	36.5	18.0	36 %	A6-2			2.54					

ESSAI DE CISAILLEMENT

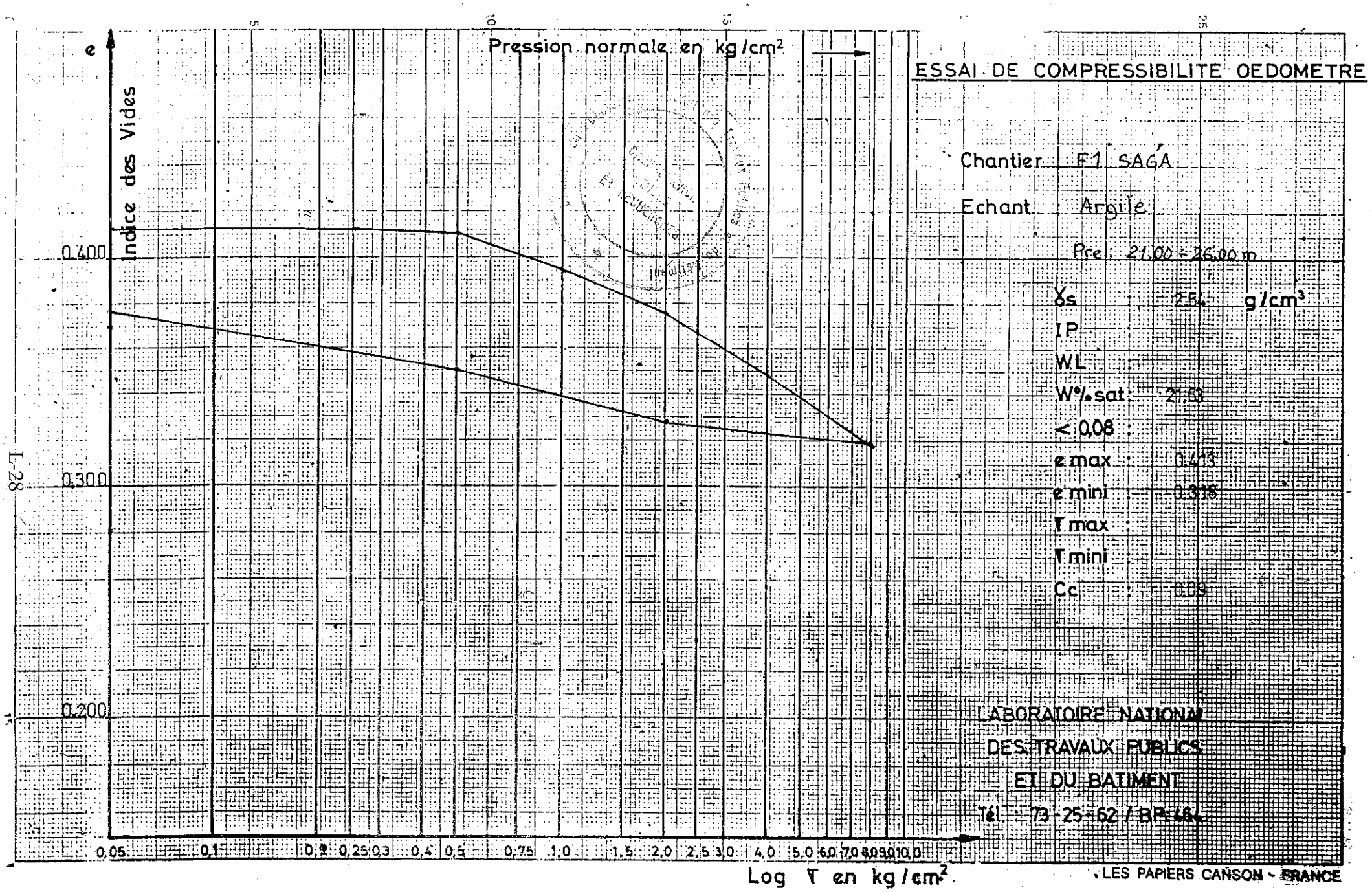
Prov. : Forage 1 SAGA

Echant. : Argile / Prél. 21.00 à 26.00 m





Laboratoire Central des Ponts et Chaussées et du Bâtiment ET RECHERCHES


ESSAI DE COMPRESSIBILITE OEDOMETRE
Pression normale en kg/cm²
e
Indice des Vides
0.400
0.300
0.200
Chantier : F1 SAGA
Echant : Argile
Prel : 21.00 - 26.00 m
γs : 2.54 g/cm³
IP :
WL :
W% sat : 21.60
< 0,08 :
e max : 0.413
e mini : 0.316
γ max :
γ mini :
Cc : 0.09
LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
Tél. : 73-25-62 / BP 48
0,05 0,1 0,2 0,25 0,3 0,4 0,5 0,75 1,0 1,5 2,0 2,5 3,0 4,0 5,0 6,0 7,0 8,0 9,0 10,0
Log γ en kg/cm²
LES PAPIERS CANSON - FRANCE

L-28

REPUBLIQUE DU NIGER
MINISTERE DE L'EQUIPEMENT ET DES TRANSPORTS
DIRECTION DU LABORATOIRE NATIONAL DES TRAVAUX PUBLICS ET DU BATIMENT
B.P 464 Tel:73 - 25 - 62 Niamey

ESSAIS DE PERMEABILITE

PROVENANCE: Assainissement de la ville de niamey — DATE :

FORAGE: F 1 SAGA — DEMANDEUR SENAGHRY

PROFONDEUR: 21,00 - 26,00 m — OPERATEUR: LABARAN

NATURE DU SOL : ARGILE

TEMPERATURE DE L'ESSAI: θ = 28 °C

SECTION DU TUBE DE MESURE: a = 3,14 mm2

SECTION DE L'ECHANTILLON: A = 78,54 cm2

HAUTEUR DE L'ECHANTILLON: L = 18,8 mm

ESSAIS N°	1	2	3
H o	93	86	82
H 1	87	83	80
Temps : t (s)	374	243	189
Kθ (cm/s)	$4,7 * 10^{-6}$	$7,2 * 10^{-6}$	$9,3 * 10^{-6}$
Kθ moy. (cm/s)		$7,1 * 10^{-6}$	
K 20 (cm/s)		$3,5 * 10^{-7}$	

OBSERVATIONS:
W% = 11,2 γd = 1,86 Durée de saturation 96 heures

LE CHEF SERVICE LABORATOIRE

APPENDIX 2: FORAGE N°2/SAGA

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov. : ASSAINISSEMENT VILLE NY.

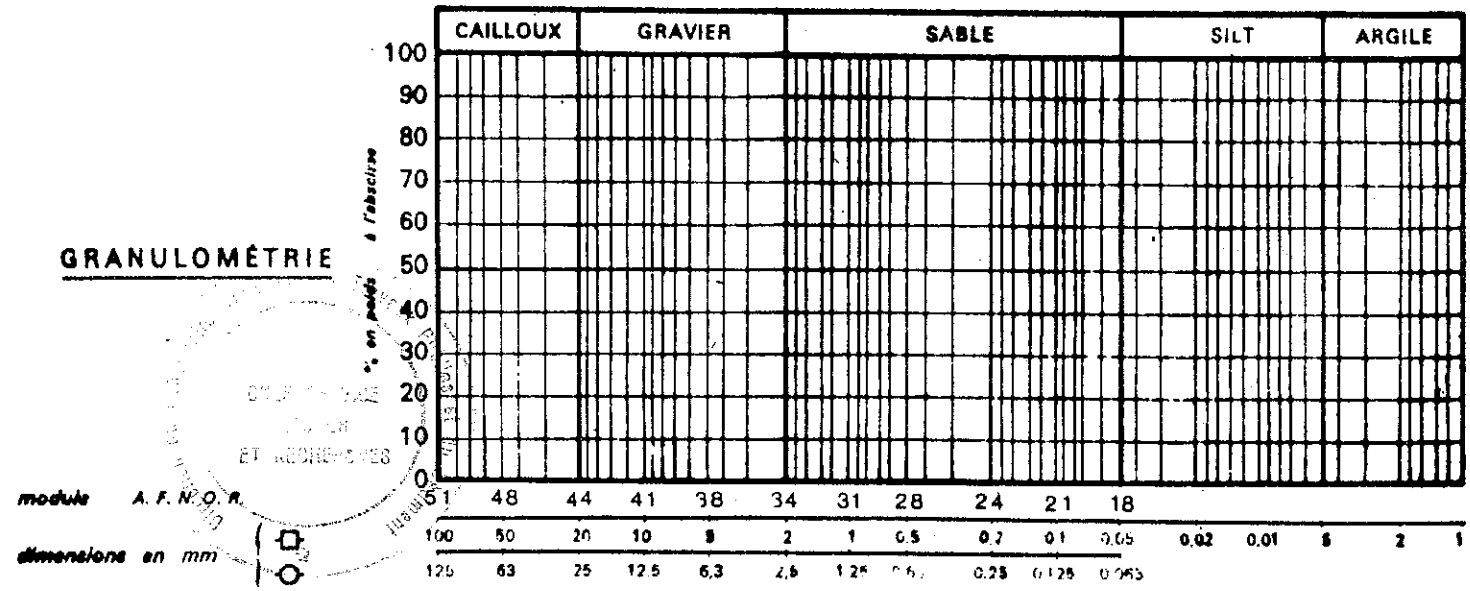
N° ECH.	PROF.	PROFIL	NATURE
F 2	1.50 à 5.90m		Sable

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	ES	Poids spécifique	m - IP	Classification U S	H R B
			45 %				

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMÉTRIE



ESSAI PROCTOR

Densité sèche max. 1.69 T / m³

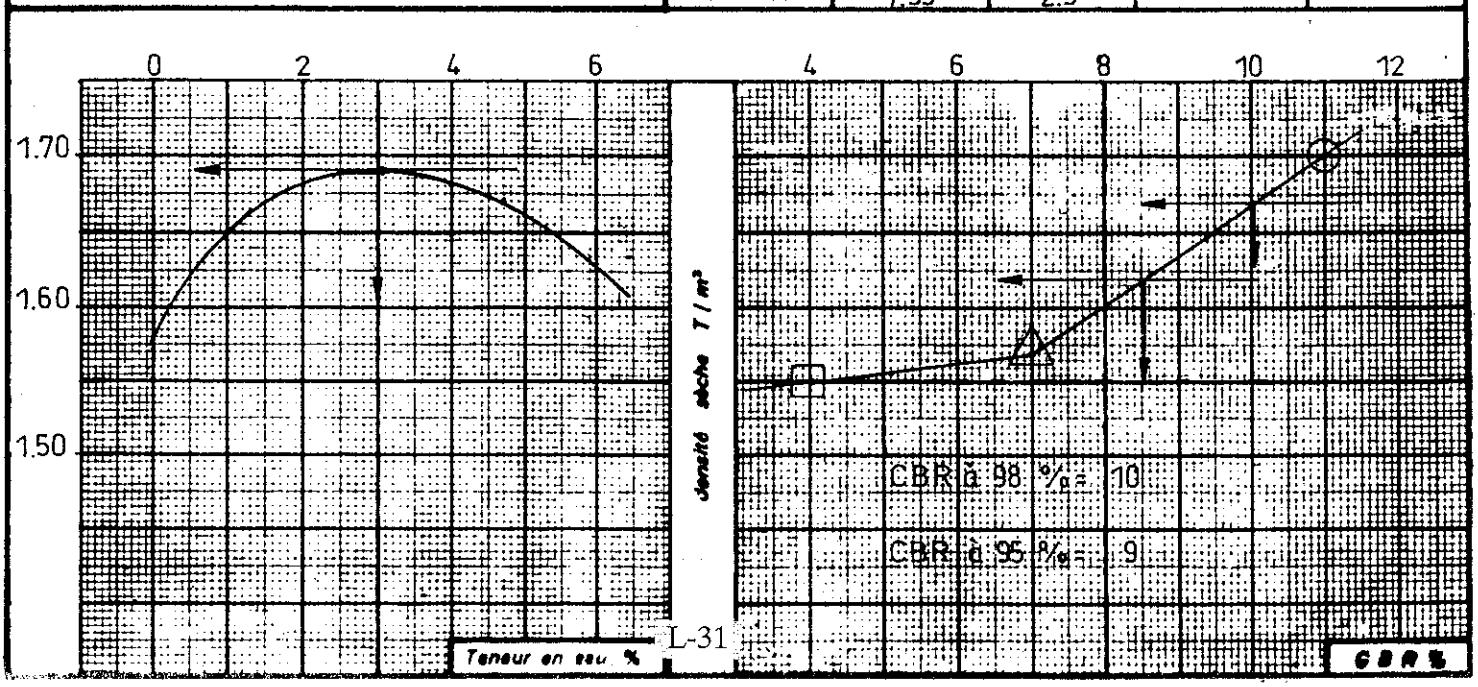
Teneur en eau opt. 3.0 %

ESSAI CBR

W % optimale

Sols fins

N coups	γd T, m³	W % moulage	% après imbib	gonflement %
○ 55	1.70	2.5		
△ 25	1.57	2.5		
□ 10	1.55	2.5		



DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

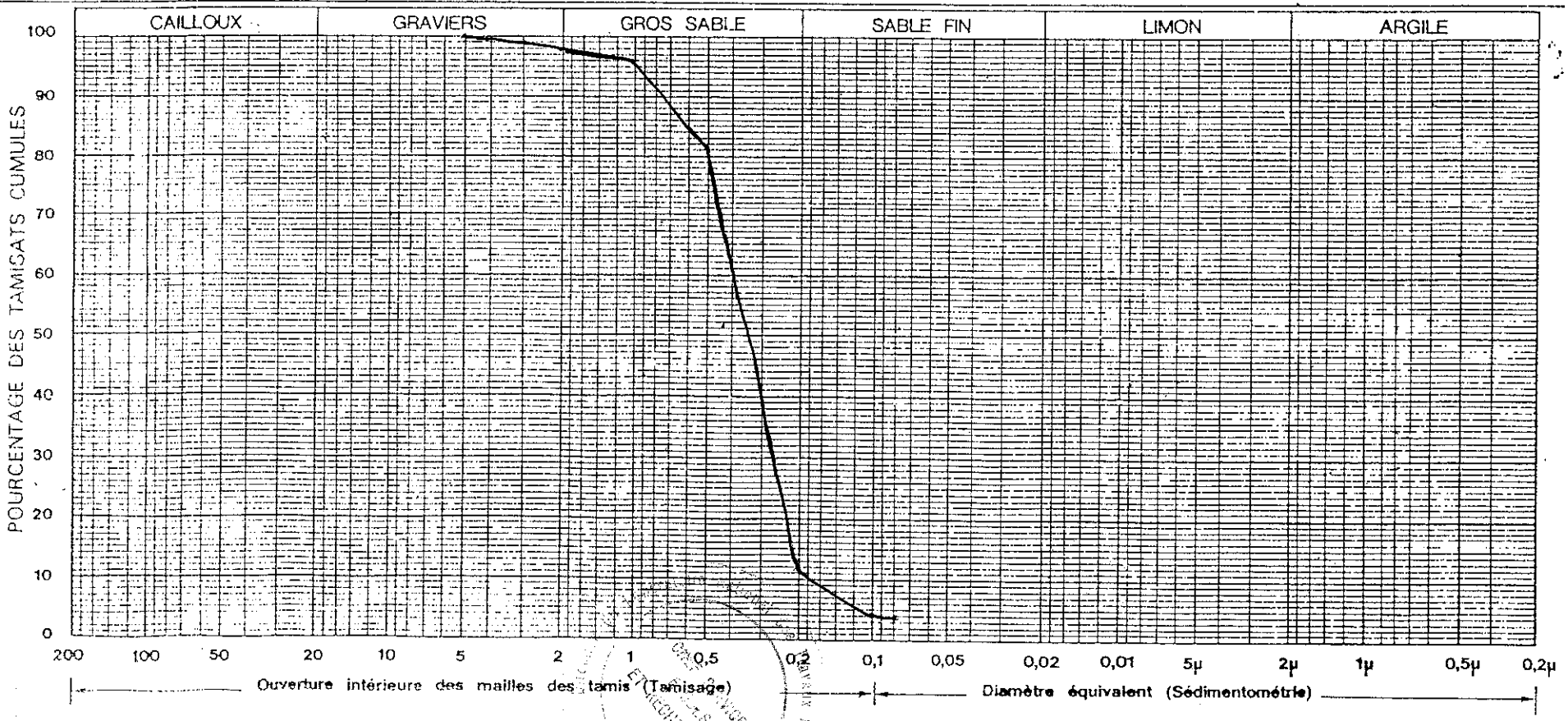
Opérateur: _____

Désignation des échantillons _____ N° _____

Provenance: ASSAINISS. VILLE NY.

Echantillon : Sable

N° F2 / Prél. 1.50 à 5.90 m



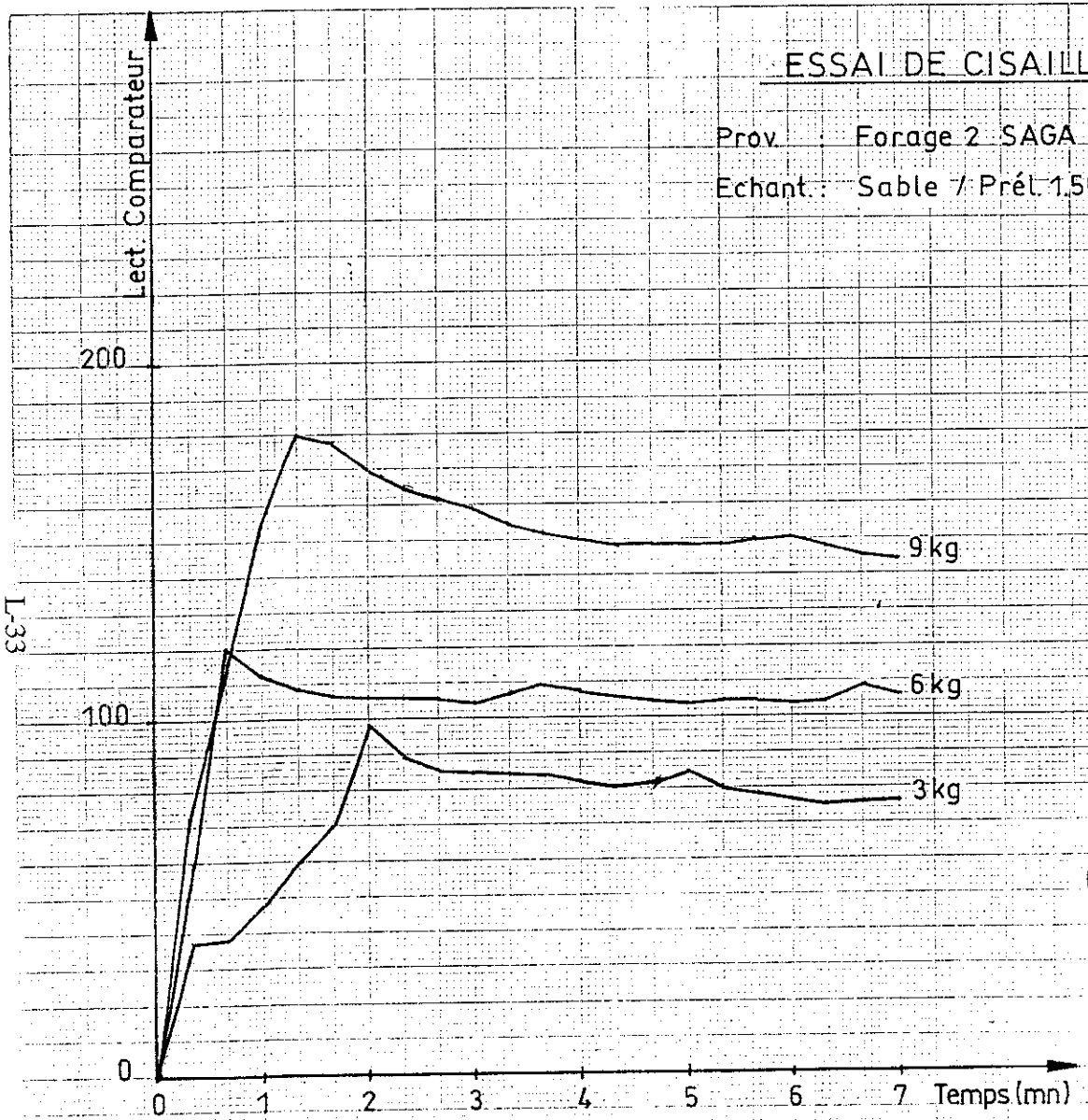
N°	L.L.	I.P.	< 0,08	HRB	ES	I.G.	γs	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
			4%	A3(0)	45%		2.61					

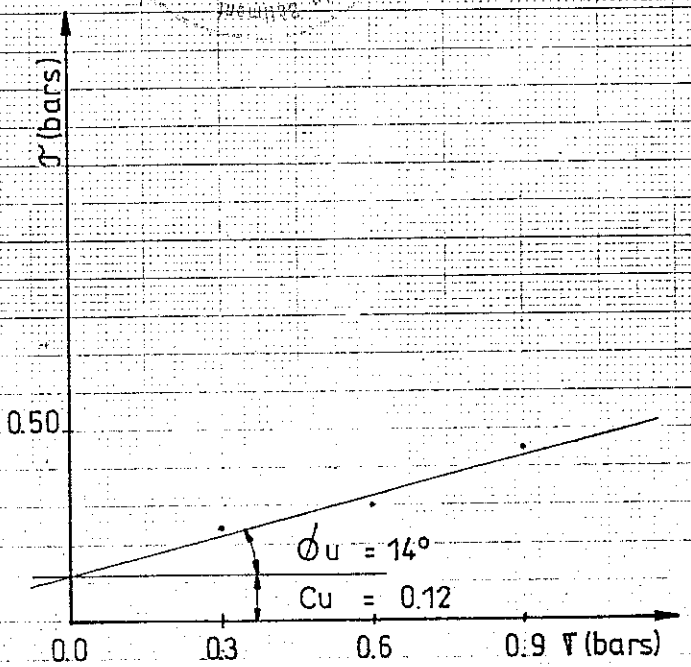
L-32

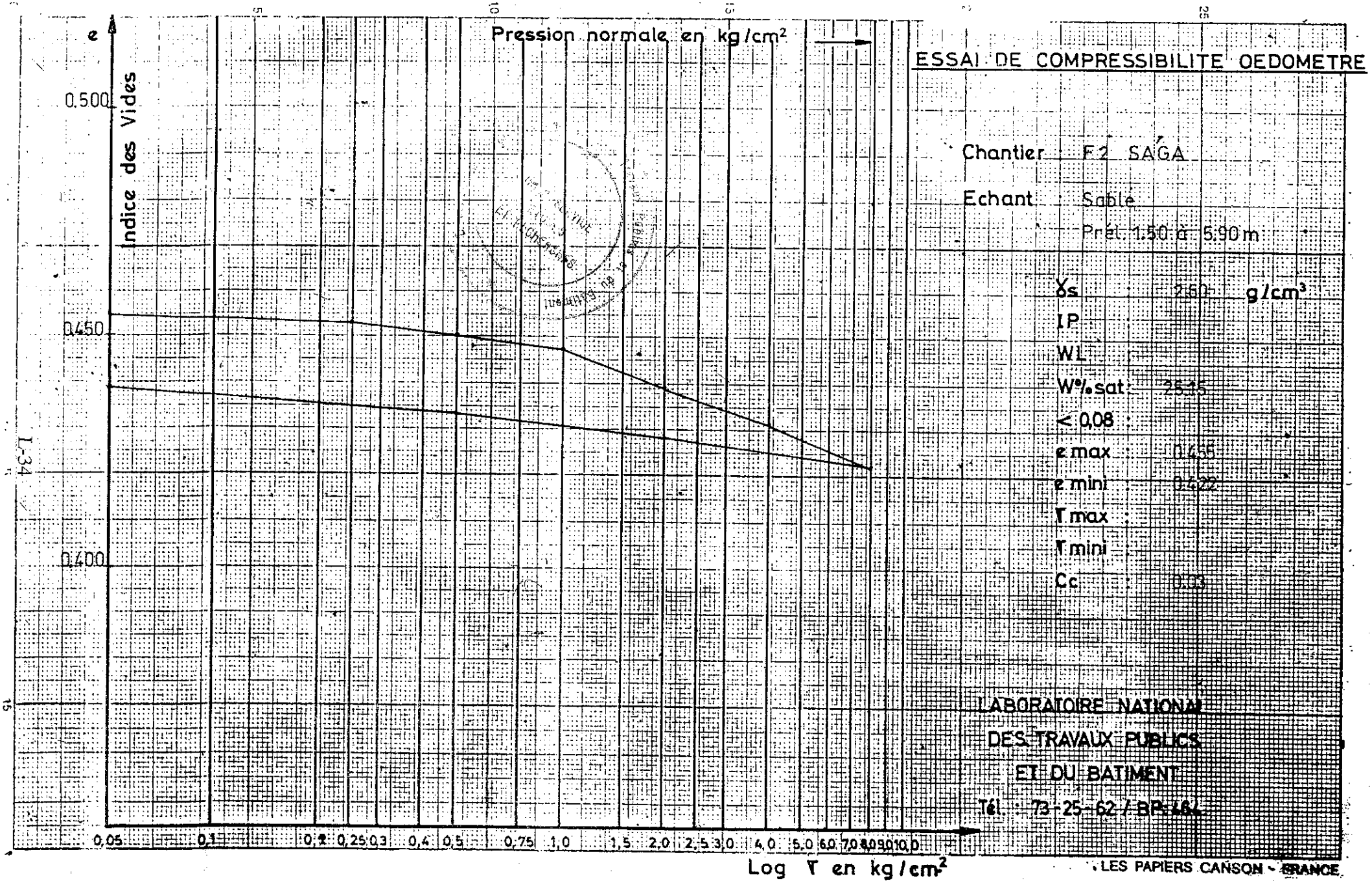
ESSAI DE CISAILLEMENT

Prov. : Forage 2 SAGA

Echant. : Sable / Prél. 1.50 à 5.90m






e
Indice des Vides
0.500
0.450
0.400
Pression normale en kg/cm²
0,05
0,1
0,2
0,25
0,3
0,4
0,5
0,75
1,0
1,5
2,0
2,5
3,0
4,0
5,0
6,0
7,0
8,0
9,0
10,0
Log σ en kg/cm²
ESSAI DE COMPRESSIBILITE OEDOMETRE
Chantier : F2 SAGA
Echant : Sable
Prél. 1.50 à 5.90 m
γs : 2.60 g/cm³
IP :
WL :
W% sat : 25.15
< 0,08 :
e max : 0.455
e mini : 0.422
σ max :
σ mini :
Cc : 0.03
LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
Tél. : 73-25-62 / BP 164
LES PAPIERS CANSON - FRANCE

REPUBLIQUE DU NIGER
MINISTERE DE L'EQUIPEMENT ET DES TRANSPORTS
DIRECTION DU LABORATOIRE NATIONAL DES TRAVAUX PUBLICS ET DU BATIMENT
B.P 464 Tel:73 - 25 - 62 Niamey

ESSAIS DE PERMEABILITE

PROVENANCE: Assainissement de la ville de niamey — DATE :

FORAGE N° 2 SAGA — DEMANDEUR SENAGHRY

PROFONDEUR : 1,50 m - 5,90 m — OPERATEUR: LABARAN

NATURE DU SOL : SABLE

TEMPERATURE DE L'ESSAI: θ = 28,5 °C

SECTION DU TUBE DE MESURE: a = 3,14 mm2

SECTION DE L'ECHANTILLON: A = 78,54 cm2

HAUTEUR DE L'ECHANTILLON: L = 18,8 mm

ESSAIS N°	1	2	3
H o	100	100	100
H 1	7	20	2
Temps : t (s)	6	5	7
Kθ (cm/s)	$6,9 * 10^{-4}$	$5,4 * 10^{-4}$	$16,6 * 10^{-4}$
Kθ moy. (cm/s)			
K 20 (cm/s)		$4,8 * 10^{-5}$	

OBSERVATIONS:

W% = 3,0 s = 1,69 Durée de saturation : immédiatement

LE CHEF SERVICE LABORATOIRE

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov.: ASSAINISSEMENT VILLE NY.

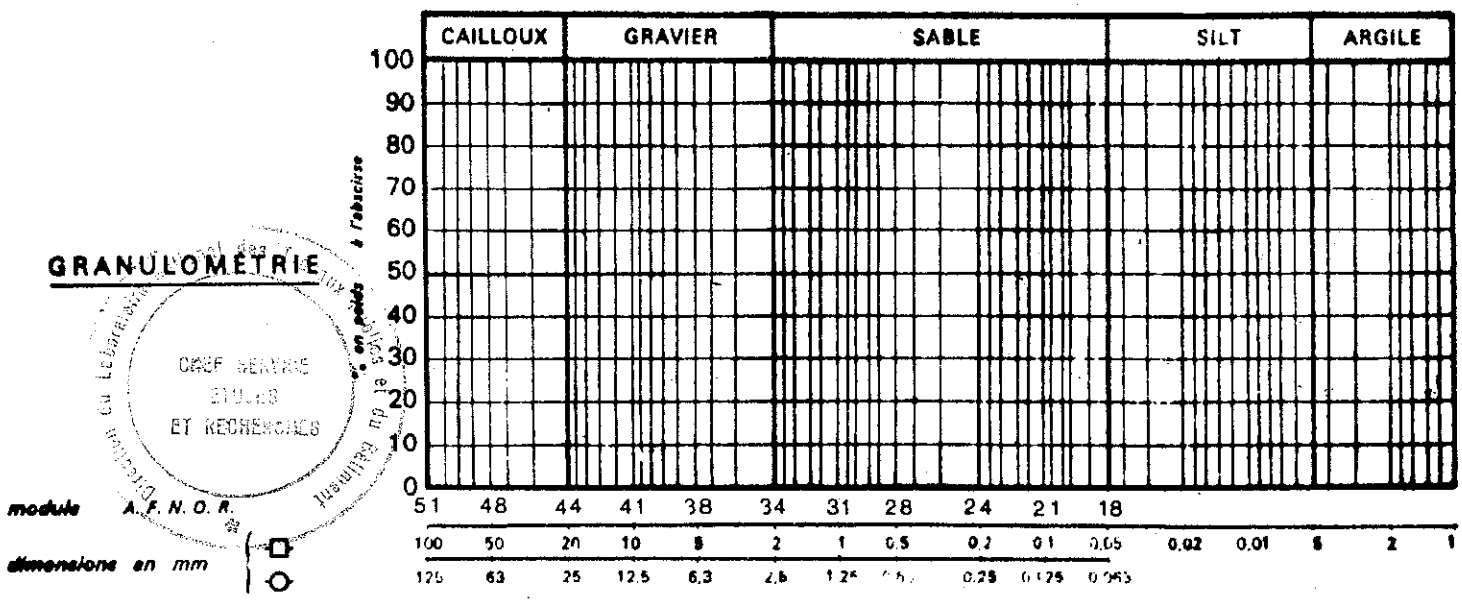
N° ECH.	PROF.	PROFIL	NATURE
F2	6.00 à 15.2m		Granite altéré

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	IP	Poids spécifique	m - I P	Classification U S H R B
	33.2	17.4	15.8			

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMETRIE



Direction du Laboratoire des Travaux Routiers et du Bâtiment
CHEF SERVICE ETUDES ET RECHERCHES

ESSAI PROCTOR

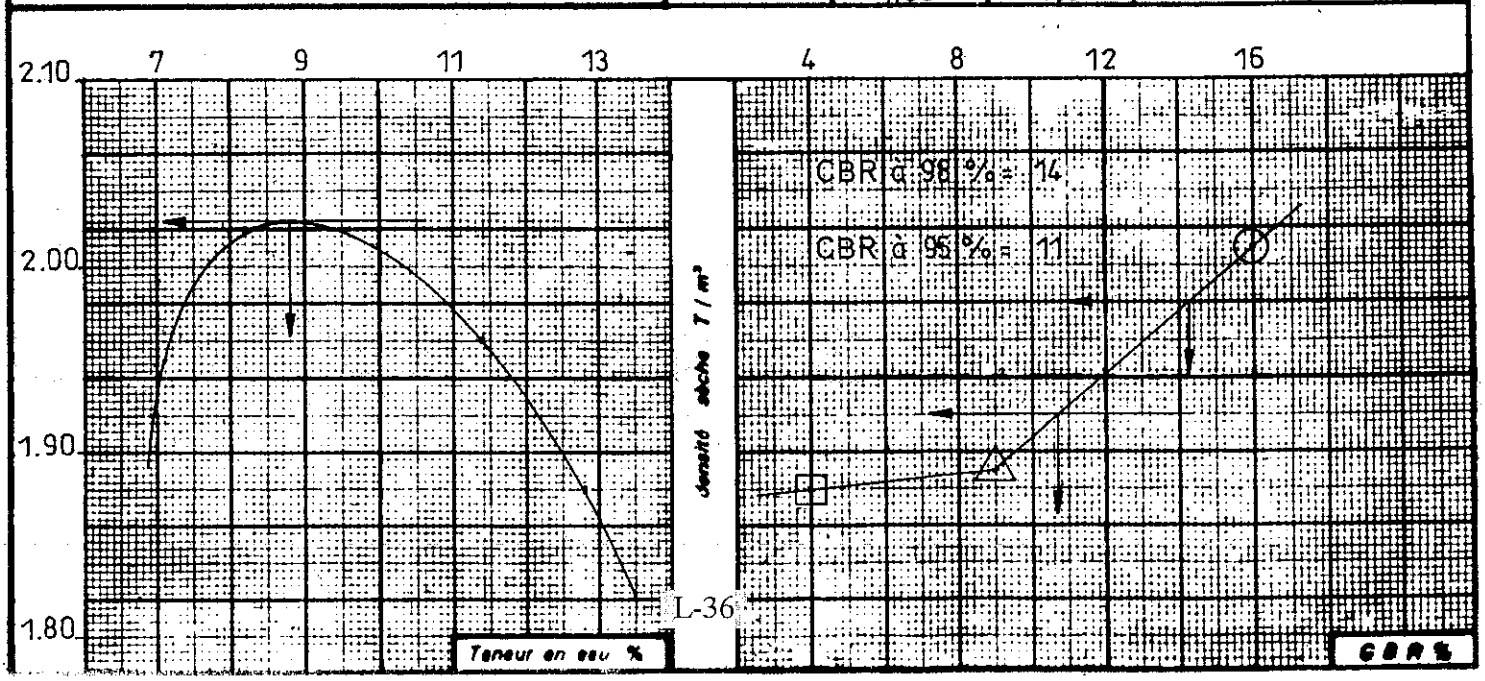
Densité sèche max. 2.02 T / m³

Teneur en eau opt. 8.8 %

ESSAI CBR

W % optimale
Sol remoulés

N coups	γ d T / m³	W % moulage	% après imbib	gonflement %
⊙ 55	1.99	9.8		
△ 25	1.80	9.8		
□ 10	1.80	9.8		



DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

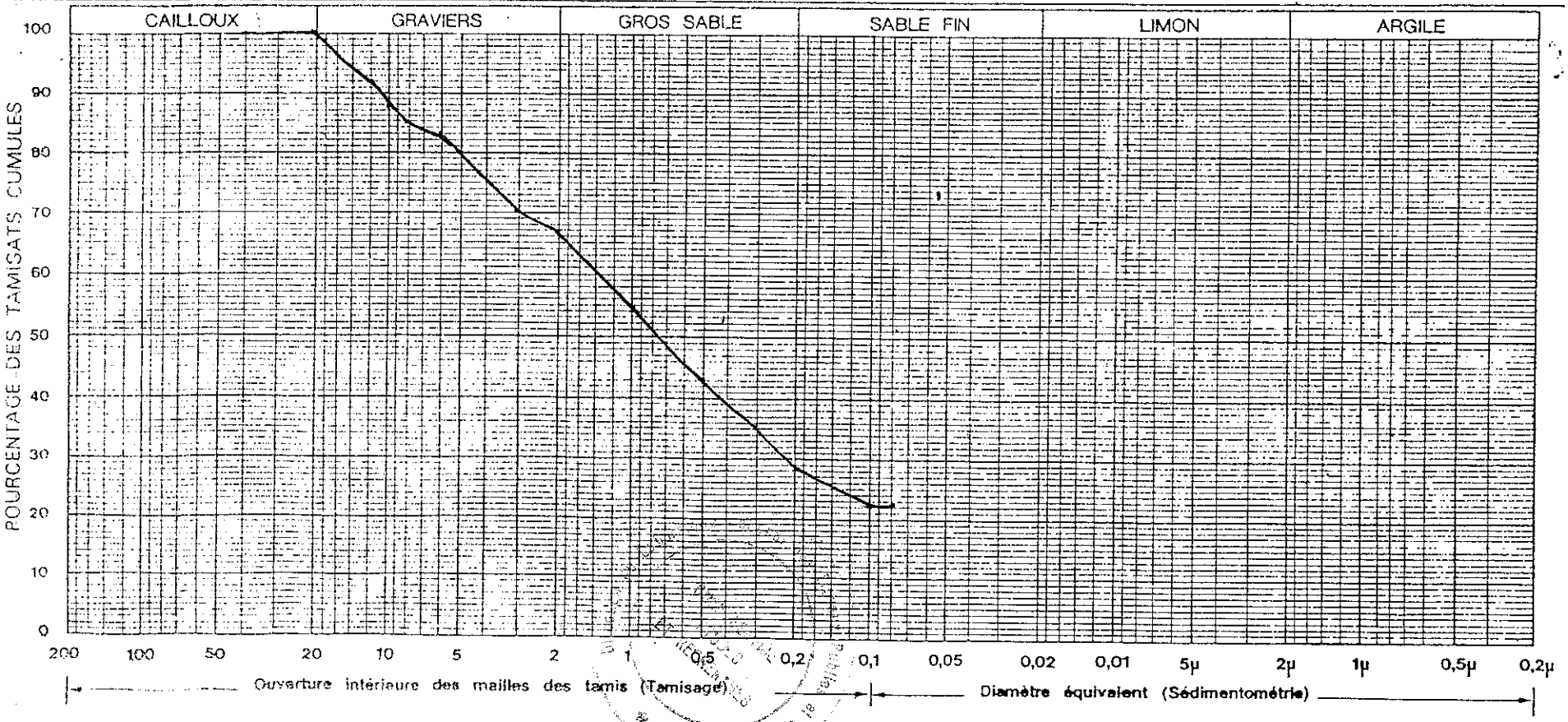
Opérateur : _____

Désignation des échantillons _____ N° _____

Provenance : ASSAINISS. VILLE NY.

Echantillon : Granite altéré

N° F2 / Prél. 6.00 à 15.20m



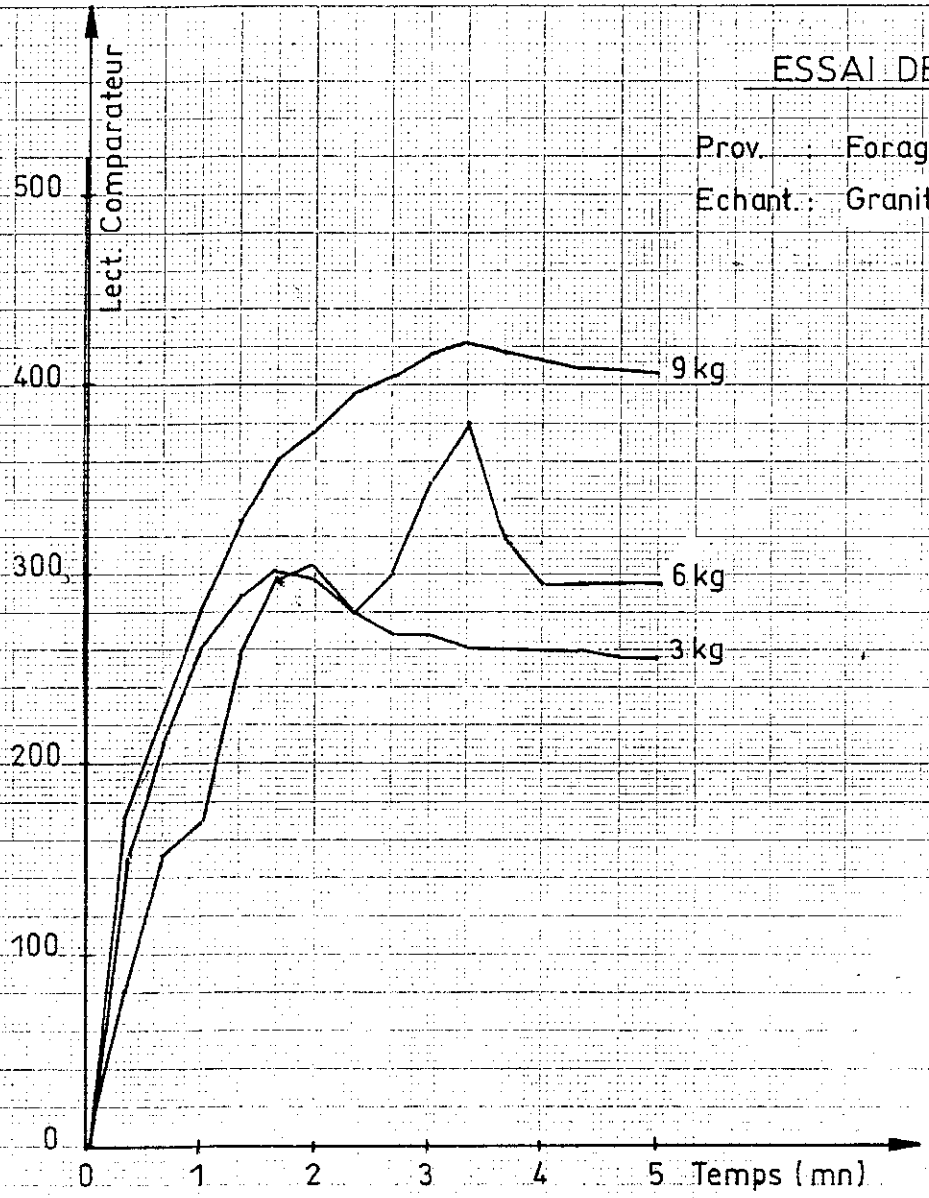
N°	L.L.	I.P.	< 0,08	HRB	F.P.	I.G.	ds max.	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
	33.2	15.8	22 %	A-16 (0)								

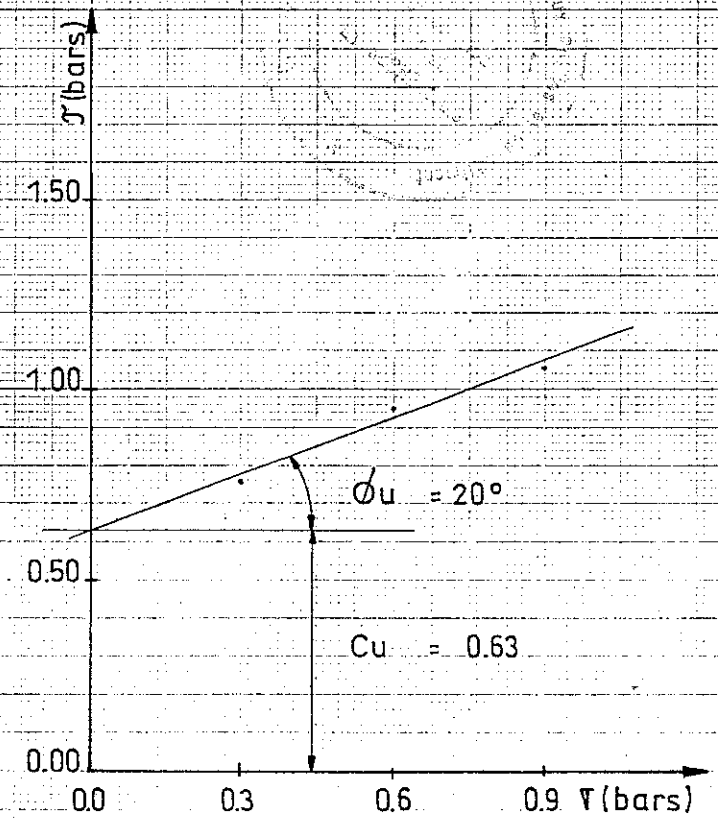
L-37

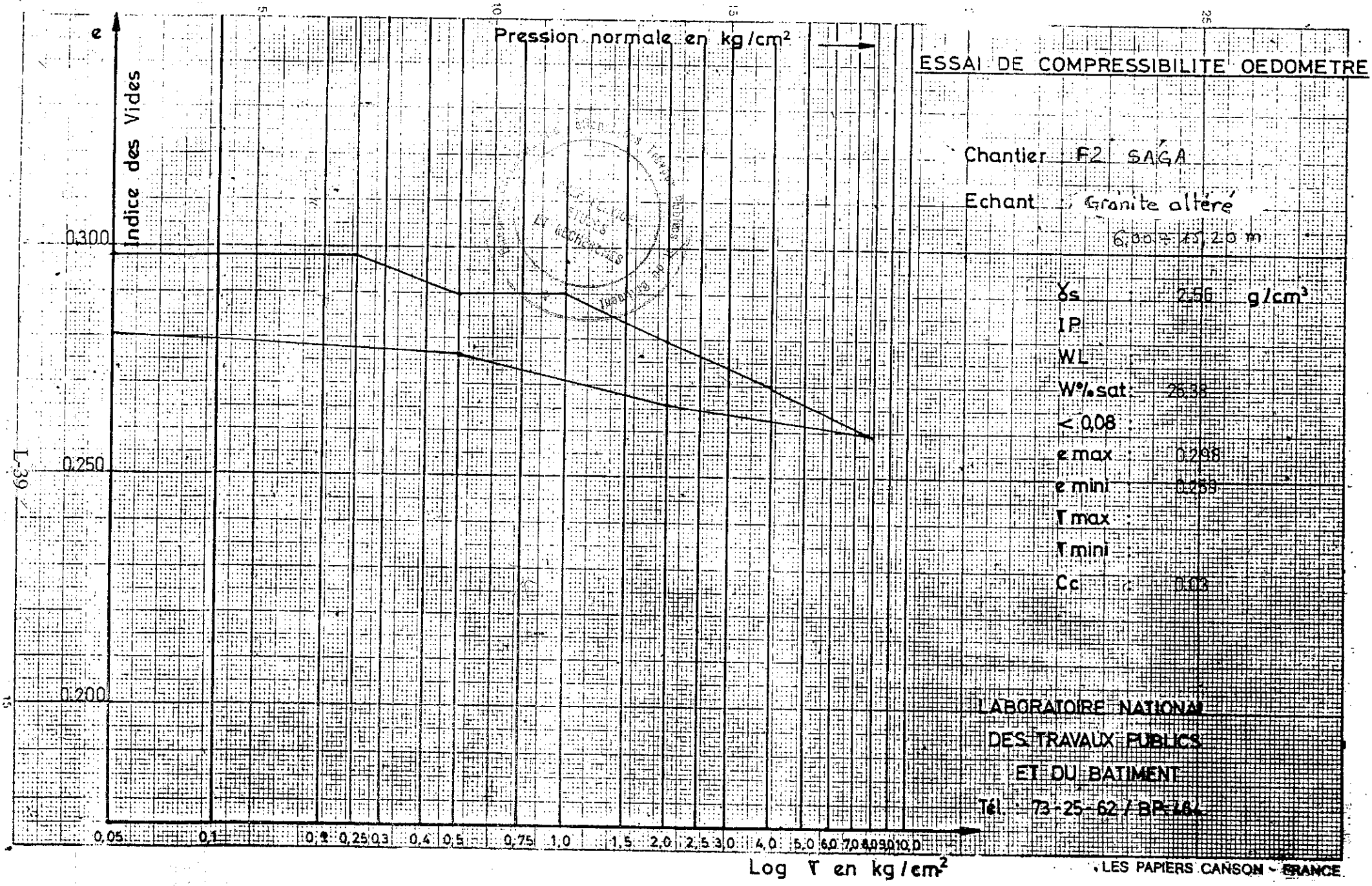
ESSAI DE CISAILLEMENT

Prov. : Forage 2 SAGA

Echant. : Granite altéré / Prél. 6.00 à 15.20 m






ESSAI DE COMPRESSIBILITE OEDOMETRE
Chantier F2 SAGA
Echant Granite altéré
6,00 ÷ 7,20 m
γs 2,56 g/cm³
IP
WL
W%sat 26,38
< 0,08
e max 0,298
e mini 0,259
T max
T mini
Cc 0,03
Pression normale en kg/cm²
e
Indice des Vides
0,300
0,250
0,200
0,05 0,1 0,2 0,25 0,3 0,4 0,5 0,75 1,0 1,5 2,0 2,5 3,0 4,0 5,0 6,0 7,0 8,0 9,0 10,0
Log T en kg/cm²
LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
Tél. : 73-25-62 / BP 14
LES PAPIERS CANSON - FRANCE

L-39

LABORATOIRE NATIONAL DES TRAVAUX PUBLICS

B.P. 464 NIAMEY Prov. : ASSAINISSEMENT VILLE NY.

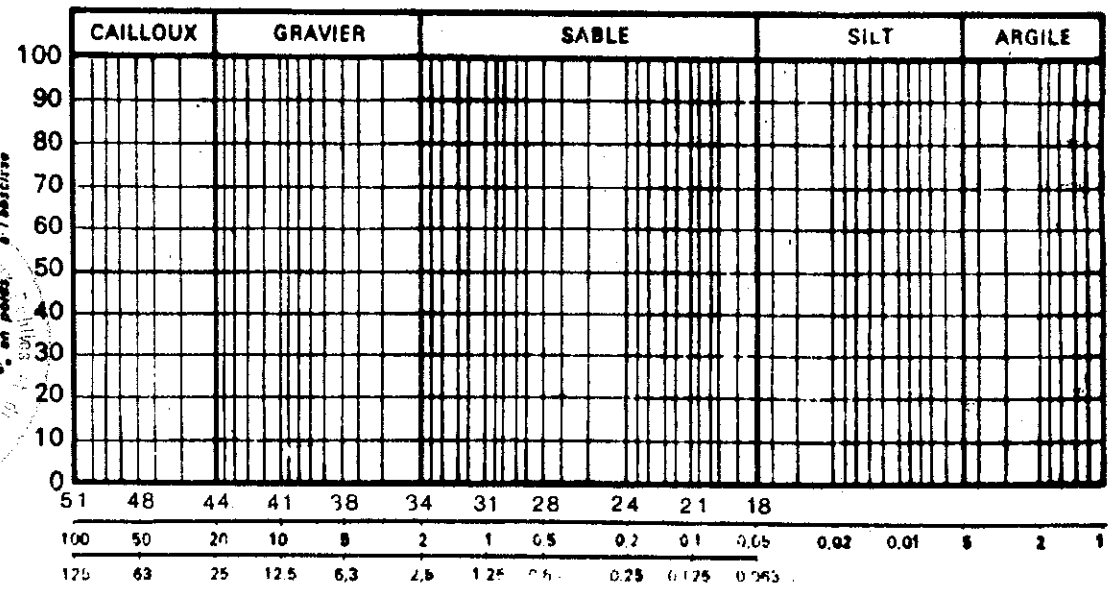
N° ECH.	PROF.	PROFIL	NATURE
F2	15.2 à 19.5 m		Granite altéré

ESSAIS D'IDENTIFICATION

Ech.	Limites d'Atterberg LL	LP	IP	Poids spécifique	m - IP	Classification U S	H R B
	32.7	15.6	17.1				

m éléments du mortier passant au tamis de 0,42 (module 27)

GRANULOMÉTRIE



ESSAI PROCTOR

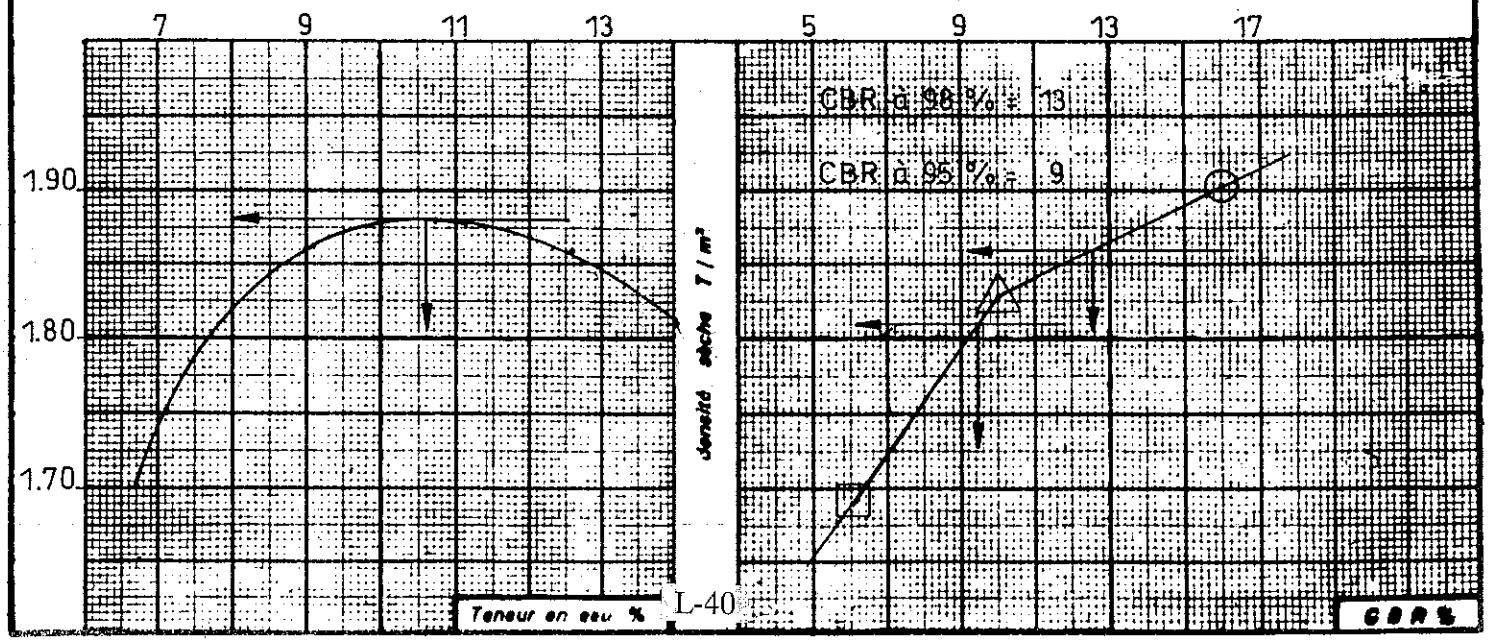
Densité sèche max. 1.88 T / m³

Teneur en eau opt. 10.6 %

ESSAI CBR

W % optimale
Sec [illegible]

N coups	γd T / m³	W % imbibage	% après imbib	gonflement %
○ 55	1.90	10.8		
△ 25	1.83	10.8		
□ 10	1.69	10.8		



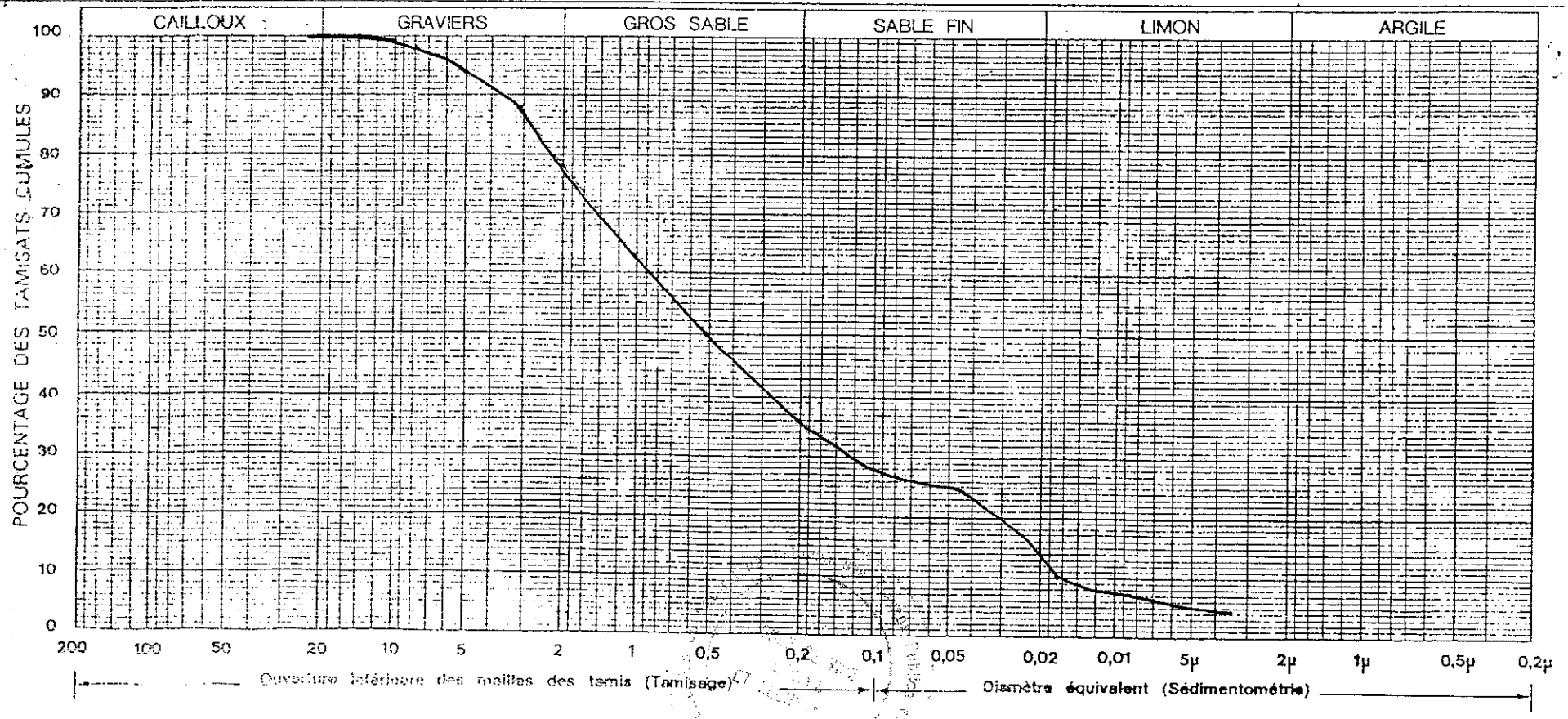
DIRECTION
DU LABORATOIRE NATIONAL
DES TRAVAUX PUBLICS
ET DU BATIMENT
B. P. 464 — NIAMEY

ANALYSES GRANULOMETRIQUES

Opérateur: _____

Désignation des échantillons _____ N° _____
_____ N° _____

Provenance: ASSAINISS. VILLE NY.
Echantillon : Granite altéré
F2 / Prél. 15.20 à 19.50 m

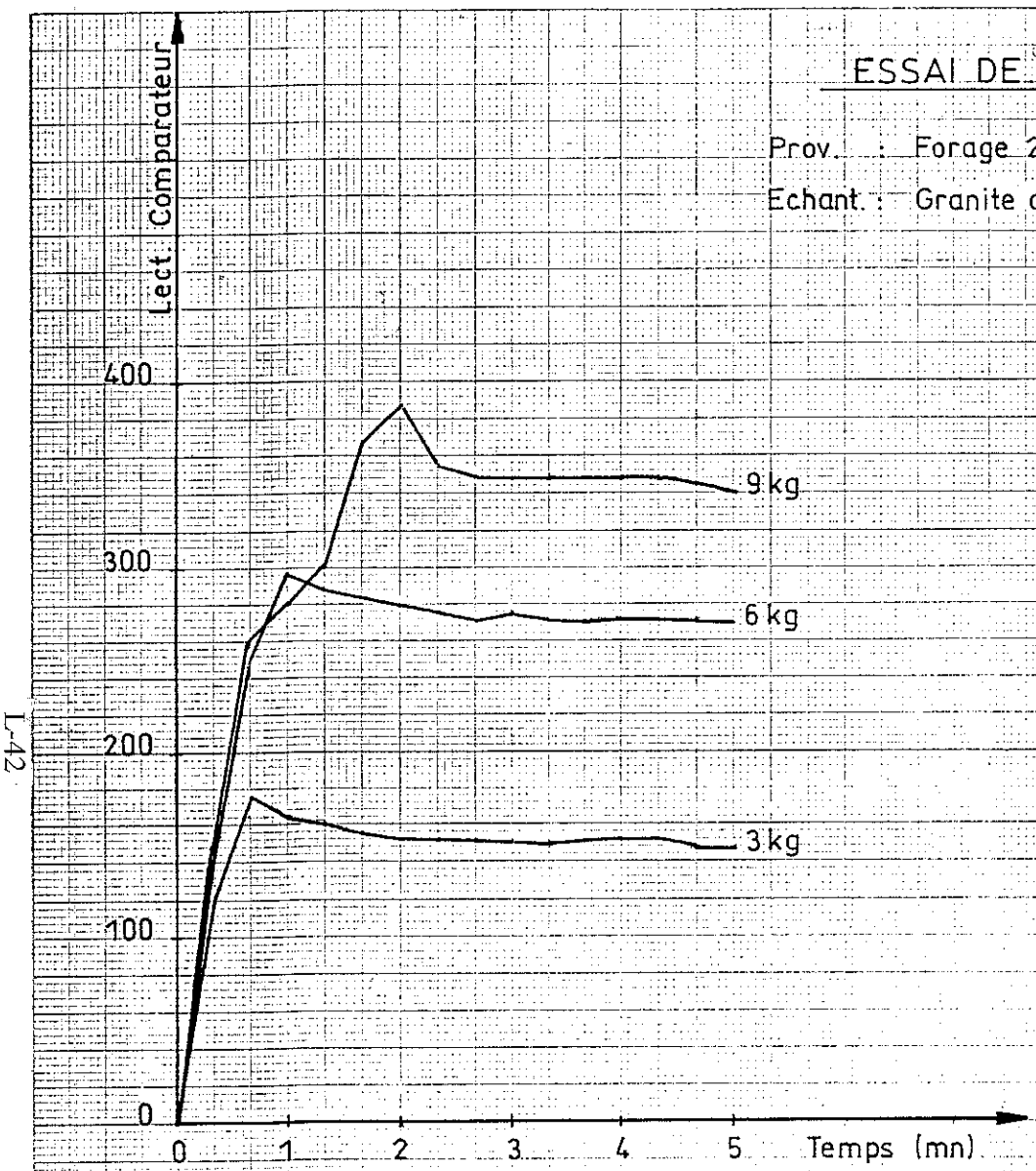


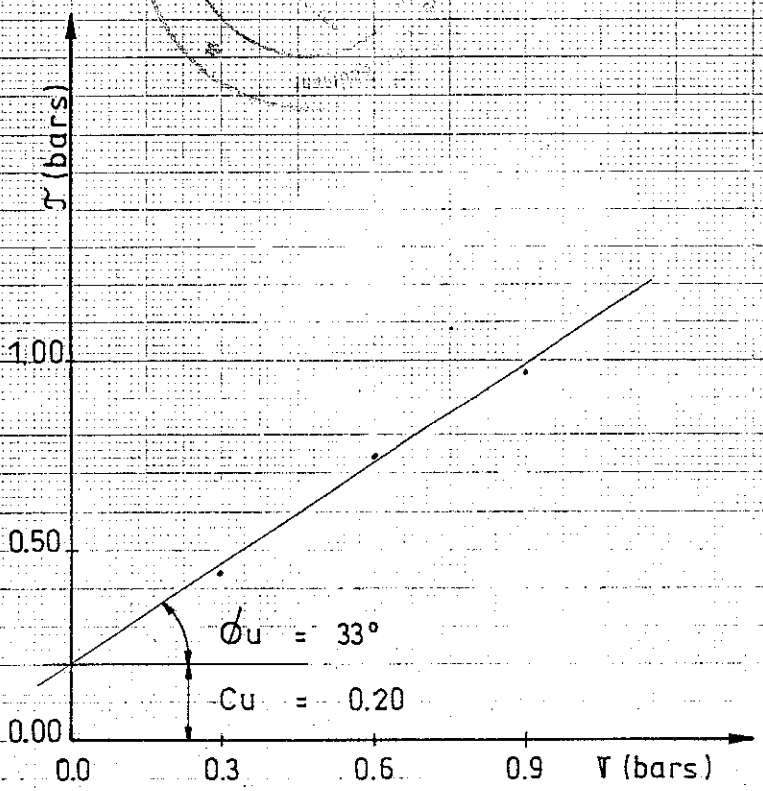
N°	L.L.	I.P.	< 0,08	HRB	F.P.	I.G.	ρs	α opt.	CBR	Gonfl.	ds situ.	comp.rel.
	32.7	17.1	27%	A2-6(1)			2.47					

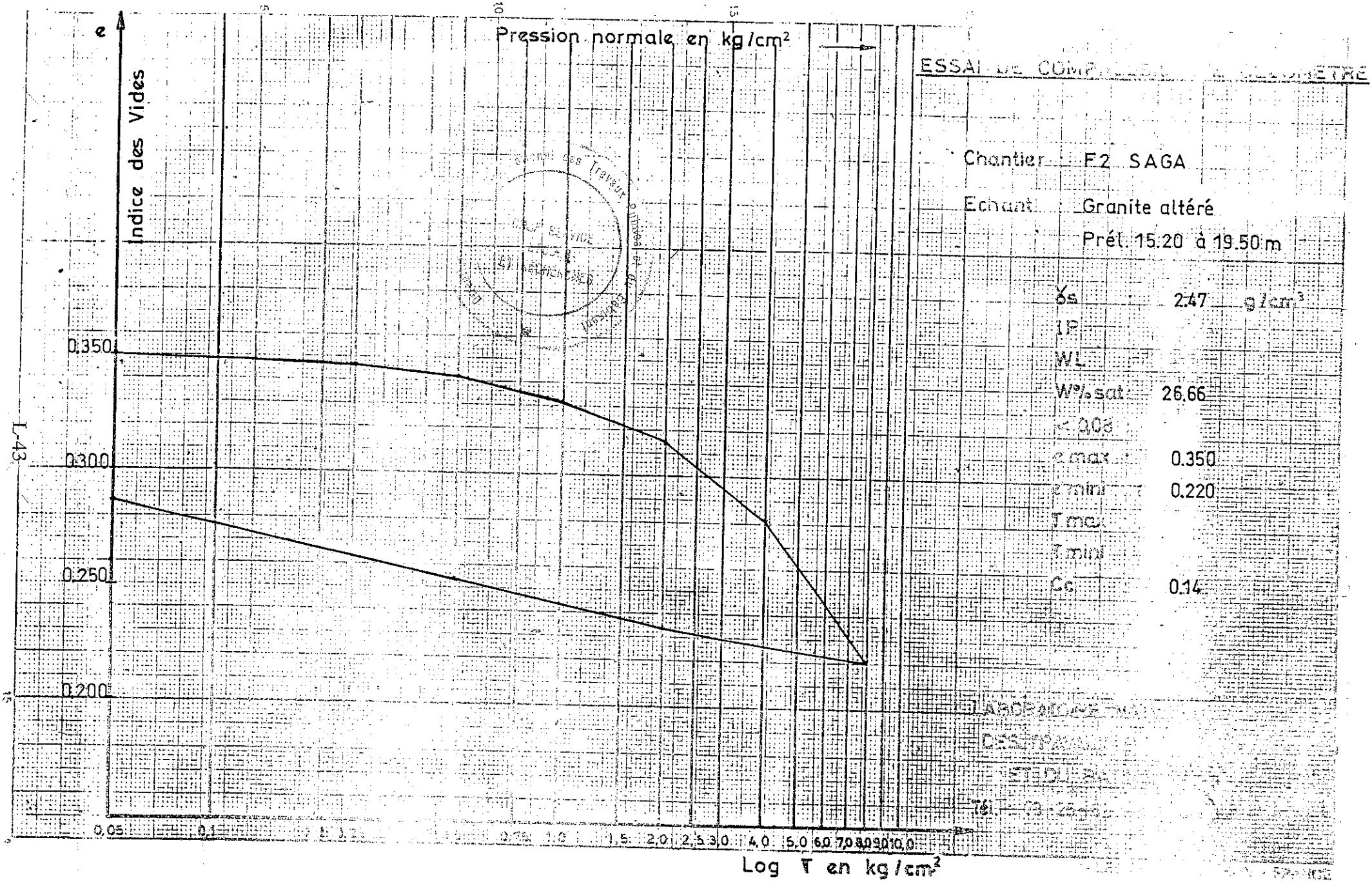
ESSAI DE CISAILLEMENT

Prov. : Forage 2 SAGA

Echant. : Granite altéré / Prél. 15.20 à 19.50 m






e
Indice des Vides
Pression normale en kg/cm²
0.350
0.300
0.250
0.200
0.05
0.1
1.0
1.5
2.0
2.5
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Log T en kg/cm²
ESSAI DE COMPRESSIBILITE
Chantier F2 SAGA
Echant. Granite altéré
Prél. 15.20 à 19.50 m
ós 2.47 g/cm³
IP
WL
W% sat 26.66
e max 0.350
e min 0.220
T max
T min
Cc 0.14
L-43

REPUBLIQUE DU NIGER
MINISTERE DE L'EQUIPEMENT ET DES TRANSPORTS
DIRECTION DU LABORATOIRE NATIONAL DES TRAVAUX PUBLICS ET DU BATIMENT
B.P 464 Tel:73 - 25 - 62 Niamey

ESSAIS DE PERMEABILITE

PROVENANCE: Assainissement de la ville de niamey — DATE : 30/10/2000

FORAGE N° 2 SAGA — DEMANDEUR SENAGHRY

PROFONDEUR: 15,20 m - 19,50 m — OPERATEUR: LABARAN

NATURE DU SOL : GRANITE ALTERE

TEMPERATURE DE L'ESSAI: θ = 29 °C

SECTION DU TUBE DE MESURE: a = 3,14 mm2

SECTION DE L'ECHANTILLON: A = 78,54 cm2

HAUTEUR DE L'ECHANTILLON: L = 18,8 mm

ESSAIS N°	1	2	3
H o	96	92	80
H 1	93	86	73
Temps : t (s)	116	260	332
Kθ (cm/s)	$15 * 10^{-6}$	$6,8 * 10^{-6}$	$5,4 * 10^{-6}$
Kθ moy. (cm/s)		$9,1 * 10^{-6}$	
K 20 (cm/s)		$4,5 * 10^{-7}$	

OBSERVATIONS:
W% = 10,7 γ_d = 1,88 Durée de saturation 24 heures

LE CHEF SERVICE LABORATOIRE