FIRR (Phase 1 only)

FIRR (Loan) 1/5 - Phase 1 only

Case A:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
FIRR												-5.71%	-4.71%	-3.74%	-2.79%	-1.87%	-0.97%	-0.08%	0.79%	1.64%	2.49%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-371	0	0	0	0	0	0	0	0	0	0	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371
2000	-1,263	63	79	95	111	126	142	158	174	190	205	-1,199	-1,184	-1,168	-1,152	-1,136	-1,120	-1,105	-1,089	-1,073	-1,057
2001	-1,228	64	80	96	112	128	144	160	176	192	207	-1,164	-1,148	-1,132	-1,116	-1,100	-1,084	-1,068	-1,052	-1,036	-1,020
2002	-109	64	81	97	113	129	145	161	177	193	209	-44	-28	-12	4	20	36	52	68	85	101
2003	-109	65	81	98	114	130	146	163	179	195	211	-44	-27	-11	5	21	38	54	70	86	103
2004	-109	66	82	98	115	131	148	164	180	197	213	-43	-27	-10	6	23	39	55	72	88	105
2005	-109	66	83	99	116	132	149	166	182	199	215	-43	-26	-9	7	24	40	57	73	90	106
2006	-226	67	84	100	117	134	150	167	184	200	217	-159	-143	-126	-109	-93	-76	-59	-42	-26	-9
2007	-109	67	84	101	118	135	152	169	185	202	219	-41	-24	-8	9	26	43	60	77	93	110
2008	-109	68	85	102	119	136	153	170	187	204	221	-41	-24	-7	10	27	44	61	78	95	112
2009	-109	69	86	103	120	137	154	171	189	206	223	-40	-23	-6	11	28	46	63	80	97	114
2010	-111	69	86	104	121	138	156	173	190	208	225	-42	-25	-7	10	27	44	62	79	96	114
2011	-122	69	86	104	121	138	156	173	190	208	225	-53	-36	-18	-1	16	33	51	68	85	103
2012	-218	69	86	104	121	138	156	173	190	208	225	-149	-132	-114	-97	-80	-62	-45	-28	-10	7
2013	-108	69	86	104	121	138	156	173	190	208	225	-39	-21	-4	13	30	48	65	82	100	117
2014	-106	69	86	104	121	138	156	173	190	208	225	-36	-19	-2	16	33	50	67	85	102	119
2015	-103	69	86	104	121	138	156	173	190	208	225	-34	-17	1	18	35	53	70	87	104	122
2016	-432	69	86	104	121	138	156	173	190	208	225	-363	-345	-328	-311	-294	-276	-259	-242	-224	-207
2017	-98	69	86	104	121	138	156	173	190	208	225	-29	-12	5	23	40	57	75	92	109	126
2018	-204	69	86	104	121	138	156	173	190	208	225	-135	-117	-100	-83	-66	-48	-31	-14	4	21
2019	-94	69	86	104	121	138	156	173	190	208	225	-25	-7	10	27	45	62	79	97	114	131
2020	-91	69	86	104	121	138	156	173	190	208	225	-22	-5	12	30	47	64	82	99	116	133
2021	-99	69	86	104	121	138	156	173	190	208	225	-29	-12	5	22	40	57	74	92	109	126
2022	-87	69	86	104	121	138	156	173	190	208	225	-17	-0	17	34	52	69	86	104	121	138
2023	-84	69	86	104	121	138	156	173	190	208	225	-15	2	19	37	54	71	89	106	123	141
2024	-190	69	86	104	121	138	156	173	190	208	225	-121	-103	-86	-69	-51	-34	-17	0	18	35
2025	-80	69	86	104	121	138	156	173	190	208	225	-10	7	24	41	59	76	93	111	128	145
2026	-87	69	86	104	121	138	156	173	190	208	225	-18	-0	17	34	52	69	86	103	121	138
2027	-75	69	86	104	121	138	156	173	190	208	225	-6	12	29	46	63	81	98	115	133	150
2028	-73	69	86	104	121	138	156	173	190	208	225	-3	14	31	49	66	83	100	118	135	152
2029	-70	69	86	104	121	138	156	173	190	208	225	-1	16	34	51	68	85	103	120	137	155
2030	1,062	69	86	104	121	138	156	173	190	208	225	1,131	1,148	1,165	1,183	1,200	1,217	1,235	1,252	1,269	1,286
2031	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2032	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2033	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2034	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2035	-0	-0	0	-0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2036	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2037	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2038	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2039	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2040	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
	-5,330	2,112	2,640	3,168	3,696	4,224	4,752	5,280	5,808	6,336	6,864	-3,218	-2,690	-2,162	-1,634	-1,106	-578	-50	478	1,006	1,534

FIRR (Loan) 2/5 - **Phase 1 only**

Case B:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
FIRR												-6.16%	-5.26%	-4.38%	-3.53%	-2.69%	-1.87%	-1.07%	-0.28%	0.50%	1.27%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-371	0	0	0	0	0	0	0	0	0	0	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371
2000	-1,263	56	70	84	98	112	126	140	155	169	183	-1,206	-1,192	-1,178	-1,164	-1,150	-1,136	-1,122	-1,108	-1,094	-1,080
2001	-1,228	57	71	85	99	114	128	142	156	170	184	-1,171	-1,157	-1,143	-1,129	-1,114	-1,100	-1,086	-1,072	-1,058	-1,043
2002	-109	57	72	86	100	115	129	143	158	172	186	-51	-37	-23	-8	6	20	34	49	63	77
2003	-109	58	72	87	101	116	130	145	159	173	188	-51	-36	-22	-8	7	21	36	50	65	79
2004	-109	58	73	87	102	117	131	146	160	175	190	-50	-36	-21	-7	8	23	37	52	66	81
2005	-109	59	74	88	103	118	132	147	162	177	191	-50	-35	-20	-6	9	24	38	53	68	83
2006	-226	59	74	89	104	119	134	148	163	178	193	-167	-152	-137	-122	-107	-93	-78	-63	-48	-33
2007	-109	60	75	90	105	120	135	150	165	180	195	-49	-34	-19	-4	11	26	41	56	71	86
2008	-109	60	76	91	106	121	136	151	166	181	196	-48	-33	-18	-3	12	27	42	57	73	88
2009	-109	61	76	91	107	122	137	152	168	183	198	-48	-33	-17	-2	13	28	44	59	74	89
2010	-111	61	77	92	108	123	138	154	169	184	200	-50	-34	-19	-4	12	27	43	58	73	89
2011	-122	61	77	92	108	123	138	154	169	184	200	-61	-45	-30	-15	1	16	32	47	62	78
2012	-218	61	77	92	108	123	138	154	169	184	200	-157	-141	-126	-110	-95	-80	-64	-49	-34	-18
2013	-108	61	77	92	108	123	138	154	169	184	200	-46	-31	-16	-0	15	30	46	61	77	92
2014	-106	61	77	92	108	123	138	154	169	184	200	-44	-29	-13	2	17	33	48	64	79	94
2015	-103	61	77	92	108	123	138	154	169	184	200	-42	-26	-11	4	20	35	51	66	81	97
2016	-432	61	77	92	108	123	138	154	169	184	200	-370	-355	-340	-324	-309	-294	-278	-263	-247	-232
2017	-98	61	77	92	108	123	138	154	169	184	200	-37	-22	-6	9	25	40	55	71	86	101
2018	-204	61	77	92	108	123	138	154	169	184	200	-142	-127	-112	-96	-81	-66	-50	-35	-19	-4
2019	-94	61	77	92	108	123	138	154	169	184	200	-32	-17	-1	14	29	45	60	75	91	106
2020	-91	61	77	92	108	123	138	154	169	184	200	-30	-15	1	16	32	47	62	78	93	108
2021	-99	61	77	92	108	123	138	154	169	184	200	-37	-22	-6	9	24	40	55	70	86	101
2022	-87	61	77	92	108	123	138	154	169	184	200	-25	-10	6	21	36	52	67	82	98	113
2023	-84	61	77	92	108	123	138	154	169	184	200	-23	-7	8	23	39	54	69	85	100	116
2024	-190	61	77	92	108	123	138	154	169	184	200	-128	-113	-98	-82	-67	-51	-36	-21	-5	10
2025	-80	61	77	92	108	123	138	154	169	184	200	-18	-3	13	28	43	59	74	90	105	120
2026	-87	61	77	92	108	123	138	154	169	184	200	-25	-10	5	21	36	52	67	82	98	113
2027	-75	61	77	92	108	123	138	154	169	184	200	-13	2	17	33	48	63	79	94	110	125
2028	-73	61	77	92	108	123	138	154	169	184	200	-11	4	20	35	50	66	81	97	112	127
2029	-70	61	77	92	108	123	138	154	169	184	200	-9	7	22	37	53	68	84	99	114	130
2030	1,062	61	77	92	108	123	138	154	169	184	200	1,123	1,138	1,154	1,169	1,185	1,200	1,215	1,231	1,246	1,261
2031	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2032	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2033	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2034	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2035	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2036	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2037	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2038	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2039	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2040	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
	-5,330	1,877	2,347	2,816	3,285	3,755	4,224	4,694	5,163	5,632	6,102	-3,453	-2,983	-2,514	-2,045	-1,575	-1,106	-637	-167	302	771

FIRR (Loan) 3/5 - **Phase 1 only**

Case C:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
FIRR												-6.62%	-5.82%	-5.04%	-4.28%	-3.53%	-2.79%	-2.07%	-1.37%	-0.67%	0.01%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-371	0	0	0	0	0	0	0	0	0	0	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371
2000	-1,263	49	61	74	86	98	111	123	135	147	160	-1,213	-1,201	-1,189	-1,177	-1,164	-1,152	-1,140	-1,127	-1,115	-1,103
2001	-1,228	50	62	74	87	99	112	124	137	149	161	-1,178	-1,166	-1,153	-1,141	-1,129	-1,116	-1,104	-1,091	-1,079	-1,066
2002	-109	50	63	75	88	100	113	125	138	150	163	-59	-46	-34	-21	-8	4	17	29	42	54
2003	-109	51	63	76	89	101	114	126	139	152	164	-58	-46	-33	-20	-8	5	18	30	43	56
2004	-109	51	64	77	89	102	115	128	140	153	166	-58	-45	-32	-19	-7	6	19	32	44	57
2005	-109	52	64	77	90	103	116	129	142	155	167	-57	-44	-31	-19	-6	7	20	33	46	59
2006	-226	52	65	78	91	104	117	130	143	156	169	-174	-161	-148	-135	-122	-109	-96	-83	-70	-57
2007	-109	52	66	79	92	105	118	131	144	157	170	-56	-43	-30	-17	-4	9	22	35	49	62
2008	-109	53	66	79	93	106	119	132	145	159	172	-56	-43	-29	-16	-3	10	23	37	50	63
2009	-109	53	67	80	93	107	120	133	147	160	173	-55	-42	-29	-15	-2	11	25	38	51	65
2010	-111	54	67	81	94	108	121	135	148	161	175	-57	-44	-31	-17	-4	10	23	37	50	64
2011	-122	54	67	81	94	108	121	135	148	161	175	-68	-55	-41	-28	-15	-1	12	26	39	53
2012	-218	54	67	81	94	108	121	135	148	161	175	-164	-151	-137	-124	-110	-97	-84	-70	-57	-43
2013	-108	54	67	81	94	108	121	135	148	161	175	-54	-41	-27	-14	-0	13	27	40	54	67
2014	-106	54	67	81	94	108	121	135	148	161	175	-52	-38	-25	-11	2	16	29	42	56	69
2015	-103	54	67	81	94	108	121	135	148	161	175	-49	-36	-22	-9	4	18	31	45	58	72
2016	-432	54	67	81	94	108	121	135	148	161	175	-378	-365	-351	-338	-324	-311	-297	-284	-271	-257
2017	-98	54	67	81	94	108	121	135	148	161	175	-45	-31	-18	-4	9	23	36	50	63	76
2018	-204	54	67	81	94	108	121	135	148	161	175	-150	-137	-123	-110	-96	-83	-69	-56	-42	-29
2019	-94	54	67	81	94	108	121	135	148	161	175	-40	-26	-13	0	14	27	41	54	68	81
2020	-91	54	67	81	94	108	121	135	148	161	175	-38	-24	-11	3	16	30	43	57	70	83
2021	-99	54	67	81	94	108	121	135	148	161	175	-45	-31	-18	-4	9	22	36	49	63	76
2022	-87	54	67	81	94	108	121	135	148	161	175	-33	-19	-6	7	21	34	48	61	75	88
2023	-84	54	67	81	94	108	121	135	148	161	175	-31	-17	-4	10	23	37	50	64	77	91
2024	-190	54	67	81	94	108	121	135	148	161	175	-136	-123	-109	-96	-82	-69	-55	-42	-28	-15
2025	-80	54	67	81	94	108	121	135	148	161	175	-26	-12	1	15	28	41	55	68	82	95
2026	-87	54	67	81	94	108	121	135	148	161	175	-33	-20	-6	7	21	34	48	61	75	88
2027	-75	54	67	81	94	108	121	135	148	161	175	-21	-8	6	19	33	46	60	73	87	100
2028	-73	54	67	81	94	108	121	135	148	161	175	-19	-5	8	22	35	49	62	75	89	102
2029	-70	54	67	81	94	108	121	135	148	161	175	-16	-3	11	24	37	51	64	78	91	105
2030	1,062	54	67	81	94	108	121	135	148	161	175	1,115	1,129	1,142	1,156	1,169	1,183	1,196	1,210	1,223	1,236
2031	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2032	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2033	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2034	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2035	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2036	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2037	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2038	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2039	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2040	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
	-5,330	1,643	2,053	2,464	2,875	3,285	3,696	4,107	4,518	4,928	5,339	-3,687	-3,277	-2,866	-2,455	-2,045	-1,634	-1,223	-813	-402	9

FIRR (Loan) 4/5 - Phase 1 only

Case D:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
FIRR												-7.09%	-6.39%	-5.71%	-5.04%	-4.38%	-3.74%	-3.11%	-2.48%	-1.87%	-1.27%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-371	0	0	0	0	0	0	0	0	0	0	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371
2000	-1,263	42	53	63	74	84	95	105	116	126	137	-1,220	-1,210	-1,199	-1,189	-1,178	-1,168	-1,157	-1,147	-1,136	-1,126
2001	-1,228	43	53	64	74	85	96	106	117	128	138	-1,185	-1,175	-1,164	-1,153	-1,143	-1,132	-1,121	-1,111	-1,100	-1,089
2002	-109	43	54	64	75	86	97	107	118	129	140	-66	-55	-44	-34	-23	-12	-1	9	20	31
2003	-109	43	54	65	76	87	98	108	119	130	141	-65	-55	-44	-33	-22	-11	-0	10	21	32
2004	-109	44	55	66	77	87	98	109	120	131	142	-65	-54	-43	-32	-21	-10	1	12	23	33
2005	-109	44	55	66	77	88	99	110	121	132	143	-65	-54	-43	-31	-20	-9	2	13	24	35
2006	-226	45	56	67	78	89	100	111	122	134	145	-182	-170	-159	-148	-137	-126	-115	-104	-93	-81
2007	-109	45	56	67	79	90	101	112	124	135	146	-64	-53	-41	-30	-19	-8	4	15	26	37
2008	-109	45	57	68	79	91	102	113	125	136	147	-63	-52	-41	-29	-18	-7	5	16	27	39
2009	-109	46	57	69	80	91	103	114	126	137	149	-63	-52	-40	-29	-17	-6	6	17	28	40
2010	-111	46	58	69	81	92	104	115	127	138	150	-65	-54	-42	-31	-19	-7	4	16	27	39
2011	-122	46	58	69	81	92	104	115	127	138	150	-76	-65	-53	-41	-30	-18	-7	5	16	28
2012	-218	46	58	69	81	92	104	115	127	138	150	-172	-160	-149	-137	-126	-114	-103	-91	-80	-68
2013	-108	46	58	69	81	92	104	115	127	138	150	-62	-50	-39	-27	-16	-4	7	19	30	42
2014	-106	46	58	69	81	92	104	115	127	138	150	-59	-48	-36	-25	-13	-2	10	21	33	44
2015	-103	46	58	69	81	92	104	115	127	138	150	-57	-46	-34	-22	-11	1	12	24	35	47
2016	-432	46	58	69	81	92	104	115	127	138	150	-386	-374	-363	-351	-340	-328	-317	-305	-294	-282
2017	-98	46	58	69	81	92	104	115	127	138	150	-52	-41	-29	-18	-6	5	17	28	40	51
2018	-204	46	58	69	81	92	104	115	127	138	150	-158	-146	-135	-123	-112	-100	-89	-77	-66	-54
2019	-94	46	58	69	81	92	104	115	127	138	150	-48	-36	-25	-13	-1	10	22	33	45	56
2020	-91	46	58	69	81	92	104	115	127	138	150	-45	-34	-22	-11	1	12	24	35	47	59
2021	-99	46	58	69	81	92	104	115	127	138	150	-53	-41	-29	-18	-6	5	17	28	40	51
2022	-87	46	58	69	81	92	104	115	127	138	150	-41	-29	-17	-6	6	17	29	40	52	63
2023	-84	46	58	69	81	92	104	115	127	138	150	-38	-27	-15	-4	8	19	31	43	54	66
2024	-190	46	58	69	81	92	104	115	127	138	150	-144	-132	-121	-109	-98	-86	-74	-63	-51	-40
2025	-80	46	58	69	81	92	104	115	127	138	150	-33	-22	-10	1	13	24	36	47	59	70
2026	-87	46	58	69	81	92	104	115	127	138	150	-41	-29	-18	-6	5	17	28	40	52	63
2027	-75	46	58	69	81	92	104	115	127	138	150	-29	-17	-6	6	17	29	40	52	63	75
2028	-73	46	58	69	81	92	104	115	127	138	150	-26	-15	-3	8	20	31	43	54	66	77
2029	-70	46	58	69	81	92	104	115	127	138	150	-24	-13	-1	11	22	34	45	57	68	80
2030	1,062	46	58	69	81	92	104	115	127	138	150	1,108	1,119	1,131	1,142	1,154	1,165	1,177	1,188	1,200	1,212
2031	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2032	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2033	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2034	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2035	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2036	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2037	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2038	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2039	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2040	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
	-5,330	1,408	1,760	2,112	2,464	2,816	3,168	3,520	3,872	4,224	4,576	-3,922	-3,570	-3,218	-2,866	-2,514	-2,162	-1,810	-1,458	-1,106	-754

FIRR (Loan) 5/5 - **Phase 1 only**

Case E:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
FIRR												-7.56%	-6.97%	-6.39%	-5.82%	-5.26%	-4.71%	-4.17%	-3.63%	-3.11%	-2.59%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-371	0	0	0	0	0	0	0	0	0	0	-371	-371	-371	-371	-371	-371	-371	-371	-371	-371
2000	-1,263	35	44	53	61	70	79	88	97	105	114	-1,227	-1,219	-1,210	-1,201	-1,192	-1,184	-1,175	-1,166	-1,157	-1,148
2001	-1,228	35	44	53	62	71	80	89	98	106	115	-1,192	-1,183	-1,175	-1,166	-1,157	-1,148	-1,139	-1,130	-1,121	-1,113
2002	-109	36	45	54	63	72	81	89	98	107	116	-73	-64	-55	-46	-37	-28	-19	-10	-1	8
2003	-109	36	45	54	63	72	81	90	99	108	117	-73	-64	-55	-46	-36	-27	-18	-9	-0	9
2004	-109	36	46	55	64	73	82	91	100	109	118	-72	-63	-54	-45	-36	-27	-18	-8	1	10
2005	-109	37	46	55	64	74	83	92	101	110	120	-72	-63	-54	-44	-35	-26	-17	-8	2	11
2006	-226	37	46	56	65	74	84	93	102	111	121	-189	-180	-170	-161	-152	-143	-133	-124	-115	-105
2007	-109	37	47	56	66	75	84	94	103	112	122	-71	-62	-53	-43	-34	-24	-15	-6	4	13
2008	-109	38	47	57	66	76	85	94	104	113	123	-71	-62	-52	-43	-33	-24	-14	-5	5	14
2009	-109	38	48	57	67	76	86	95	105	114	124	-71	-61	-52	-42	-33	-23	-13	-4	6	15
2010	-111	38	48	58	67	77	86	96	106	115	125	-73	-63	-54	-44	-34	-25	-15	-6	4	14
2011	-122	38	48	58	67	77	86	96	106	115	125	-84	-74	-65	-55	-45	-36	-26	-16	-7	3
2012	-218	38	48	58	67	77	86	96	106	115	125	-180	-170	-160	-151	-141	-132	-122	-112	-103	-93
2013	-108	38	48	58	67	77	86	96	106	115	125	-69	-60	-50	-41	-31	-21	-12	-2	7	17
2014	-106	38	48	58	67	77	86	96	106	115	125	-67	-57	-48	-38	-29	-19	-9	0	10	19
2015	-103	38	48	58	67	77	86	96	106	115	125	-65	-55	-46	-36	-26	-17	-7	3	12	22
2016	-432	38	48	58	67	77	86	96	106	115	125	-394	-384	-374	-365	-355	-345	-336	-326	-317	-307
2017	-98	38	48	58	67	77	86	96	106	115	125	-60	-50	-41	-31	-22	-12	-2	7	17	26
2018	-204	38	48	58	67	77	86	96	106	115	125	-165	-156	-146	-137	-127	-117	-108	-98	-89	-79
2019	-94	38	48	58	67	77	86	96	106	115	125	-55	-46	-36	-26	-17	-7	2	12	22	31
2020	-91	38	48	58	67	77	86	96	106	115	125	-53	-43	-34	-24	-15	-5	5	14	24	34
2021	-99	38	48	58	67	77	86	96	106	115	125	-60	-51	-41	-31	-22	-12	-3	7	17	26
2022	-87	38	48	58	67	77	86	96	106	115	125	-48	-39	-29	-19	-10	-0	9	19	29	38
2023	-84	38	48	58	67	77	86	96	106	115	125	-46	-36	-27	-17	-7	2	12	21	31	41
2024	-190	38	48	58	67	77	86	96	106	115	125	-151	-142	-132	-123	-113	-103	-94	-84	-74	-65
2025	-80	38	48	58	67	77	86	96	106	115	125	-41	-32	-22	-12	-3	7	16	26	36	45
2026	-87	38	48	58	67	77	86	96	106	115	125	-48	-39	-29	-20	-10	-0	9	19	28	38
2027	-75	38	48	58	67	77	86	96	106	115	125	-36	-27	-17	-8	2	12	21	31	40	50
2028	-73	38	48	58	67	77	86	96	106	115	125	-34	-25	-15	-5	4	14	24	33	43	52
2029	-70	38	48	58	67	77	86	96	106	115	125	-32	-22	-13	-3	7	16	26	36	45	55
2030	1,062	38	48	58	67	77	86	96	106	115	125	1,100	1,110	1,119	1,129	1,138	1,148	1,158	1,167	1,177	1,187
2031	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2032	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2033	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2034	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2035	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2036	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2037	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2038	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2039	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
2040	-0	0	0	0	0	0	0	0	0	0	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
	-5,330	1,173	1,467	1,760	2,053	2,347	2,640	2,933	3,227	3,520	3,814	-4,157	-3,863	-3,570	-3,277	-2,983	-2,690	-2,397	-2,103	-1,810	-1,517

FIRR (Grant) 1/5 - **Phase 1 only**

Case A:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
FIRR												-4.25%	-3.21%	-2.21%	-1.24%	-0.29%	0.64%	1.55%	2.45%	3.33%	4.20%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-370	0	0	0	0	0	0	0	0	0	0	-370	-370	-370	-370	-370	-370	-370	-370	-370	-370
2000	-1,250	63	79	95	111	126	142	158	174	190	205	-1,186	-1,171	-1,155	-1,139	-1,123	-1,107	-1,092	-1,076	-1,060	-1,044
2001	-1,192	64	80	96	112	128	144	160	176	192	207	-1,128	-1,112	-1,096	-1,080	-1,064	-1,048	-1,032	-1,016	-1,000	-984
2002	-62	64	81	97	113	129	145	161	177	193	209	3	19	35	51	67	83	99	116	132	148
2003	-62	65	81	98	114	130	146	163	179	195	211	3	20	36	52	68	85	101	117	133	150
2004	-62	66	82	98	115	131	148	164	180	197	213	4	20	37	53	70	86	102	119	135	152
2005	-62	66	83	99	116	132	149	166	182	199	215	5	21	38	54	71	87	104	120	137	154
2006	-179	67	84	100	117	134	150	167	184	200	217	-112	-96	-79	-62	-45	-29	-12	5	21	38
2007	-62	67	84	101	118	135	152	169	185	202	219	6	23	39	56	73	90	107	124	141	157
2008	-62	68	85	102	119	136	153	170	187	204	221	6	23	40	57	74	91	108	125	142	159
2009	-62	69	86	103	120	137	154	171	189	206	223	7	24	41	58	76	93	110	127	144	161
2010	-64	69	86	104	121	138	156	173	190	208	225	5	22	40	57	74	92	109	126	143	161
2011	-76	69	86	104	121	138	156	173	190	208	225	-7	10	28	45	62	79	97	114	131	149
2012	-174	69	86	104	121	138	156	173	190	208	225	-105	-88	-71	-53	-36	-19	-1	16	33	50
2013	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2014	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2015	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2016	-398	69	86	104	121	138	156	173	190	208	225	-329	-311	-294	-277	-259	-242	-225	-208	-190	-173
2017	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2018	-174	69	86	104	121	138	156	173	190	208	225	-105	-88	-71	-53	-36	-19	-1	16	33	50
2019	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2020	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2021	-76	69	86	104	121	138	156	173	190	208	225	-7	10	28	45	62	79	97	114	131	149
2022	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2023	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2024	-174	69	86	104	121	138	156	173	190	208	225	-105	-88	-71	-53	-36	-19	-1	16	33	50
2025	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2026	-76	69	86	104	121	138	156	173	190	208	225	-7	10	28	45	62	79	97	114	131	149
2027	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2028	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2029	-67	69	86	104	121	138	156	173	190	208	225	3	20	37	54	72	89	106	124	141	158
2030	1,063	69	86	104	121	138	156	173	190	208	225	1,132	1,149	1,167	1,184	1,201	1,218	1,236	1,253	1,270	1,288
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4,386	2,112	2,640	3,168	3,696	4,224	4,752	5,280	5,808	6,336	6,864	-2,274	-1,745	-1,217	-689	-161	367	895	1,423	1,951	2,479

FIRR (Grant) 2/5 - Phase 1 only

Case B:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
FIRR												-4.72%	-3.78%	-2.88%	-1.99%	-1.13%	-0.29%	0.54%	1.35%	2.15%	2.94%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-370	0	0	0	0	0	0	0	0	0	0	-370	-370	-370	-370	-370	-370	-370	-370	-370	-370
2000	-1,250	56	70	84	98	112	126	140	155	169	183	-1,193	-1,179	-1,165	-1,151	-1,137	-1,123	-1,109	-1,095	-1,081	-1,067
2001	-1,192	57	71	85	99	114	128	142	156	170	184	-1,135	-1,121	-1,107	-1,093	-1,078	-1,064	-1,050	-1,036	-1,022	-1,007
2002	-62	57	72	86	100	115	129	143	158	172	186	-4	10	24	39	53	67	82	96	110	125
2003	-62	58	72	87	101	116	130	145	159	173	188	-4	11	25	40	54	68	83	97	112	126
2004	-62	58	73	87	102	117	131	146	160	175	190	-3	11	26	40	55	70	84	99	113	128
2005	-62	59	74	88	103	118	132	147	162	177	191	-3	12	27	41	56	71	86	100	115	130
2006	-179	59	74	89	104	119	134	148	163	178	193	-120	-105	-90	-75	-60	-45	-31	-16	-1	14
2007	-62	60	75	90	105	120	135	150	165	180	195	-2	13	28	43	58	73	88	103	118	133
2008	-62	60	76	91	106	121	136	151	166	181	196	-1	14	29	44	59	74	89	105	120	135
2009	-62	61	76	91	107	122	137	152	168	183	198	-1	15	30	45	60	76	91	106	121	137
2010	-64	61	77	92	108	123	138	154	169	184	200	-3	13	28	43	59	74	90	105	120	136
2011	-76	61	77	92	108	123	138	154	169	184	200	-15	1	16	31	47	62	77	93	108	124
2012	-174	61	77	92	108	123	138	154	169	184	200	-113	-98	-82	-67	-51	-36	-21	-5	10	25
2013	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2014	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2015	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2016	-398	61	77	92	108	123	138	154	169	184	200	-336	-321	-306	-290	-275	-259	-244	-229	-213	-198
2017	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2018	-174	61	77	92	108	123	138	154	169	184	200	-113	-98	-82	-67	-51	-36	-21	-5	10	25
2019	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2020	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2021	-76	61	77	92	108	123	138	154	169	184	200	-15	1	16	31	47	62	77	93	108	124
2022	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2023	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2024	-174	61	77	92	108	123	138	154	169	184	200	-113	-98	-82	-67	-51	-36	-21	-5	10	25
2025	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2026	-76	61	77	92	108	123	138	154	169	184	200	-15	1	16	31	47	62	77	93	108	124
2027	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2028	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2029	-67	61	77	92	108	123	138	154	169	184	200	-5	10	26	41	56	72	87	102	118	133
2030	1,063	61	77	92	108	123	138	154	169	184	200	1,124	1,140	1,155	1,170	1,186	1,201	1,217	1,232	1,247	1,263
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-4,386	1,877	2,347	2,816	3,285	3,755	4,224	4,694	5,163	5,632	6,102	-2,508	-2,039	-1,569	-1,100	-631	-161	308	777	1,247	1,716

FIRR (Grant) 3/5 - **Phase 1 only**

Case C:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
FIRR												-5.19%	-4.36%	-3.55%	-2.76%	-1.99%	-1.24%	-0.50%	0.23%	0.95%	1.65%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-370	0	0	0	0	0	0	0	0	0	0	-370	-370	-370	-370	-370	-370	-370	-370	-370	-370
2000	-1,250	49	61	74	86	98	111	123	135	147	160	-1,200	-1,188	-1,176	-1,164	-1,151	-1,139	-1,127	-1,114	-1,102	-1,090
2001	-1,192	50	62	74	87	99	112	124	137	149	161	-1,142	-1,130	-1,117	-1,105	-1,093	-1,080	-1,068	-1,055	-1,043	-1,031
2002	-62	50	63	75	88	100	113	125	138	150	163	-12	1	14	26	39	51	64	76	89	101
2003	-62	51	63	76	89	101	114	126	139	152	164	-11	2	14	27	40	52	65	77	90	103
2004	-62	51	64	77	89	102	115	128	140	153	166	-11	2	15	28	40	53	66	79	92	104
2005	-62	52	64	77	90	103	116	129	142	155	167	-10	3	16	29	41	54	67	80	93	106
2006	-179	52	65	78	91	104	117	130	143	156	169	-127	-114	-101	-88	-75	-62	-49	-36	-23	-10
2007	-62	52	66	79	92	105	118	131	144	157	170	-9	4	17	30	43	56	69	83	96	109
2008	-62	53	66	79	93	106	119	132	145	159	172	-9	4	18	31	44	57	71	84	97	110
2009	-62	53	67	80	93	107	120	133	147	160	173	-8	5	18	32	45	58	72	85	98	112
2010	-64	54	67	81	94	108	121	135	148	161	175	-10	3	17	30	43	57	70	84	97	111
2011	-76	54	67	81	94	108	121	135	148	161	175	-22	-9	4	18	31	45	58	72	85	99
2012	-174	54	67	81	94	108	121	135	148	161	175	-121	-107	-94	-80	-67	-53	-40	-26	-13	0
2013	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2014	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2015	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2016	-398	54	67	81	94	108	121	135	148	161	175	-344	-331	-317	-304	-290	-277	-263	-250	-236	-223
2017	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2018	-174	54	67	81	94	108	121	135	148	161	175	-121	-107	-94	-80	-67	-53	-40	-26	-13	0
2019	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2020	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2021	-76	54	67	81	94	108	121	135	148	161	175	-22	-9	4	18	31	45	58	72	85	99
2022	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2023	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2024	-174	54	67	81	94	108	121	135	148	161	175	-121	-107	-94	-80	-67	-53	-40	-26	-13	0
2025	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2026	-76	54	67	81	94	108	121	135	148	161	175	-22	-9	4	18	31	45	58	72	85	99
2027	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2028	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2029	-67	54	67	81	94	108	121	135	148	161	175	-13	1	14	28	41	54	68	81	95	108
2030	1,063	54	67	81	94	108	121	135	148	161	175	1,117	1,130	1,143	1,157	1,170	1,184	1,197	1,211	1,224	1,238
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-4,386	1,643	2,053	2,464	2,875	3,285	3,696	4,107	4,518	4,928	5,339	-2,743	-2,332	-1,921	-1,511	-1,100	-689	-279	132	543	953

FIRR (Grant) 4/5 - **Phase 1 only**

Case D:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
FIRR												-5.67%	-4.95%	-4.25%	-3.55%	-2.88%	-2.21%	-1.56%	-0.92%	-0.29%	0.34%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-370	0	0	0	0	0	0	0	0	0	0	-370	-370	-370	-370	-370	-370	-370	-370	-370	-370
2000	-1,250	42	53	63	74	84	95	105	116	126	137	-1,207	-1,197	-1,186	-1,176	-1,165	-1,155	-1,144	-1,134	-1,123	-1,113
2001	-1,192	43	53	64	74	85	96	106	117	128	138	-1,149	-1,139	-1,128	-1,117	-1,107	-1,096	-1,086	-1,075	-1,064	-1,054
2002	-62	43	54	64	75	86	97	107	118	129	140	-19	-8	3	14	24	35	46	57	67	78
2003	-62	43	54	65	76	87	98	108	119	130	141	-18	-7	3	14	25	36	47	58	68	79
2004	-62	44	55	66	77	87	98	109	120	131	142	-18	-7	4	15	26	37	48	59	70	81
2005	-62	44	55	66	77	88	99	110	121	132	143	-17	-6	5	16	27	38	49	60	71	82
2006	-179	45	56	67	78	89	100	111	122	134	145	-134	-123	-112	-101	-90	-79	-68	-57	-45	-34
2007	-62	45	56	67	79	90	101	112	124	135	146	-17	-5	6	17	28	39	51	62	73	84
2008	-62	45	57	68	79	91	102	113	125	136	147	-16	-5	6	18	29	40	52	63	74	86
2009	-62	46	57	69	80	91	103	114	126	137	149	-16	-4	7	18	30	41	53	64	76	87
2010	-64	46	58	69	81	92	104	115	127	138	150	-18	-6	5	17	28	40	51	63	74	86
2011	-76	46	58	69	81	92	104	115	127	138	150	-30	-19	-7	4	16	28	39	51	62	74
2012	-174	46	58	69	81	92	104	115	127	138	150	-128	-117	-105	-94	-82	-71	-59	-48	-36	-25
2013	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2014	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2015	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2016	-398	46	58	69	81	92	104	115	127	138	150	-352	-340	-329	-317	-306	-294	-282	-271	-259	-248
2017	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2018	-174	46	58	69	81	92	104	115	127	138	150	-128	-117	-105	-94	-82	-71	-59	-48	-36	-25
2019	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2020	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2021	-76	46	58	69	81	92	104	115	127	138	150	-30	-19	-7	4	16	28	39	51	62	74
2022	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2023	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2024	-174	46	58	69	81	92	104	115	127	138	150	-128	-117	-105	-94	-82	-71	-59	-48	-36	-25
2025	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2026	-76	46	58	69	81	92	104	115	127	138	150	-30	-19	-7	4	16	28	39	51	62	74
2027	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2028	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2029	-67	46	58	69	81	92	104	115	127	138	150	-21	-9	3	14	26	37	49	60	72	83
2030	1,063	46	58	69	81	92	104	115	127	138	150	1,109	1,120	1,132	1,143	1,155	1,167	1,178	1,190	1,201	1,213
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-4,386	1,408	1,760	2,112	2,464	2,816	3,168	3,520	3,872	4,224	4,576	-2,978	-2,626	-2,274	-1,921	-1,569	-1,217	-865	-513	-161	191

FIRR (Grant) 1/5 - **Phase 1 only**

Case F:

	EXPENDITURE	RECEIPT BY EXPECTED COLLECTION RATIO										NET CASH FLOW IN (OUT) & FIRR									
Monthly tariff		80	100	120	140	160	180	200	220	240	260	80	100	120	140	160	180	200	220	240	260
Collection rates		50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
FIRR												-6.17%	-5.55%	-4.95%	-4.36%	-3.78%	-3.21%	-2.65%	-2.10%	-1.56%	-1.02%
1998	-13	0	0	0	0	0	0	0	0	0	0	-13	-13	-13	-13	-13	-13	-13	-13	-13	-13
1999	-370	0	0	0	0	0	0	0	0	0	0	-370	-370	-370	-370	-370	-370	-370	-370	-370	-370
2000	-1,250	35	44	53	61	70	79	88	97	105	114	-1,214	-1,206	-1,197	-1,188	-1,179	-1,171	-1,162	-1,153	-1,144	-1,135
2001	-1,192	35	44	53	62	71	80	89	98	106	115	-1,156	-1,148	-1,139	-1,130	-1,121	-1,112	-1,103	-1,094	-1,086	-1,077
2002	-62	36	45	54	63	72	81	89	98	107	116	-26	-17	-8	1	10	19	28	37	46	55
2003	-62	36	45	54	63	72	81	90	99	108	117	-25	-16	-7	2	11	20	29	38	47	56
2004	-62	36	46	55	64	73	82	91	100	109	118	-25	-16	-7	2	11	20	30	39	48	57
2005	-62	37	46	55	64	74	83	92	101	110	120	-25	-16	-6	3	12	21	30	40	49	58
2006	-179	37	46	56	65	74	84	93	102	111	121	-142	-133	-123	-114	-105	-96	-86	-77	-68	-58
2007	-62	37	47	56	66	75	84	94	103	112	122	-24	-15	-5	4	13	23	32	41	51	60
2008	-62	38	47	57	66	76	85	94	104	113	123	-24	-14	-5	4	14	23	33	42	52	61
2009	-62	38	48	57	67	76	86	95	105	114	124	-24	-14	-4	5	15	24	34	43	53	62
2010	-64	38	48	58	67	77	86	96	106	115	125	-26	-16	-6	3	13	22	32	42	51	61
2011	-76	38	48	58	67	77	86	96	106	115	125	-38	-28	-19	-9	1	10	20	29	39	49
2012	-174	38	48	58	67	77	86	96	106	115	125	-136	-126	-117	-107	-98	-88	-78	-69	-59	-50
2013	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2014	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2015	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2016	-398	38	48	58	67	77	86	96	106	115	125	-359	-350	-340	-331	-321	-311	-302	-292	-282	-273
2017	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2018	-174	38	48	58	67	77	86	96	106	115	125	-136	-126	-117	-107	-98	-88	-78	-69	-59	-50
2019	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2020	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2021	-76	38	48	58	67	77	86	96	106	115	125	-38	-28	-19	-9	1	10	20	29	39	49
2022	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2023	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2024	-174	38	48	58	67	77	86	96	106	115	125	-136	-126	-117	-107	-98	-88	-78	-69	-59	-50
2025	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2026	-76	38	48	58	67	77	86	96	106	115	125	-38	-28	-19	-9	1	10	20	29	39	49
2027	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2028	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2029	-67	38	48	58	67	77	86	96	106	115	125	-28	-19	-9	1	10	20	29	39	49	58
2030	1,063	38	48	58	67	77	86	96	106	115	125	1,101	1,111	1,120	1,130	1,140	1,149	1,159	1,168	1,178	1,188
2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-4,386	1,173	1,467	1,760	2,053	2,347	2,640	2,933	3,227	3,520	3,814	-3,212	-2,919	-2,626	-2,332	-2,039	-1,745	-1,452	-1,159	-865	-572

Expenditure for FIRR - **Phase 1 only**

Total Expenditure: (Capital Expenditures, Operating & Maintenance Expenditures, and Terminal Value): By Type of Financial Sources								
	Case # 1: Loan only				Case # 3: Grant Aid			
Year	Capital Expend	Ope. & Maint.	Terminal value	Total	Capital	Ope. & Maint.	Terminal	Total
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
1998	0	13		13	0	13		13
1999	371	0		371	370	0		370
2000	1,251	11		1,263	1,238	11		1,250
2001	1,166	62		1,228	1,130	62		1,192
2002	47	62		109	0	62		62
2003	47	62		109	0	62		62
2004	47	62		109	0	62		62
2005	47	62		109	0	62		62
2006	155	71		226	108	71		179
2007	47	62		109	0	62		62
2008	47	62		109	0	62		62
2009	47	62		109	0	62		62
2010	47	64		111	0	64		64
2011	46	76		122	0	76		76
2012	151	67		218	108	67		174
2013	41	67		108	0	67		67
2014	39	67		106	0	67		67
2015	37	67		103	0	67		67
2016	356	76		432	322	76		398
2017	32	67		98	0	67		67
2018	137	67		204	108	67		174
2019	27	67		94	0	67		67
2020	25	67		91	0	67		67
2021	22	76		99	0	76		76
2022	20	67		87	0	67		67
2023	18	67		84	0	67		67
2024	123	67		190	108	67		174
2025	13	67		80	0	67		67
2026	11	76		87	0	76		76
2027	8	67		75	0	67		67
2028	6	67		73	0	67		67
2029	4	67		70	0	67		67
2030	109	67	-1,237	-1,062	108	67	-1,237	-1,063
2031	0	0		0	0	0		0
2032	0	0		0	0	0		0
2033	0	0		0	0	0		0
2034	0	0		0	0	0		0
2035	0	0		0	0	0		0
2036	0	0		0	0	0		0
2037	0	0		0	0	0		0
2038	0	0		0	0	0		0
2039	0	0		0	0	0		0
2040	0	0		0	0	0		0
Total	4,543	2,024	-1,237	5,330	3,599	2,024	-1,237	4,386

Capital (Loan) - **Phase 1 only**

	Foreign Aid in the form of Loans					Foreign Aid form of Grants	Internal Fund			Total Capital Expenditure (D+F+G+J)
	Opening	Transactions		Ending	Interest		Initial	Subsequent	Total	
Year	Balance	Repayment	Borrowing	Balance	2.10%		(Land, etc.)	Replacement	Disbursemen	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1998	0	0	0	0	0			0	0	0
1999	0		60	60	1		310	0	310	371
2000	60		1,116	1,176	13		122	0	122	1,251
2001	1,176		1,067	2,243	36		63	0	63	1,166
2002	2,243			2,243	47			0	0	47
2003	2,243			2,243	47			0	0	47
2004	2,243			2,243	47			0	0	47
2005	2,243			2,243	47			0	0	47
2006	2,243			2,243	47			108	108	155
2007	2,243			2,243	47			0	0	47
2008	2,243		0	2,243	47		0	0	0	47
2009	2,243		0	2,243	47		0	0	0	47
2010	2,243		0	2,243	47		0	0	0	47
2011	2,243	-112		2,131	46			0	0	46
2012	2,131	-112		2,019	44			108	108	151
2013	2,019	-112		1,907	41			0	0	41
2014	1,907	-112		1,795	39			0	0	39
2015	1,795	-112		1,682	37			0	0	37
2016	1,682	-112		1,570	34			322	322	356
2017	1,570	-112		1,458	32			0	0	32
2018	1,458	-112		1,346	29			108	108	137
2019	1,346	-112		1,234	27			0	0	27
2020	1,234	-112		1,122	25			0	0	25
2021	1,122	-112		1,009	22			0	0	22
2022	1,009	-112		897	20			0	0	20
2023	897	-112		785	18			0	0	18
2024	785	-112		673	15			108	108	123
2025	673	-112		561	13			0	0	13
2026	561	-112		449	11			0	0	11
2027	449	-112		336	8			0	0	8
2028	336	-112		224	6			0	0	6
2029	224	-112		112	4			0	0	4
2030	112	-112		0	1			108	108	109
2031	0	0		0	0			0	0	0
2032	0	0		0	0			0	0	0
2033	0	0		0	0			0	0	0
2034	0	0		0	0			0	0	0
2035	0	0		0	0			0	0	0
2036	0	0		0	0			0	0	0
2037	0	0		0	0			0	0	0
2038	0	0		0	0			0	0	0
2039	0	0		0	0			0	0	0
2040	0	0		0	0			0	0	0
Total		-2,243	2,243		945	0	495	861	1,356	4,543

Capital (Grant) - **Phase 1 only**

	Foreign Aid in the form of Loans					Foreign Aid	Internal Fund			Total Capital
	Opening	Transactions		Ending	Interest	form of	Initial	Subsequent	Total	Expenditure
Year	Balance	Repayment	Borrowing	Balance	2.10%	Grants	(Land, etc.)	Replacement	Disbursemen	(D+F+G+J)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1998	0	0	0	0	0			0	0	0
1999	0			0	0	88	283	0	283	370
2000	0			0	0	1,228	10	0	10	1,238
2001	0			0	0	1,120	10	0	10	1,130
2002	0			0	0			0	0	0
2003	0			0	0			0	0	0
2004	0			0	0			0	0	0
2005	0			0	0			0	0	0
2006	0			0	0			108	108	108
2007	0			0	0			0	0	0
2008	0			0	0	0	0	0	0	0
2009	0			0	0	0	0	0	0	0
2010	0			0	0	0	0	0	0	0
2011	0	0		0	0			0	0	0
2012	0	0		0	0			108	108	108
2013	0	0		0	0			0	0	0
2014	0	0		0	0			0	0	0
2015	0	0		0	0			0	0	0
2016	0	0		0	0			322	322	322
2017	0	0		0	0			0	0	0
2018	0	0		0	0			108	108	108
2019	0	0		0	0			0	0	0
2020	0	0		0	0			0	0	0
2021	0	0		0	0			0	0	0
2022	0	0		0	0			0	0	0
2023	0	0		0	0			0	0	0
2024	0	0		0	0			108	108	108
2025	0	0		0	0			0	0	0
2026	0	0		0	0			0	0	0
2027	0	0		0	0			0	0	0
2028	0	0		0	0			0	0	0
2029	0	0		0	0			0	0	0
2030	0	0		0	0			108	108	108
2031	0	0		0	0			0	0	0
2032	0	0		0	0			0	0	0
2033	0	0		0	0			0	0	0
2034	0	0		0	0			0	0	0
2035	0	0		0	0			0	0	0
2036	0	0		0	0			0	0	0
2037	0	0		0	0			0	0	0
2038	0	0		0	0			0	0	0
2039	0	0		0	0			0	0	0
2040	0	0		0	0			0	0	0
Total		0	0		0	2,436	303	861	1,163	3,599

Initial - **Phase 1 only**

	Initial Investment Amounts						Loan				Grant Aid			
							Internal fund (15 % of total investment)			External fund	Internal fund			External fund
Year	Land Acquisition	Local Administration	Construction	Procurement Equipment	Engineering Service	Total Investment	Land & admin	Other portion	Total	(85 % of total)	Land & admin	Other portion	Total	(Balance)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1998						0	0	0	0	0	0		0	0
1999	260	10			100	370	270	40	310	60	270	13	283	88
2000		10	1,080	108	40	1,238	10	112	122	1,116	10		10	1,228
2001		10	1,080		40	1,130	10	53	63	1,067	10		10	1,120
2002						0	0	0	0	0	0		0	0
2003						0	0	0	0	0	0		0	0
2004						0	0	0	0	0	0		0	0
2005						0	0	0	0	0	0		0	0
2006						0	0	0	0	0	0		0	0
2007						0	0	0	0	0	0		0	0
2008						0	0	0	0	0	0		0	0
2009						0	0	0	0	0	0		0	0
2010						0	0	0	0	0	0		0	0
2011						0	0	0	0	0	0		0	0
2012						0	0	0	0	0	0		0	0
2013						0	0	0	0	0	0		0	0
2014						0	0	0	0	0	0		0	0
2015						0	0	0	0	0	0		0	0
2016						0	0	0	0	0	0		0	0
2017						0	0	0	0	0	0		0	0
2018						0	0	0	0	0	0		0	0
2019						0	0	0	0	0	0		0	0
2020						0	0	0	0	0	0		0	0
2021						0	0	0	0	0	0		0	0
2022						0	0	0	0	0	0		0	0
2023						0	0	0	0	0	0		0	0
2024						0	0	0	0	0	0		0	0
2025						0	0	0	0	0	0		0	0
2026						0	0	0	0	0	0		0	0
2027						0	0	0	0	0	0		0	0
2028						0	0	0	0	0	0		0	0
2029						0	0	0	0	0	0		0	0
2030						0	0	0	0	0	0		0	0
2031						0	0	0	0	0	0		0	0
2032						0	0	0	0	0	0		0	0
2033						0	0	0	0	0	0		0	0
2034						0	0	0	0	0	0		0	0
2035						0	0	0	0	0	0		0	0
2036						0	0	0	0	0	0		0	0
2037						0	0	0	0	0	0		0	0
2038						0	0	0	0	0	0		0	0
2039						0	0	0	0	0	0		0	0
2040						0	0	0	0	0	0		0	0
Total	260	30	2,161	108	180	2,738	290	205	495	2,243	290	13	303	2,436

Replacement - **Phase 1 only**

	Construction							Procurement of maintenance equipment			Grand Total	Subtraction	Subsequent Disbursement
	Structure (1)	Engineering (1)	Machinery (1)	Structure (2)	Engineering (2)	Machinery (2)	Total	Vehicles (1)	Vehicles (2)	Total		Initial Disbursements	
Year	50	50	15	50	50	15	B+C+D+E+F+G	6	6	(I+J)	(H+K)		(L-M)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
1998							0			0	0		0
1999		100					100			0	100	-100	0
2000	1,080	40					1,120	108		108	1,228	-1,228	0
2001	759	40	322				1,120			0	1,120	-1,120	0
2002							0			0	0		0
2003							0			0	0		0
2004							0			0	0		0
2005							0			0	0		0
2006							0	108		108	108		108
2007							0			0	0		0
2008							0			0	0	0	0
2009							0			0	0	0	0
2010							0			0	0	0	0
2011							0			0	0		0
2012							0	108		108	108		108
2013							0			0	0		0
2014							0			0	0		0
2015							0			0	0		0
2016			322				322			0	322		322
2017							0			0	0		0
2018							0	108		108	108		108
2019							0			0	0		0
2020							0			0	0		0
2021							0			0	0		0
2022							0			0	0		0
2023							0			0	0		0
2024							0	108		108	108		108
2025						0	0			0	0		0
2026							0			0	0		0
2027							0			0	0		0
2028							0			0	0		0
2029							0			0	0		0
2030							0	108		108	108		108
2031							0			0	0		0
2032							0			0	0		0
2033							0			0	0		0
2034							0			0	0		0
2035							0			0	0		0
2036							0			0	0		0
2037							0			0	0		0
2038							0			0	0		0
2039							0		0	0	0		0
2040						0	0			0	0		0
Total	1,839	180	643	0	0	0	2,662	647	0	647	3,309	-2,448	861

Operating & Maintenance - **Phase 1 only**

Year	Sewer Cleaning			Wastewater Treatment plant							Admin.. Planing	Audit fee	Total
	Payroll	Fuel	Total	Payroll	Electric	Chemical	Repairs	Overhaul # 1	Overhaul # 2	Total			
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
1998	0		0							0	13	0	13
1999	0		0							0		0	0
2000	0	0	0							0	6	5	11
2001	11	3	14	6	21	5	3			36	6	5	62
2002	11	3	14	6	21	5	3			36	6	5	62
2003	11	3	14	6	21	5	3			36	6	5	62
2004	11	3	14	6	21	5	3			36	6	5	62
2005	11	3	14	6	21	5	3			36	6	5	62
2006	11	3	14	6	21	5	3	10		46	6	5	71
2007	11	3	14	6	21	5	3			36	6	5	62
2008	11	3	14	6	21	5	3			36	6	5	62
2009	11	3	14	6	21	5	3			36	6	5	62
2010	11	3	14	6	21	5	3			36	9	5	64
2011	11	3	14	9	21	5	3	10		48	9	5	76
2012	11	3	14	9	21	5	3			39	9	5	67
2013	11	3	14	9	21	5	3			39	9	5	67
2014	11	3	14	9	21	5	3			39	9	5	67
2015	11	3	14	9	21	5	3			39	9	5	67
2016	11	3	14	9	21	5	3	10		48	9	5	76
2017	11	3	14	9	21	5	3			39	9	5	67
2018	11	3	14	9	21	5	3			39	9	5	67
2019	11	3	14	9	21	5	3			39	9	5	67
2020	11	3	14	9	21	5	3			39	9	5	67
2021	11	3	14	9	21	5	3	10		48	9	5	76
2022	11	3	14	9	21	5	3			39	9	5	67
2023	11	3	14	9	21	5	3			39	9	5	67
2024	11	3	14	9	21	5	3			39	9	5	67
2025	11	3	14	9	21	5	3			39	9	5	67
2026	11	3	14	9	21	5	3	10		48	9	5	76
2027	11	3	14	9	21	5	3			39	9	5	67
2028	11	3	14	9	21	5	3			39	9	5	67
2029	11	3	14	9	21	5	3			39	9	5	67
2030	11	3	14	9	21	5	3			39	9	5	67
2031			0										0
2032			0										0
2033			0										0
2034			0										0
2035			0										0
2036			0										0
2037			0										0
2038			0										0
2039			0										0
2040			0										0
Total	335	84	419	245	631	164	96	48	0	1,184	266	155	2,024

Depreciation - Phase 1 only

	Construction					Procurement of maintenance equipment			
	Structure (1)	Machinery (1)	Structure (2)	Machinery (2)	Total	Vehicles (1)	Vehicles (2)	Total	Grand Total
Year	50	15	50	15		6	6		
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
1999					0			0	0
2000					0			0	0
2001					0	18		18	18
2002	40	21			62	18		18	80
2003	40	21			62	18		18	80
2004	40	21			62	18		18	80
2005	40	21			62	18		18	80
2006	40	21			62	18		18	80
2007	40	21			62	18		18	80
2008	40	21			62	18		18	80
2009	40	21			62	18		18	80
2010	40	21			62	18	0	18	80
2011	40	21	0	0	62	18	0	18	80
2012	40	21	0	0	62	18	0	18	80
2013	40	21	0	0	62	18	0	18	80
2014	40	21	0	0	62	18	0	18	80
2015	40	21	0	0	62	18	0	18	80
2016	40	21	0	0	62	18	0	18	80
2017	40	21	0	0	62	18	0	18	80
2018	40	21	0	0	62	18	0	18	80
2019	40	21	0	0	62	18	0	18	80
2020	40	21	0	0	62	18	0	18	80
2021	40	21	0	0	62	18	0	18	80
2022	40	21	0	0	62	18	0	18	80
2023	40	21	0	0	62	18	0	18	80
2024	40	21	0	0	62	18	0	18	80
2025	40	21	0	0	62	18	0	18	80
2026	40	21	0	0	62	18	0	18	80
2027	40	21	0	0	62	18	0	18	80
2028	40	21	0	0	62	18	0	18	80
2029	40	21	0	0	62	18	0	18	80
2030	40	21	0	0	62	18	0	18	80
2031			0	0	0		0	0	0
2032			0	0	0		0	0	0
2033			0	0	0		0	0	0
2034			0	0	0		0	0	0
2035			0	0	0		0	0	0
2036			0	0	0		0	0	0
2037			0	0	0		0	0	0
2038			0	0	0		0	0	0
2039			0	0	0		0	0	0
2040			0	0	0		0	0	0
Total	1,171	622	0	0	1,793	539	0	539	2,332
Cost	2,019	322	0	0	2,341	108	0	108	2,448
Acc.Dep	-1,171	-300	0	0	-1,471	0	0	0	-1,471
NBV	848	21	0	0	869	108	0	108	977
								Land	260
								Terminal Value	1,237

Revenue - Phase 1 only

Year	Volume of Wastewater	Collection Fee Rate	Tariff Revenue Net of Collection Fee to Water-Supply Enterprise before considering possible write-off Break Down by Monthly Tariff Rate									
			80	100	120	140	160	180	200	220	240	260
1998	0	3.00%	0	0	0	0	0	0	0	0	0	0
1999	0	3.00%	0	0	0	0	0	0	0	0	0	0
2000	63,230	3.00%	70	88	105	123	140	158	176	193	211	228
2001	63,865	3.00%	71	89	106	124	142	160	177	195	213	231
2002	64,459	3.00%	72	89	107	125	143	161	179	197	215	233
2003	65,053	3.00%	72	90	108	126	145	163	181	199	217	235
2004	65,646	3.00%	73	91	109	128	146	164	182	201	219	237
2005	66,240	3.00%	74	92	110	129	147	166	184	202	221	239
2006	66,834	3.00%	74	93	111	130	148	167	186	204	223	241
2007	67,428	3.00%	75	94	112	131	150	169	187	206	225	243
2008	68,022	3.00%	76	94	113	132	151	170	189	208	227	246
2009	68,616	3.00%	76	95	114	133	152	171	191	210	229	248
2010	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2011	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2012	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2013	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2014	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2015	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2016	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2017	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2018	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2019	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2020	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2021	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2022	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2023	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2024	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2025	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2026	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2027	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2028	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2029	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2030	69,210	3.00%	77	96	115	135	154	173	192	211	231	250
2031	0	3.00%	0	0	0	0	0	0	0	0	0	0
2032	0	3.00%	0	0	0	0	0	0	0	0	0	0
2033	0	3.00%	0	0	0	0	0	0	0	0	0	0
2034	0	3.00%	0	0	0	0	0	0	0	0	0	0
2035	0	3.00%	0	0	0	0	0	0	0	0	0	0
2036	0	3.00%	0	0	0	0	0	0	0	0	0	0
2037	0	3.00%	0	0	0	0	0	0	0	0	0	0
2038	0	3.00%	0	0	0	0	0	0	0	0	0	0
2039	0	3.00%	0	0	0	0	0	0	0	0	0	0
2040	0	3.00%	0	0	0	0	0	0	0	0	0	0
Total			2,347	2,933	3,520	4,107	4,694	5,280	5,867	6,454	7,040	7,627

Wastewater Volume - **Phase 1 only**

	Domestic				Non-Domestic Watewater	Total Watewater Volume	Maximum Treatment Capacity	Capacity Allowance (H-G)
Year	Estimated Population	Daily Water Consumption	Leakage ratio	Watewater Volume				
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
1998	0	0.170	0.20	0		0		
1999	0	0.170	0.20	0		0		
2000	354,629	0.170	0.20	48,230	15,000	63,230	50,000	-13,230
2001	359,300	0.170	0.20	48,865	15,000	63,865	50,000	-13,865
2002	363,667	0.170	0.20	49,459	15,000	64,459	50,000	-14,459
2003	368,033	0.170	0.20	50,053	15,000	65,053	50,000	-15,053
2004	372,400	0.170	0.20	50,646	15,000	65,646	50,000	-15,646
2005	376,767	0.170	0.20	51,240	15,000	66,240	50,000	-16,240
2006	381,133	0.170	0.20	51,834	15,000	66,834	50,000	-16,834
2007	385,500	0.170	0.20	52,428	15,000	67,428	50,000	-17,428
2008	389,867	0.170	0.20	53,022	15,000	68,022	50,000	-18,022
2009	394,233	0.170	0.20	53,616	15,000	68,616	50,000	-18,616
2010	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2011	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2012	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2013	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2014	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2015	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2016	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2017	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2018	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2019	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2020	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2021	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2022	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2023	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2024	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2025	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2026	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2027	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2028	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2029	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2030	398,600	0.170	0.20	54,210	15,000	69,210	50,000	-19,210
2031		0.170	0.20	0		0		0
2032		0.170	0.20	0		0		0
2033		0.170	0.20	0		0		0
2034		0.170	0.20	0		0		0
2035		0.170	0.20	0		0		0
2036		0.170	0.20	0		0		0
2037		0.170	0.20	0		0		0
2038		0.170	0.20	0		0		0
2039		0.170	0.20	0		0		0
2040		0.170	0.20	0		0		0

Local - **Phase 1 only**

	Case # 1: Loan only						Case # 3: Grant Aid					
	Internal						Internal					
Year	Initial	Subsequent	O & M	Repayment	Interest	Total	Initial	Subsequent	O & M	Repayment	Interest	Total
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
1998	0	0	13	0	0	13	0	0	13	0	0	13
1999	310	0	0	0	1	311	283	0	0	0	0	283
2000	122	0	11	0	13	146	10	0	11	0	0	21
2001	63	0	62	0	36	161	10	0	62	0	0	72
2002	0	0	62	0	47	109	0	0	62	0	0	62
2003	0	0	62	0	47	109	0	0	62	0	0	62
2004	0	0	62	0	47	109	0	0	62	0	0	62
2005	0	0	62	0	47	109	0	0	62	0	0	62
2006	0	108	71	0	47	226	0	108	71	0	0	179
2007	0	0	62	0	47	109	0	0	62	0	0	62
2008	0	0	62	0	47	109	0	0	62	0	0	62
2009	0	0	62	0	47	109	0	0	62	0	0	62
2010	0	0	64	0	47	111	0	0	64	0	0	64
2011	0	0	76	112	46	234	0	0	76	0	0	76
2012	0	108	67	112	44	330	0	108	67	0	0	174
2013	0	0	67	112	41	220	0	0	67	0	0	67
2014	0	0	67	112	39	218	0	0	67	0	0	67
2015	0	0	67	112	37	215	0	0	67	0	0	67
2016	0	322	76	112	34	544	0	322	76	0	0	398
2017	0	0	67	112	32	211	0	0	67	0	0	67
2018	0	108	67	112	29	316	0	108	67	0	0	174
2019	0	0	67	112	27	206	0	0	67	0	0	67
2020	0	0	67	112	25	204	0	0	67	0	0	67
2021	0	0	76	112	22	211	0	0	76	0	0	76
2022	0	0	67	112	20	199	0	0	67	0	0	67
2023	0	0	67	112	18	196	0	0	67	0	0	67
2024	0	108	67	112	15	302	0	108	67	0	0	174
2025	0	0	67	112	13	192	0	0	67	0	0	67
2026	0	0	76	112	11	199	0	0	76	0	0	76
2027	0	0	67	112	8	187	0	0	67	0	0	67
2028	0	0	67	112	6	185	0	0	67	0	0	67
2029	0	0	67	112	4	182	0	0	67	0	0	67
2030	0	108	67	112	1	288	0	108	67	0	0	174
2031	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0
Total	495	861	2,024	2,243	945	6,567	303	861	2,024	0	0	3,187

Funding (Detail) - **Phase 1 only**

	Case # 1: Loan only						Case # 3: Grant Aid					
	External	Internal				Grand	External	Internal				Grand
Year	Initial	Initial	Subsequent	O & M	Sub-total	Total	Initial	Initial	Subsequent	O & M	Sub-total	Total
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
1998	0	0	0	13	13	13	0	0	0	13	13	13
1999	60	310	0	0	310	370	88	283	0	0	283	370
2000	1,116	122	0	11	133	1,250	1,228	10	0	11	21	1,250
2001	1,067	63	0	62	125	1,192	1,120	10	0	62	72	1,192
2002	0	0	0	62	62	62	0	0	0	62	62	62
2003	0	0	0	62	62	62	0	0	0	62	62	62
2004	0	0	0	62	62	62	0	0	0	62	62	62
2005	0	0	0	62	62	62	0	0	0	62	62	62
2006	0	0	108	71	179	179	0	0	108	71	179	179
2007	0	0	0	62	62	62	0	0	0	62	62	62
2008	0	0	0	62	62	62	0	0	0	62	62	62
2009	0	0	0	62	62	62	0	0	0	62	62	62
2010	0	0	0	64	64	64	0	0	0	64	64	64
2011	0	0	0	76	76	76	0	0	0	76	76	76
2012	0	0	108	67	174	174	0	0	108	67	174	174
2013	0	0	0	67	67	67	0	0	0	67	67	67
2014	0	0	0	67	67	67	0	0	0	67	67	67
2015	0	0	0	67	67	67	0	0	0	67	67	67
2016	0	0	322	76	398	398	0	0	322	76	398	398
2017	0	0	0	67	67	67	0	0	0	67	67	67
2018	0	0	108	67	174	174	0	0	108	67	174	174
2019	0	0	0	67	67	67	0	0	0	67	67	67
2020	0	0	0	67	67	67	0	0	0	67	67	67
2021	0	0	0	76	76	76	0	0	0	76	76	76
2022	0	0	0	67	67	67	0	0	0	67	67	67
2023	0	0	0	67	67	67	0	0	0	67	67	67
2024	0	0	108	67	174	174	0	0	108	67	174	174
2025	0	0	0	67	67	67	0	0	0	67	67	67
2026	0	0	0	76	76	76	0	0	0	76	76	76
2027	0	0	0	67	67	67	0	0	0	67	67	67
2028	0	0	0	67	67	67	0	0	0	67	67	67
2029	0	0	0	67	67	67	0	0	0	67	67	67
2030	0	0	108	67	174	174	0	0	108	67	174	174
2031	0	0	0	0	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0	0	0
Total	2,243	495	861	2,024	3,380	5,623	2,436	303	861	2,024	3,187	5,623

13.6 Conclusion and Recommendation

13.6.1 Tariff Structure for Sewer Services

(1) Introduction

This appendix outlines the various considerations in preparing a tariff structure for sewer services, which is particularly important in ensuring that the community is able to pay.

(2) Revenue Sources

In general, there are three main sources of revenue for sewer systems. Sometimes a single source meets all requirements, but more frequently, a combination of two and, sometimes, all three is used. They are as follows:

1) A direct charge to consumers
2) Allocations from the municipality
3) Subsidies from the national government and/or district governments

Even though a tariff system may be the preferred method, it may be necessary to rely on subsidies so as to stay within the community's capacity to pay.

Financing the revenue requirements of sewer services with municipal funds is a widespread practice throughout the world, at least as far as domestic connections are concerned. The major benefit is that no separate billing and revenue collection services are required. Moreover, one of the arguments often raised in favor of this is that improved overall public health is a community benefit which all members of the community benefit from, regardless of whether they are connected to the sewer system Its major drawback, however, is that revenues from the community are often raised from property taxes or other non-buoyant sources which make it difficult for the community to raise its total revenue very rapidly without a strong public backlash. Moreover, other services provided by the community are also subject to expansion, and require equal amounts of revenue so as to provide consistent service. Consequently, municipal revenues often cannot keep up with the pace of growth, necessitating the use of outside funding, i.e., from the national government. Thus, use of the second revenue source—municipal funds—can often lead to reliance on the third, i.e., those from the national government.

A tariff system has other functions besides being a source of revenue. One is to economize use of the system—to minimize usage—while at the same time providing general access to it so as to preserve public health. The general public welfare benefits brought about by a sewer system are covered at a fairly low level of service, i.e., the transport and treatment of solid waste matter and other contaminating material. Any use above this, such as the drainage of bath water or water used to wash clothes, is a service which should be paid for in proportion to the volume used. A progressive tariff is thus a way to encourage use of the sewer system in moderation. This particularly holds true for industrial users, for charges in proportion to volume of use are method of encouraging such users to economize their operations through either the advent of higher technology or recycling.

(3) Criteria for Setting Tariffs

A system of criteria is necessary when creating a tariff system, such as equity of tariffs, sufficiency of revenue, and economic efficiency.

1) Equity of Tariffs

The term equity, as used here, means that charges should be levied in proportion to the benefit received by the user. However, for public health services, it is difficult to measure the actual level of benefits received. Thus, another method of calculating this is working from the costs imposed upon the system by the user. For example, if the waste generated by one user is similar in nature to that generated by another, they will both be charged in proportion to the volume of waste produced. However, if the nature of the waste is more extreme, such as that generated by industry, cost may also be derived from the composition of the waste. In addition, another factor to be considered is the user's ability to pay. Accordingly, any tariff system should take into account the existence of these users. Preventing from utilizing the sewer system with tariffs beyond their ability to pay would result in harm to both the individual and to the general level of public health.

2) Sufficiency of Revenue

A tariff system is sufficient when it is able to raise enough revenue to meet financial objectives. These objectives are two-pronged: 1) covering the initial costs of the system; and 2) having sufficient funds to be able to adapt to changing needs.

However, sufficiency of revenue must also take the user's ability to pay into account. If rates are set to an extent that it discourages use of the sewer system or makes it such that users are unable to pay, the tariff system would then be counter-productive.

3) Economic Efficiency

It is a given that any tariff system should promote the efficient use of the service provided. Levying tariffs in proportion to the user's impact on the system, especially in the case of industry, would help promote the use of more efficient industrial processes, and in more extreme examples, actually influence the location of the industry itself, for example, in areas with more lenient tariff systems.

(4) Tariff Systems

In the following section, we examine three systems of raising revenue.

1) In Proportion to Volume

This is probably the most widely used method at present. When water usage is being metered and charged on a volume basis, adjusting rates to cover the amount of usage is fairly easy. A major benefit of this method is that it satisfies the concept of equity, for the costs imposed on the sewer system are almost directly proportional to the volume used. Another is simplicity, for covering the volume of water used for sewage purposes would merely involving adding another item to the water tariff. Economic efficiency is also satisfied, for tariffs are levied in proportion to the user's impact on the system, which would encourage use in moderation.

However, this method can lead to difficulties in terms of ensuring sufficient revenue, for charging an overly high tariff could lead to user backlash, and setting tariffs too low would lead to insufficient funds.

2) Flat Tariff

A flat tariff refers to when all connections are charged the same set monthly rate, or when various flat rates are set according to the type of end user, such as residences, businesses, and industry. The greatest benefit of this system is simplicity, for it requires little administration, which makes it attractive to nations without a sophisticated administrative structure. However, this system ignores the concept of

equity because it gives no consideration to the user's ability to pay. Moreover, it does little to encourage efficient use of the sewer system.

3) Revenue via Taxes

While this is not a direct charge on usage, many nations use property taxes as means of raising revenue for sewer services. While this does not always hold true, water use tends to increase in conjunction with increases in property value. Thus, this method is an efficient method of satisfying the condition of equity. Moreover, it does not have the effect of discouraging low-income users from using the sewer system, and thus avoids any potential drops in general public health. However, it does have a drawback in that it does not promote efficient usage, since charges are not being levied on the actual amount used.

(5) Recommendations

The ideal tariff system, especially in terms of equity and efficiency, is to charge users based on the amount of use and the degree of waste being discharged. As mentioned above, users who discharge highly contaminated waste would be charged at a higher rate than those who discharge low-grade waste. Moreover, this method would encourage use in moderation, since the more the user consumes, the more he will be charged.

However, this method also necessitates the installation of meters, which unto itself requires a substantial investment. As a consequence, while the ideal system would be one that charges in proportion to volume, the most feasible alternative would most likely to set sewer tariffs as a part of water supply charges at a flat percentage. While this may lead to some inequity in charges, at present, given Albania's circumstances, it remains the most feasible method. Moreover, given that the water supply in Tirana is currently not sufficient enough to meet consumer demand, continuing with the present system of no sewer tariffs is not feasible, especially if one wants to encourage use in moderation. Therefore, levying a charge as a part of water supply is the most simple method of encouraging moderation while also providing a revenue source for the government.

CHAPTER 15

PROJECT EVALUATION

15.4 Project Evaluation

15.4.1 Effect on Improvement of Water Quality in the Lana River by Implementation of Project

Effect of the proposed project for improvement of water quality in the Lana River was verified through water quality simulation based on the water quality examination results.

(1) Conditions and assumptions on water quality simulation

1) Parameters of water quality simulation and their comparison

BOD is adopted as key parameter for water quality simulation and is estimated for the present and target years of 2001 and 2010 when the river has low flow conditions that can be observed for 275 days or 75 % of days in a year. For 2001 and 2010, future water quality is estimated for two cases whether or not the proposed project is implemented.

2) Reference points for water quality simulation in the Lana River

The following three reference points were selected for water quality simulation:

a. Shetitorja Deshmort bridge at the center of Tirana City
b. Rruga e Kavajes bridge located at the most downstream of the Lana North and Lana South interceptor mains.
c. Crossing point of Durres road over the Lana River (sampling point of water quality examination)

Location of these reference points are indicated in Figure 15.4.1.

3) Estimation of low flow in the Lana River

Monthly river flow measurement data for the past 20 years at Shetitorja Deshmort bridge in the Lana River as shown in Table 2.1.3 in the Main Report were referred to estimate the low flow.

As a base figure of the Lana River, 0.287 m^3/sec which was average figure for 6 month period in dry season (May to November) was adopted. The low flow at 0.167 m^3/sec was then established deducting 0.120 m^3/sec of present sewage flow from the above base figure.

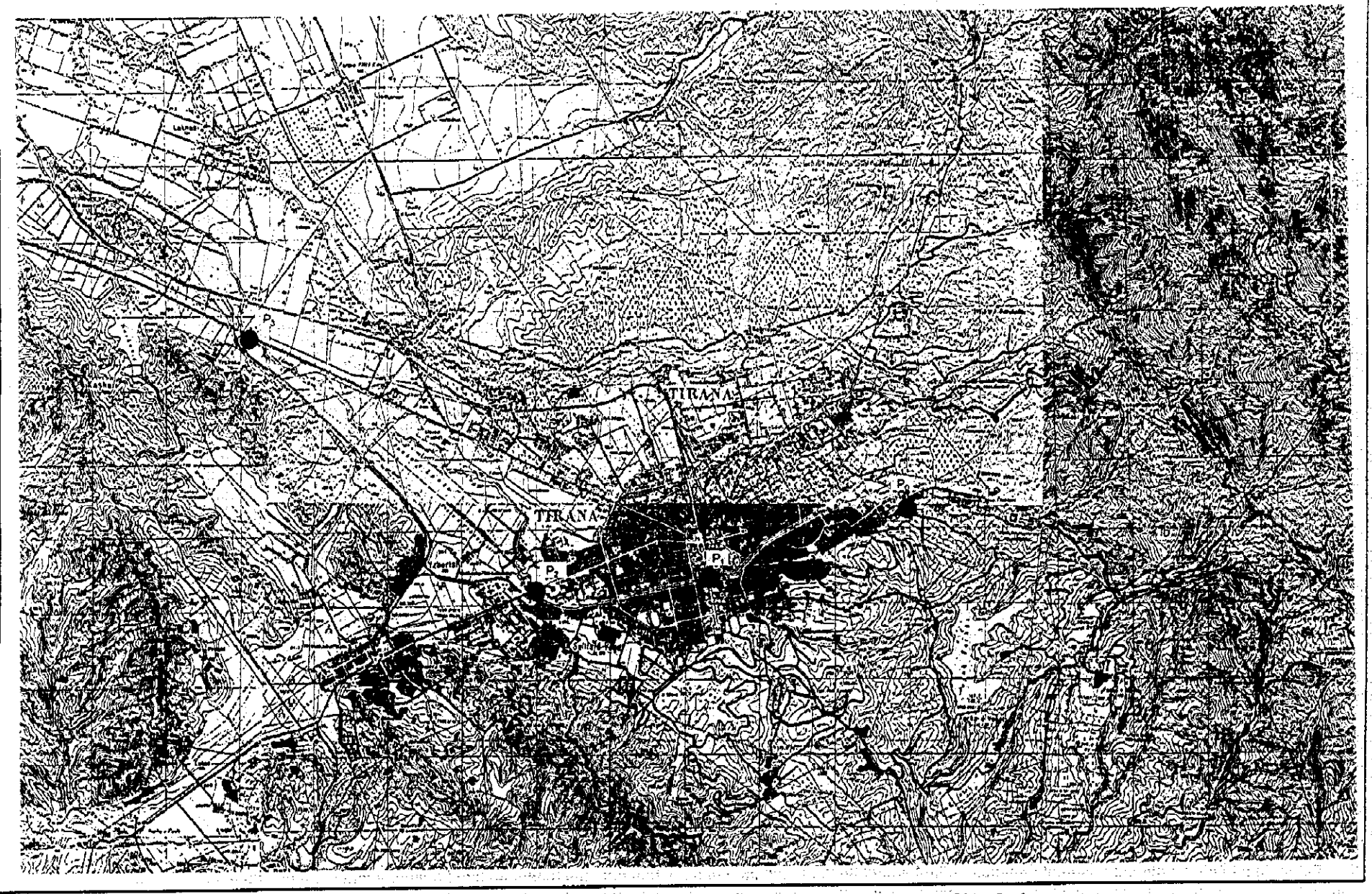

Figure 15.4.1 **Location of Reference Points for Water Quality Simulation**

Specific low flow (7.61×10^{-5} m^3/sec.ha) of the Lana River at the Shetitorja Deshmort bridge was obtained dividing the above low flow by the river basin area (2,200 ha). The low flow at respective reference points of water quality simulation was then calculated by multiplying this specific low flow and their river basin area.

4) Natural pollution load

Natural pollution load at the Lana River was estimated as follows:

a. Run-off natural pollution load (40.7 kg/day) at the most upstream of the Lana River was calculated by multiplying the water quality examination data (1.5 mg/l) as agricultural wastewater and the flow rate measurement (0.314 m^3/sec).
b. Net run-off natural pollution load (36.0 kg/day) was then calculated by deducting pollution load of domestic sewage (4.7 kg/day) from the above run-off natural pollution load.
c. Specific run-off natural pollution load (0.0333 kg/day.ha) was established by dividing the above net run-off natural pollution load with the river basin area (1,080 ha).

Run-off natural pollution load at respective reference points in the Lana River was then obtained by multiplying the said specific run-off natural pollution load and river basin area.

5) Sewage volume discharged into the Lana River

Present per capita unit domestic sewage volume in the sewerage service area is estimated as follows:

a. Per capita sewage volume (100 lpcd) was estimated considering commercial and institutional consumption (30 %) to the per capita domestic sewage volume (70 lpcd).
b. A sum of 20 % to the per capita sewage volume (100 lpcd) was considered as leakage of sewage from sewer pipes and groundwater infiltration into sewer pipes to obtain the sewage volume being discharged into the Lana River (80 lpcd).
c. Per capita sewage volume at outside of the existing sewerage service area was assumed at 50 % of the inside of the service area.

The above mentioned sewage flow is summarized as follows:

Table 15.4.1 Per Capita Sewage Volume

Unit: liter/capita/day

Area Classification	Present	2001	2010
Sewered Area	80	200	200
Unserved Area	40	100	100

6) Pollution load concentrated into the Lana River

The calculation of concentrated pollution load into the Lana River was made as follows:

a. The pollution load of nightsoil and gray water being concentrated into the Lana River from the existing sewerage service area was estimated by deducting 35 % of generated per capita unit pollution load as leakage from sewer pipes.

b. The pollution load generated in the outside of sewerage service area is separately calculated by such pollution load concentrated from septic tank and cesspool that:

- Composition of septic tank and cesspool are assumed at 50 5 : 50 % in terms of number of households.
- Households located within the proposed expansion area of the sewerage system are considered to be septic tanks.
- Treatment efficiency of septic tank is assumed at 50 % of the generated pollution load.
- Concentration ratio of pollution load from septic tank and cesspool to the Lana River is assumed to be 50 % of the discharged pollution load.

Generated and concentrated per capita unit pollution load are summarized below.

Table 15.4.2 Per Capita Unit Pollution Load

Unit: g/capita/day

Category			Present	2001	2010
Generated Unit Pollution Load		Nightsoil	18	18	18
		Gray Water	17	22	27
		Total	35	40	45
Concentrated Unit Pollution Load	Sewered Area		22.75	26	29.25
	Unserved Area	Septic Tank	13	16	18
		Cesspool	9	11	14

(2) Results of water quality simulation

When the priority project and the entire project are implemented in accordance with the proposed implementation program, the water quality (BOD) in the Lana River will be steadily improved based on the water quality simulation as shown in below.

Table 15.4.3 Results of Water Quality Simulation

Unit: BOD mg/l

Target Year		2001			2010		
Reference Point of Water Quality		Upstream	Middle	Down-stream	Upstream	Middle	Down-stream
Estimated Present Water Quality (Dry Season)		5.7	122	120	5.7	122	120
Estimated Future Water Quality	Without Project	-	87	87	-	102	106
	After Implementation	-	20	19	-	17	15

Upon implementation of the project, approximately 80 % of pollution load will be reduced in 2001, while about 85 % in 2010, respectively.

For furtherance of environmental improvement in the Lana River, the following measures are deemed inevitable for those households (approximately 24,000 persons) being located within the drainage basin of the Lana River:

1) Appropriate maintenance of septic tanks
2) Introduction of advanced biological treatment unit for individual houses
3) Implementation of small community sewerage system

Details of the above water quality simulation are shown in Table 15.4.4.

Table 15.4.4 Details of Water Quality Simulation in the Lana River

Item				P_0	P_1					P_2					P_3				
				Present	Present	2001		2010		Present	2001		2010		Present	2001		2010	
						No Project	Phase-1	No Project	Phase-2		No Project	Phase-1	No Project	Phase-2		non	Phase-1	non	Phase-2
Area	Sewered	Treated	ha	-	-	-	425	-	454	-	-	842	-	937	-	-	1,096	-	1,581
		Un-treated	ha	-	410	410	-	410	-	777	777	-	777	-	1,031	1,031	-	1,031	-
	Unserved	Un-treated	ha	1,080	1,774	1,774	1,775	1,774	1,746	2,523	2,523	2,458	2,523	2,363	4,469	4,469	4,404	4,469	3,919
	Total		ha	1,080	2,200	2,200	2,200	2,200	2,200	3,300	3,300	3,300	3,300	3,300	5,500	5,500	5,500	5,500	5,500
Population	Sewered	Treated	person	-	-	-	129,400	-	151,200	-	-	254,000	-	286,900	-	-	322,300	-	441,900
		Un-treated	person	-	117,700	123,500	-	139,200	-	225,300	240,000	-	266,300	-	289,500	308,300	-	342,000	-
	Unserved	Septic Tank	person	220	17,100	17,300	11,400	18,000	6,000	27,000	27,400	13,400	28,600	8,000	37,300	43,000	29,000	111,900	12,000
		Cesspool	person	220	6,000	6,000	6,000	6,000	6,000	8,000	8,000	8,000	8,000	8,000	12,000	12,000	12,000	12,000	12,000
	Total		person	440	140,800	146,800	146,800	163,200	163,200	260,300	275,400	275,400	302,900	302,900	338,800	363,300	363,300	465,900	465,900
River flow	Dry Season Average	Measured Flow	m^3/sec		0.287														
		Sewage Volume	m^3/sec		0.120														
		Net River flow	m^3/sec		0.167														
	River Flow	Basin Area	ha		2,200														
		Specific Flow	$m^3/sec.ha$	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05	7.61E-05
		River Flow	m^3/sec	0.082	0.167	0.167	0.167	0.167	0.167	0.251	0.251	0.251	0.251	0.251	0.418	0.418	0.418	0.418	0.418
	Sewered (non treated)	Unit Sewage Volume	l/capita/day	80	80	200	200	200	200	80	200	200	200	200	80	200	200	200	200
		Sewage Flow	m^3/sec	-	0.109	0.286	-	0.322	-	0.209	0.556	-	0.616	-	0.268	0.714	-	0.792	-
	Unserved	Unit Sewage Volume	l/capita/day	40	40	100	100	100	100	40	100	100	100	100	40	100	100	100	100
		Sewage Flow	m^3/sec	0.000	0.011	0.027	0.020	0.028	0.014	0.016	0.041	0.025	0.042	0.019	0.023	0.064	0.047	0.143	0.028
	Total		m^3/sec	0.082	0.287	0.480	0.187	0.517	0.181	0.476	0.848	0.276	0.910	0.270	0.709	1.196	0.466	1.353	0.446
Pollutant	Natural Pollution Load	Measured Water Quality	mg/l	1.5															
		Measured Flow	m^3/sec	0.314															
		Pollution Load	kg/day	40.7															
		By Domestic Sewage	kg/day	4.7															
		By Natural Pollution	kg/day	36.0	73.3	73.3	73.3	73.3	73.3	109.9	109.9	109.9	109.9	109.9	183.2	183.2	183.2	183.2	183.2
		Net Specific Load	kg/day	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	Sewered (non treated)	Unit Pollution Load	kg/capita/day	0.02275	0.02275	0.026	0.026	0.02925	0.02925	0.02275	0.026	0.026	0.02925	0.02925	0.02275	0.026	0.026	0.02925	0.02925
		Pollution Load	kg/day	-	2,677.7	3,211.0	-	4,071.6	-	5,125.6	6,240.0	-	7,789.3	-	6,586.1	8,015.8	-	10,003.5	-
	Unserved (septic tank)	Unit Pollution Load	kg/capita/day	0.013	0.013	0.016	0.016	0.018	0.018	0.013	0.016	0.016	0.018	0.018	0.013	0.016	0.016	0.018	0.018
		Pollution Load	kg/day	2.9	222.3	268.2	176.7	324.0	108.0	351.0	424.7	207.7	514.8	144.0	484.9	666.5	449.5	2,014.2	216.0
	Unserved (Cesspool)	Unit Pollution Load	kg/capita/day	0.009	0.009	0.011	0.011	0.014	0.014	0.009	0.011	0.011	0.014	0.014	0.009	0.011	0.011	0.014	0.014
		Pollution Load	kg/day	1.9	51.0	66.0	66.0	81.0	81.0	68.0	88.0	88.0	108.0	108.0	102.0	132.0	132.0	162.0	162.0
	Total		kg/day	40.7	3,024.2	3,618.4	316.0	4,549.9	262.3	5,654.5	6,862.6	405.6	8,522.0	361.9	7,356.2	8,997.5	764.7	12,362.9	561.2
Water quality	BOD		mg/l	5.7	122.0	87.2	19.5	101.8	16.8	137.5	93.7	17.0	108.4	15.5	120.1	87.1	19.0	105.7	14.6

15.4.2 Environmental Impact Assessment (EIA)

(1) General

During the Preparatory Study undertaken by the JICA Preparatory Study Team in March, 1996, "Screening" and "Scoping" of the anticipated environmental impacts were carried out to identify the need of the Environmental Impact Assessment (hereinafter referred to as "EIA"). In this Preparatory Study, the environmental pollution in the Study Area was preliminary foreseen that:

> "Owing to the mountainous topographic feature of Tirana and its surrounding area, rainfall is drained into the river system in a short time resulting turbid aquatic environment in the Tirana River and the Lana River. These natural conditions have restrained the utilization of surface water and concealed water pollution being caused by human activities. Resultant from this, the potential environmental pollution has not been visualized in the Study Area."

The items and contents of environmental impact as identified in the above mentioned study were then further verified during the Stage 1 field work in collaboration with the Albanian authorities, particularly the Ministry of Health and Environmental Protection, the sole national agency responsible for environmental legislation and monitoring.

The outcome of this preliminary study was reflected on the "Scope of Work" for the EIA study which was subsequently conducted in the Stage 2 field work in January to February, 1997. Major subjects on EIA were such impacts on aquatic environment in the Tirana River by discharge of effluent from the proposed sewage treatment plant, treatment/disposal of excess sludge to be generated at the sewage treatment plant, and traffic jams which would occur during the construction work of sewer lines.

An overall evaluation on environmental impacts was then carried out in the Stage 2 domestic work and countermeasures to minimize the anticipated impacts were prepared toward the successful and smooth implementation of the proposed project.

(2) Screening and scoping results

1) Screening results

a. Social environment

With regard to social environment, the sewerage system improvement is principally contribute to the improvement of current urban environment, particularly flooding and water pollution. However, some "side-effects" are anticipated during and after implementation of the project. The following items are those which to be taken into account in the detailed evaluation of alternative plans for sewerage system improvement.

i. Relocation of local residents

This particular subject may be considered for the proposed site of sewage treatment plant and, if required, sewage pumping station. Especially in the recent change of economic system in Albania, most of land ownership are being transferred to the private persons or entities.

ii. Economic activities

The sewerage system improvement project is considered to have positive economic impact. Firstly, residents in Tirana City will have an opportunity to enjoy better urban living environment and sanitary conditions ever than before. Secondary, the improvement of urban sanitation will largely contribute to the country's tourism development to attain better international trade balance. The project will not cause any significant change on economic activities in Tirana City and neighboring towns, and not trigger significant loss on opportunity for economic development, since most of sewerage facilities will be placed underground and sewage treatment plant will be located considerably far away from city center.

iii. Transportation and social facilities

During the installation and rehabilitation of sewer lines, traffic jams may be irresistible social problems. When such routing of sewer line is indispensable, temporary rerouting of daily traffic will be firstly considered to minimize unnecessary social problems. Alternative technical solutions may be considered, but are subject to cost-benefit evaluation.

When the burden cost sharing is acceptable by the Albanian government and by the beneficiaries, shield tunneling method and the like may be considered to lessen the traffic jams. It shall also be taken into account that the recent economic development has caused rapid increase of urban traffic and certain part in Tirana City is now encountering this problem everyday.

Impact to social facilities, such as hospitals, schools, etc., is considered minimal at this moment. However, when such facilities are subject to connect sewer lines through the project implementation, individual countermeasures shall be taken up on the case-by-case basis.

iv. Separation of local society

The project will not cause this kind of problem by nature of configuration of the sewerage system.

v. Ruins and cultural assets

In the proposed project site, especially sewage treatment plant and its vicinity, no ruins and cultural assets have been confirmed to present.

vi. Water right and right of common

As of now, no water right has been established within the project area. Even if established, especially at downstream of the Tirana River, such water right will have better benefit ever than before through the project implementation.

Right of common will not be appeared, since most of the area is privately owned for agricultural purpose.

vii. Public hygiene

By nature of project, the present situation of public hygiene will be drastically improved. Final disposal of excess sludge may, however, have certain concern to this particular subject depending on manner of disposal and location of disposal site.

viii. Wastes from project

Any waste to be generated from the project shall be subject to follow prevailing laws and regulations. Excess sludge to be generated from the sewage

treatment plant shall be the same.

ix. Natural disaster

Any large scale landscaping is not considered which may trigger natural disaster.

b. Natural environment

As it is mentioned in the above, the nature of project is to improve urban environment and aquatic environment in the Tirana River and the Lana River, and is principally "environmental friendly" project. The degree of improvement in aquatic environment is already discussed in the preceding subsection 15.4.1 of this Supporting Report.

i. Topography and geology

No significant change of landscape is considered.

ii. Soil erosion

No large scale landscaping is proposed.

iii. Groundwater

Utilization of shallow groundwater is minimal in the Study Area. There is deep well field for water supply in the vicinity of the proposed site of sewage treatment plant. Influence to deep aquifer is minimal since the shield tunneling method will not take such depth, even if it is introduced. Treated sewage will be discharged into the Tirana River, but it will not cause direct pollution of aquifer, in appreciation of presence of thick impermeable layer above the aquifer.

iv. River, lake and pond

Although the Tirana River will be the receiving water body of treated sewage, the total pollution load will be definitely decreased from present situation.

v. Coast and sea

No coastal line exists in the Study Area.

vi. Flora and fauna

The proposed site for sewage treatment plant is mostly agricultural land or grass land. No endangered species is confirmed in the subject area.

vii. Climate

No large scale facility is considered to cause significant climatic change.

viii.Scenery

The proposed sewerage facilities will not have a height to interfere the harmony of scenery.

c. Public nuisance

Public nuisance is also considered negative at this project owing to its nature.

i. Air pollution

No incineration is considered for sludge treatment.

ii. Water pollution

Although treated sewage itself is pollution load to the receiving water body, the overall pollution load will be drastically decreased by the sewage treatment plant and aquatic environment will be improved accordingly. The recovery of aquatic environment in the Lana River and impact to the downstream of the Tirana River have been verified through water quality simulation in the preceding subsection 15.4.1 of this Supporting Report..

iii. Soil pollution

Except for disposal of excess sludge, no soil pollution is anticipated in the project. Manner of final disposal of excess sludge is subject for further verification.

iv. Noise and vibration

During the implementation, certain noise and vibration will happen during sewer pipe installation. For sewage treatment plant, these problems are not anticipated due to its isolated location away from densely populated area.

v. Land subsidence

No groundwater utilization which may trigger land subsidence is planned in the project.

vi. Odor

Certain degree of smell may occur from the sewage treatment plant. Wind direction and magnitude in relation to its location are subject to further verification.

d. Overall evaluation

Some sign of environmental impact through implementation of the sewerage system improvement are anticipated. However, it shall be noted that the proposed project aims at thorough improvement of urban environment in Tirana City including the Tirana River and the Lana River and its potential benefit is considered far important rather than the negative impact/s on environment.

2) Scoping results

Scoping of environmental impact was prepared based on the aforementioned screening results. However, the details of scoping shall be further determined through in depth study of the alternative plans for sewerage system improvement. The following are the results of scoping confirmed in the Stage 1 field work.

Table 15.4.2.1 Results of Scoping at the Stage 1 Field Survey

Item			Score	Basis of Scoring
Social Environment	1	Relocation of Local Residents	B	Location of sewage treatment site for land acquisition
	2	Economic Activity	D	No negative impact foreseen
	3	Transportation & Social Facilities	B	Traffic jam during implementation
	4	Separation of Local Society	D	No separation foreseen
	5	Ruins & Cultural Assets	D	No presence confirmed
	6	Water Right & Right of Common	D	No right confirmed yet
	7	Public Hygiene	B	Depending on disposal manner of excess sludge
	8	Wastes from Project	B	Same as above
	9	Natural Disaster	D	No large scale landscaping planned
Natural Environment	10	Topography & Geology	D	No significant change planned
	11	Soil Erosion	D	No large scale landscaping planned
	12	Groundwater	D	No discharge to aquifer planned
	13	River, Lake & Pond	B	Treated sewage be discharged to Tirana River
	14	Coast & Sea	D	No coastal line exists
	15	Flora & Fauna	D	No endangered species confirmed yet
	16	Climate	D	No significant change imposed
	17	Scenery	D	No significant change of scenery imposed
Public Nuisance	18	Air Pollution	D	No pollutant to be emitted
	19	Water Pollution	B	Treated sewage to be discharged into Tirana River
	20	Soil Pollution	B	Manner of disposal of excess sludge
	21	Noise and vibration	B	During pipe installation work by open cut method
	22	Land subsidence	D	No groundwater utilization planned
	23	Odor	B	Some smell anticipated from the sewage treatment plant

Note: Score; A-Significant impact anticipated.
B-Slight impact anticipated
C-Unknown (subject to further verification)
D-Almost no impact anticipated and not subject for IEE (Initial Environmental Evaluation) and EIA (Environmental Impact Assessment)

3) Scope of EIA

The scope of EIA Study to be undertaken by the Albanian consultants is shown below and details of specifications are contained in Supporting Report 15.4.3.

1) Laws and regulations on EIA, environmental protection and sewerage project

- Review of the existing laws and regulations pertaining to the EIA, environmental protection and sewerage project,
- Clarification of legislative requirements

The above review work shall entail to not only existing ones, but also those which being considered or proposed ones.

2) Itemized assessment of environmental impact

- Itemized assessment of environmental impact/s with their magnitudes for those identified impact items based on the results of initial environmental evaluation as shown in Table 15.4.2.1.

3) Preparation of recommendations and proposed countermeasures

- Recommendations and proposed countermeasures to mitigate environmental impact/s.

(4) Results of EIA

The results of EIA study, which is contained in Supporting Report 15.4.4, indicate possible occurrence or doubt of some environmental impacts through implementation of the proposed project. Anticipated problems which may affect the operation and maintenance of sewerage system are also discussed. Those identified impacts and problem areas are summarized below.

1) Possible environmental impacts

a. Groundwater contamination

The proposed site of sewage treatment plant is situated in the area of potential groundwater resource along the Tirana River. Deepwells of the Tirana water supply system are located in the vicinity of the proposed site.

In this regard, appropriate countermeasures to prevent groundwater contamination by infiltration of sewage from the treatment plant will be necessary, if hydro-

geological conditions of the proposed site allow such infiltration.

b. Water pollution of the Tirana River by inflow of sewerage sludge

If the treatment facility is destroyed or damaged, the sewerage sludge may flow into the Tirana River and cause unexpected water pollution. Appropriate fail-safe measure shall be considered in the facility design.

c. Water pollution of the Tirana River by disposal of effluent from treatment plant

Downstream of the Tirana River may encounter water pollution by disposal of effluent in large quantity from the sewage treatment plant, while the aquatic environment in the upstream of the Tirana River and the Lana River will be improved by implementation of the proposed project. If significant amount of pollution load is planned to be discharged into the Tirana River, proper treatment level shall be attained to prevent further water pollution.

d. Possible emission of offensive odor and growth of undesirable insects

If there is a possibility on emission of offensive odor and growth of undesirable insects at the sewage treatment plant, necessary countermeasures shall be taken up.

2) Problem areas relevant to implement public sewerage service

a. Discharge of undesirable quality and quantity of commercial and industrial wastewater

Discharge of undesirable wastewater shall be restricted by appropriate regulations to protect sewerage system and public water body.

b. Obligation of residents and business establishments to connect with the public sewerage system

Presently, many commercial establishments, such as restaurants, bars and kiosks, located on the banks of he Lana River are mostly discharging their untreated wastewater directly into the Lana river resulting serious water pollution.

The legislative arrangements shall be made to oblige residents and business establishments located within the sewerage service area to connect with sewer network.

(5) Preventive measures to identified environmental impacts and problem areas

Preventive measures are hereby presented to cope with identified environmental impacts and problem areas relevant to implement public sewerage service.

1) Preventive measures to anticipated environmental impacts

a. Groundwater contamination

As it is described in the report of EIA study, the proposed site is situated on the thick impermeable clay layer and the depth of potential aquifer is far beneath the impermeable layer. Under this hydrogeological condition, the infiltration of sewage will hardly occur.

In addition, the aerated lagoon and other treatment facilities will have clay lining to prevent seepage/infiltration of sewage.

In view of the above mentioned condition and preventive measure, it is considered that the groundwater contamination to deep aquifer is controlled under quite low risk of occurrence.

b. Water pollution of the Tirana River by inflow of sewerage sludge

In appreciation of quite stable geological conditions at the proposed site of sewage treatment plant, damage or destruction of treatment facilities will hardly occur as a result of natural disaster, i.e. earthquake.

Owing to the nature of treatment method, the generation of sewerage sludge is very minimal in comparison to the conventional activated sludge method. Fail-safe measure is considered in the facility design that effluent will be drained from surface of the final sedimentation basin.

Likewise, this particular environmental impact will not occur under the normal and foreseeable situation.

c. Water pollution of the Tirana River by disposal of effluent from treatment plant

As It has been discussed on the results of water quality examination, present water quality at the proposed discharge point of effluent into the Tirana River is 20 to 23 mg/l of BOD. This is more or less equivalent to the planned effluent quality at 25 mg/l of BOD and actual water quality in the Tirana River will be maintained better

than the effluent quality through dilution by the river water from the upstream.

If proposed project is not implemented, the water quality in the Tirana River will, on the other hand, become worse ever than before due to discharge of untreated wastewater into the river system. Prediction of future water quality, if proposed project is not implemented, has been conducted in this study.

As a whole, water pollution of the Tirana River will not occur upon implementation of the proposed project, provided however the relevant legislative arrangements and their proper enforcement are prerequisite to realize effectiveness of the proposed project.

d. Possible emission of offensive odor and growth of undesirable insects

The anticipated emission of offensive odor will be controlled and maintained within permissible and tolerable level by following reasons and measures:

- Sewage in the aerated lagoon treatment process will be continuously stirred under aerobic conditions and will not emit strong offensive odor.
- Proposed site of treatment plant is located sufficiently away from the populated area.
- The perimeter of the treatment plant will be provided with green belt and trees to maintain aesthetic view and to avoid unnecessary dispersion of sewage odor.

Possible growth of undesirable insects is considered to be minimal owing to the following conditions and preventive measures:

- Continuous circulation of sewage in the aerobic treatment process will prevent growth of undesirable insects.
- Upper part of slopes of each basin will be lined by concrete blocks o prevent growth of grasses and insects.
- Flat ground surface in the treatment plant will also be maintained to prevent growth of grasses and insects.

Thus, anticipated emission of offensive odor and growth of undesirable insects will be controlled at minimal and considered within permissible and tolerable level.

2) Legislative arrangements to problem areas relevant to implement public sewerage system

Aside from preventive measures to anticipated environmental impacts, legislative arrangements and their proper enforcement are indispensable to assure effectiveness of the proposed project. The following legislation are deemed the minimal requirements in this respect.

a. Restriction of undesirable quality and quantity of commercial and industrial wastewater

There are different types of undesirable wastewater in terms of quality and quantity as enumerated below.

i. Toxic and/or hazardous substances contained in the wastewater which affects biological treatment of sewage and may biologically concentrated in the sewerage sludge:
   - Heavy metals from leather tanning process,
   - Mineral oil from machinery factory,
   - Chemical wastes

ii. High organic pollution load contained in the wastewater from:
   - Food processing factory,
   - Slaughter house,
   - Laundry shop which includes nutrient salts for eutrophication, such as phosphorus,
   - Restaurants,
   - Livestock breeding, particularly pig and cow,

iii. Low organic pollution load which can be discharged into stormwater drainage without treatment or after primary treatment:
   - Cooling water of air conditioning system,
   - Wash water for product cleaning.

Through proper legislation on the above mentioned wastewater, treatment process and public water body will be protected from water pollution. Necessary legislation will be, but not limited to, the following:

- Legislation on wastewater quality standards which specifies allowable limit of wastewater quality to be discharged from respective factories/establishments into the public sewerage system or public water body.

- Legislation on public sewerage service and wastewater quality standards to obligate factories/establishments to install pretreatment facility within their factories/establishments at their own expense prior to discharge wastewater into public sewerage system or public water body.

- Local government authority and executing agency of public sewerage service shall be obliged by pertinent legislation to inspect the above mentioned factories/establishments to wit conformity with the wastewater quality standards including sampling and water quality examination.

- The above mentioned legislation shall have penalty clause for fine, temporary closure of factories/establishments and criminal prosecution, and shall have legal basis to enforce corrective measures to respective factories/establishments to meet with the wastewater quality standards.

b. Legal obligation of households and business establishments to connect public sewerage system

Commercial establishments, i.e. restaurants, bars and kiosks, factories and individual households within the service area of public sewerage system shall be obliged to discharge their wastewater/sewage into the public sewerage system.

Those establishments and residents presently utilizing private on-site disposal/treatment facilities may have certain grace period to connect with the public sewerage system. Violation on this legal requirements shall be subject to pertinent legal penalty.

(6) Overall evaluation on environmental impacts of proposed project

As discussed in the previous subsections on the anticipated environmental impacts of the proposed project and preventive measures to minimize such impacts and associated legislative arrangements, the environmental impacts are considered minimal to the surrounding environment and the public water body.

It shall be noted that the expected effects of the proposed project will be maximized only when the associated legislative arrangements are properly instituted and enforced. In enforcement of such legislation, campaign and implementation of public education on health and hygiene aspects shall also be taken up to attain proper awareness of residents and community participation toward realization of the principal objectives of the proposed project.