CHAPTER 10

APPENDIX – A102.1

Cost of Water Supply Components

A102.1 Cost of Water Supply Components

Unit: Rs. Million

Project Component		Base Cost (2007 Price)				Year																		
		Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Bulk Water Supply																								
A-1	Rehab of Raw Water Transmission Conduit						33.3%	33.3%	33.3%															
		304	F/C	80%	243		81	81	81															
			U/C	20%	61		20	20	20															
A-2	Rehab of Raw Water Transmission Pumping Station						17.9%	17.9%	17.9%			15.4%	15.4%	15.4%										
		1,623	F/C	100%	1,623		290	290	290			251	251	251										
			U/C	0%	0		0	0	0			0	0	0										
A-3	Rehab of Raw Water Transmission Pipes						16.7%	16.7%	16.7%								16.7%	16.7%	16.7%					
		738	F/C	75%	554		92	92	92								92	92	92					
			U/C	25%	184		31	31	31								31	31	31					
A-4	New Intake Facilities						33.3%	33.3%	33.3%															
		500	F/C	50%	250		83	83	83															
			U/C	50%	250		83	83	83															
A-5	Land Smoosing						33.3%	33.3%	33.3%															
		776	F/C	20%	155		52	52	52															
			U/C	80%	621		207	207	207															
A-6	Incidental Facilities for New Raw water Transmission Facilities						33.3%	33.3%	33.3%															
		618	F/C	100%	618		206	206	206															
			U/C	0%	0		0	0	0															
B-1	Rehab of Filtration Plant																33.3%	33.3%	33.3%					
		654	F/C	80%	523												174	174	174					
			U/C	20%	131												44	44	44					
B-2	Expansion of Reservoir						33.3%	33.3%	33.3%															
		540	F/C	10%	54		18	18	18															
			U/C	90%	486		162	162	162															
B-3	New Raw Water Transmission Facilities											33.3%	33.3%	33.3%										
		9,730	F/C	50%	4,865							1,622	1,622	1,622										
			U/C	50%	4,865							1,622	1,622	1,622										
B-4	New Raw Water Transmission Pumping Station											33.3%	33.3%	33.3%										
		1,580	F/C	80%	1,264							421	421	421										
			U/C	20%	316							105	105	105										
B-5	New Raw Water Lagoon											16.7%	16.7%	16.7%			16.7%	16.7%	16.7%					
		400	F/C	5%	20							3	3	3			3	3	3					
			U/C	95%	380							63	63	63			63	63	63					
B-6	New Filtration Plant											16.7%	16.7%	16.7%			16.7%	16.7%	16.7%					
		3,600	F/C	80%	2,880							480	480	480			480	480	480					
			U/C	20%	720							120	120	120			120	120	120					
B-7	New Reservoir											22.6%	22.6%	22.6%			10.8%	10.8%	10.8%					
		1,268	F/C	10%	127							29	29	29			14	14	14					
			U/C	90%	1,141							258	258	258			123	123	123					
B-8	New Chlorination Equipment at Reservoir											11.1%	11.1%	11.1%			22.2%	22.2%	22.2%					
		4	F/C	100%	4							0.4	0.4	0.4			0.9	0.9	0.9					
			U/C	0%	0							0.0	0.0	0.0			0.0	0.0	0.0					
B-9	New Transmission Pumping Station											10.2%	10.2%	10.2%			23.0%	23.0%	23.0%					
		64	F/C	80%	51							5	5	5			12	12	12					
			U/C	20%	13							1	1	1			3	3	3					
B-10 (a)	New Transmission Main						9.9%	9.9%	9.9%			23.4%	23.4%	23.4%										
		525	F/C	75%	394		39	39	39			92	92	92										
			U/C	25%	131		13	13	13			31	31	31										
B-10 (b)	Rehab of New Transmission Main																							
		95	F/C	75%	71										8	8	8	8	8	8	8	8	8
			U/C	25%	24										3	3	3	3	3	3	3	3	3
B-11	Flow Meters and Flow Control Valve (set)						21.1%	21.1%	21.1%			3.5%	3.5%	3.5%										
		38	F/C	100%	38		8	8	8			1	1	1										
			U/C	0%	0		0	0	0			0	0	0										
B-12	New Distribution Pumping Station at Reservoir																33.3%	33.3%	33.3%					
		28	F/C	79%	22												7	7	7					
			U/C	21%	6												2	2	2					
C-1	Rehab of Raw Water Transmission Pumping Station						21.7%	21.7%	21.7%			11.6%	11.6%	11.6%										
		186	F/C	100%	186		40	40	40			22	22	22										
			U/C	0%	0		0	0	0			0	0	0										
C-2	Rehab of Filtration Plant						19.5%	19.5%	19.5%								13.9%	13.9%	13.9%					
		1,964	F/C	80%	1,570		305	305	305								218	218	218					
			U/C	20%	394		77	77	77								55	55	55					

Unit: Rs. Million

Project Component		Base Cost (2007 Price)				Year																	
		Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
C-3	Rehab of Reservoir						12.8%	12.8%	12.8%								20.5%	20.5%	20.5%				
		283	F/C	10%	29		4	4	4								6	6	6				
			L/C	90%	254		33	33	33								52	52	52				
C-4	Expansion of Filtration Plant						33.3%	33.3%	33.3%														
		1,932	F/C	80%	1,546		515	515	515.3														
			L/C	20%	386		129	129	129														
C-5	Expansion of Reservoir						33.3%	33.3%	33.3%														
		2,266	F/C	10%	227		76	76	76														
			L/C	90%	2,039		680	680	680														
C-6	New Raw Water Transmission Facilities						33.3%	33.3%	33.3%														
		9,730	F/C	50%	4,865		1,622	1,622	1,622														
			L/C	50%	4,865		1,622	1,622	1,622														
C-7	New Raw Water Transmission Pumping Station						33.3%	33.3%	33.3%														
		1,580	F/C	80%	1,264		421	421	421.3														
			L/C	20%	316		105	105	105														
C-8	New Raw Water Lagoon						33.3%	33.3%	33.3%														
		200	F/C	5%	10		3	3	3														
			L/C	95%	190		63	63	63														
C-9	New Filtration Plant						33.3%	33.3%	33.3%														
		3,185	F/C	80%	2,548		849	849	849														
			L/C	20%	637		212	212	212														
C-10	New Reservoir						20.0%	20.0%	20.0%			4.4%	4.4%	4.4%			8.9%	8.9%	8.9%				
		614	F/C	10%	62		12	12	12			3	3	3			5	5	5				
			L/C	90%	552		110	110	110			25	25	25			49	49	49				
C-11	New Chlorination Equipment at Reservoir						26.7%	26.7%	26.7%			2.2%	2.2%	2.2%			4.4%	4.4%	4.4%				
		39	F/C	100%	39		10	10	10			1	1	1			2	2	2				
			L/C	0%	0		0	0	0			0	0	0			0	0	0				
C-12	New Transmission Pumping Station						22.2%	22.2%	22.2%			5.4%	5.4%	5.4%			5.6%	5.6%	5.6%				
		285	F/C	80%	229		51	51	51			13	13	13			13	13	13				
			L/C	20%	56		12	12	12.5			3	3	3.0			3	3	3.1				
C-13	Rehabilitation of Existing Transmission Main						33.3%	33.3%	33.3%														
		1,108	F/C	80%	887		296	296	296														
			L/C	20%	221		74	74	74														
C-14 (a)	New Transmission Main						33.3%	33.3%	33.3%														
		2,477	F/C	75%	1,857		619	619	619														
			L/C	25%	620		207	207	207														
C-14 (b)	Rehab of These New Transmission Main																						
		700	F/C	80%	560					40	40	40	40	40	40	40	40	40	40	40	40	40	40
			L/C	20%	140					10	10	10	10	10	10	10	10	10	10	10	10	10	10
C-15	Flow Meters and Flow Control Valve (Set)						33.3%	33.3%	33.3%														
		46	F/C	100%	46		15	15	15														
			L/C	0%	0		0	0	0														
C-16	New Distrubution Pumping Station at Reservoir																33.3%	33.3%	33.3%				
		31	F/C	81%	25												8	8	8				
			L/C	19%	6												2	2	2				
D-1	Rehab of Raw Water Transmission Pumping Station						21.7%	21.7%	21.7%			11.6%	11.6%	11.6%									
		361	F/C	100%	361		78	78	78			42	42	42									
			L/C	0%	0		0	0	0			0	0	0									
D-2	Rehab of Law Water Transmission Pipes						33.3%	33.3%	33.3%														
		406	F/C	75%	305		102	102	102														
			L/C	25%	101		34	34	34														
D-3	Rehab of Filtration Plant						19.5%	19.5%	19.5%								13.9%	13.9%	13.9%				
		983	F/C	80%	787		153	153	153								109	109	109				
			L/C	20%	196		38	38	38								27	27	27				
D-4	Rehab of Reservoir						12.5%	12.5%	12.5%								20.9%	20.9%	20.9%				
		174	F/C	10%	18		2	2	2								4	4	4				
			L/C	90%	156		19	19	19								33	33	33				
D-5	Expansion of Reservoir						10.6%	10.6%	10.6%			17.7%	17.7%	17.7%			5.0%	5.0%	5.0%				
		1,080	F/C	10%	108		11	11	11			19	19	19			5	5	5				
			L/C	90%	972		103	103	103			172	172	172			49	49	49				
D-6	New Raw Water Transmission Facilities																33.3%	33.3%	33.3%				
		9,730	F/C	50%	4,865												1,622	1,622	1,622				
			L/C	50%	4,865												1,622	1,622	1,622				
D-7	New Raw Water Transmission Pumping Station											16.7%	16.7%	16.7%			16.7%	16.7%	16.7%				
		1,580	F/C	80%	1,264							211	211	211			211	211	211				
			L/C	20%	316							53	53	53			53	53	53				

Unit: Rs. Million

Project Component		Base Cost (2007 Price)			Year																	
		Total	Breakdown		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
D-8	New Raw Water Lagoon										16.7%	16.7%	16.7%			16.7%	16.7%	16.7%				
		400	F/C	5%	20						3	3	3			3	3	3				
			L/C	95%	380						63	63	63			63	63	63				
D-9	New Filtration Plant										16.7%	16.7%	16.7%			16.7%	16.7%	16.7%				
		3,600	F/C	80%	2,880						480	480	480			480	480	480				
			L/C	20%	720						120	120	120			120	120	120				
D-10	New Reservoir										19.7%	19.7%	19.7%			13.7%	13.7%	13.7%				
		680	F/C	10%	68						14	14	14			9	9	9				
			L/C	90%	612						120	120	120			84	84	84				
D-11	New Chlorination Equipment at Reservoir										25.0%	25.0%	25.0%			8.3%	8.3%	8.3%				
		8	F/C	100%	8						2	2	2			1	1	1				
			L/C	0%	0						0	0	0			0	0	0				
D-12	New Transmission Pumping Station										15.9%	15.9%	15.9%			17.4%	17.4%	17.4%				
		117	F/C	80%	94						15	15	15			16	16	16				
			L/C	20%	23						4	4	4			4	4	4				
D-13 (a)	New Transmission Main										30.9%	30.9%	30.9%			2.4%	2.4%	2.4%				
		3,497	F/C	75%	2,623						811	811	811			63	63	63				
			L/C	25%	874						270	270	270			21	21	21				
D-13 (b)	Rehab of These New Transmission Main																		25%	25%	25%	25%
		280	F/C	80%	224														56	56	56	56
			L/C	20%	56														14	14	14	14
D-14	Flow Meter and Flow Control Valves (Set)										23.8%	23.8%	23.8%			9.5%	9.5%	9.5%				
		21	F/C	100%	21						5	5	5			2	2	2				
			L/C	0%	0						0	0	0			0	0	0				
D-15	New Distrubution Pumping Station at Reservoir										33.3%	33.3%	33.3%									
		13	F/C	77%	10						3	3	3									
			L/C	23%	3						1	1	1									
Bulk Water Supply Sub Total		72,641	F/C	60%	43,362	0	6,057	6,057	6,057	40	40	4,588	4,588	4,588	48	48	3,609	3,609	3,609	104	104	104	104
			L/C	40%	29,279	0	4,034	4,034	4,034	10	10	3,040	3,040	3,040	13	13	2,634	2,634	2,634	27	27	27	27
Zone-West																						
B-13	Rehab (Replacement) of Distribution Main								9.1%	18.1%	23.3%	24.8%	24.8%									
		8,806	F/C	70%	6,165				559	1,118	1,434	1,527	1,527									
			L/C	30%	2,641				240	479	614	654	654									
B-14	New Distribution Main						3.8%	3.8%	3.8%			22.7%	22.7%	22.7%			6.8%	6.8%	6.8%				
		17,369	F/C	70%	12,158		468	468	468			2755	2755	2755			830	830	830				
			L/C	30%	5,211		200	200	200			1,181	1,181	1,181			356	356	356				
B-14 (b)	Rehab of New Distribution Main																					
		2,092	F/C	70%	1,464														366	366	366	366
			L/C	30%	628														157	157	157	157
B-15	Flow Meter and Flow Control Valve (Set)						20.5%	20.5%	20.5%			7.5%	7.5%	7.5%			5.3%	5.3%	5.3%				
		120	F/C	100%	120		25	25	25			9	9	9			6	6	6				
			L/C	0%	0		0	0	0			0	0	0			0	0	0				
B-16	Rehab of Distribution Pipeline (Ave. 6 inch, Installed by DNI, Routine Work)				0.9%	0.9%	0.9%	0.9%	8.9%	17.4%	17.7%	19.1%	19.1%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
		9,680	F/C	70%	6,776	59	59	59	59	604	1,179	1,198	1,291	1,291	108	108	108	108	108	108	108	108	108
			L/C	30%	2,904	25	25	25	25	259	505	513	554	554	46	46	46	46	46	46	46	46	46
B-17	Rehab of New Distribution Pipeline (Ave 6 inch, Routine Work)				1.0%	1.4%	1.9%	2.4%	3.0%	3.6%	4.2%	4.8%	5.4%	5.9%	6.5%	7.0%	7.5%	8.1%	8.6%	9.1%	9.6%	10.1%
		1,572	F/C	70%	1,100	11	16	21	26	33	40	46	53	59	65	71	77	83	89	94	100	106	111
			L/C	30%	472	5	7	9	11	14	17	20	23	26	28	31	33	36	38	41	43	45	48
B-18	New Distribution Pipeline (Ave. 6 inch)				4.9%	4.9%	4.9%	6.2%	6.2%	6.2%	6.2%	6.2%	5.5%	5.5%	5.5%	5.5%	5.5%	5.3%	5.3%	5.3%	5.3%	5.3%
		7,618	F/C	70%	5,333	262	262	262	332	332	332	332	332	292	292	292	292	292	285	285	285	285	285
			L/C	30%	2,285	112	112	112	142	142	142	142	142	125	125	125	125	125	122	122	122	122	122
B-19	House Connection (Water Meter)												1.6%	1.6%	1.6%	1.6%	1.6%	2.3%	12.5%	22.1%	26.4%	28.7%
		1,019	F/C	100%	1,019								16	16	16	16	16	24	128	225	270	293
			L/C	0%	0								0	0	0	0	0	0	0	0	0	0
B-20	House Connection (Water Meter during DNI)								4.7%	9.4%	20.9%	32.5%	32.5%									
		190	F/C	100%	190				9	18	40	62	62									
			L/C	0%	0				0	0	0	0	0									
B-21	House Connection (Pipe Installation and Water Meter during DNI)								11.0%	22.0%	22.2%	22.4%	22.4%									
		2,149	F/C	81%	1,741				192	383	387	390	390									
			L/C	19%	408				45	90	91	91	91									
B-22	House Connection (Pipe Installation)				17.1%	17.1%	17.1%	19.3%	14.7%	14.7%												
		236	F/C	70%	165	28	28	28	32	24	24											
			L/C	30%	71	12	12	12	14	10	10											
B-23	House Connection (Pipe Installation and Water Meter)				2.4%	2.4%	2.4%	3.5%	4.5%	4.5%	7.5%	7.5%	6.6%	6.6%	6.6%	6.6%	6.6%	6.5%	6.5%	6.5%	6.5%	6.5%
		1,802	F/C	81%	1,460	35	35	35	51	65	65	110	110	97	97	97	97	97	94	94	94	94	94
			L/C	19%	342	8	8	8	12	15	15	26	26	23	23	23	23	23	22	22	22	22	22

Unit: Rs. Million

Project Component	Base Cost (2007 Price)				Year																	
	Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Zone-West Sub Total	52,653	F/C	72%	37,691	395	892	898	993	1,818	3,159	6,311	6,529	6,498	578	584	1,426	1,432	1,436	1,076	1,179	1,229	1,258
		L/C	28%	14,962	163	365	367	405	725	1,259	2,587	2,671	2,653	222	225	583	585	584	388	391	393	396
ZONE-Central																						
Project Component	Base Cost (2007 Price)				Year																	
	Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
C-17 Rehab (Replacement) of Distribution Main														14.1%	28.3%	22.8%	17.4%	17.4%				
	9,753	F/C	70%	6,828										965	1,930	1,559	1,188	1,188				
		L/C	30%	2,925										413	826	668	509	509				
C-18 (a) New Distribution Main						22.1%	22.1%	22.1%			7.5%	7.5%	7.5%			3.7%	3.7%	3.7%				
	17,728	F/C	70%	12,410		2,741	2,741	2,741			934	934	934			462	462	462				
		L/C	30%	5,318		1,175	1,175	1,175			400	400	400			198	198	198				
C-18 (b) Rehab of New Distribution Main																						
	2,200	F/C	70%	1,540															385	385	385	385
		L/C	30%	660															165	165	165	165
C-19 Flow Meter and Flow Control Valve (Set)						32.4%	32.4%	32.4%			0.9%	0.9%	0.9%									
	185	F/C	100%	185		60	60	60			2	2	2									
		L/C	0%	0		0	0	0			0	0	0									
C-20 Rehab of Distribution Pipeline (Ave. 6 inch, Installed by DNI, Routine Work)					0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	12.4%	24.7%	19.7%	15.7%	15.7%	1.7%	1.7%	1.7%	1.7%
	10,706	F/C	70%	7,494	41	41	41	41	41	41	41	41	41	931	1,853	1,473	1,178	1,178	129	129	129	129
		L/C	30%	3,212	17	17	17	17	17	17	17	17	17	399	794	632	505	505	55	55	55	55
C-21 Rehab of New Distribution Pipeline (Ave. 6 inch, Routine Work)					0.9%	1.4%	1.9%	2.3%	2.9%	3.5%	4.1%	4.7%	5.3%	5.9%	6.4%	7.0%	7.6%	8.1%	8.7%	9.2%	9.7%	10.3%
	1,918	F/C	70%	1,343	13	19	25	32	39	47	55	63	71	79	86	94	102	109	116	124	131	138
		L/C	30%	575	5	8	11	14	17	20	24	27	31	34	37	40	44	47	50	53	56	59
C-22 New Distribution Pipeline (Ave. 6 inch)					4.8%	4.8%	4.8%	6.0%	6.0%	6.0%	6.0%	6.0%	5.7%	5.7%	5.7%	5.7%	5.7%	5.4%	5.4%	5.4%	5.4%	5.4%
	9,456	F/C	70%	6,619	315	315	315	397	397	397	397	397	380	380	380	380	380	358	358	358	358	358
		L/C	30%	2,837	135	135	135	170	170	170	170	170	163	163	163	163	163	154	154	154	154	154
C-23 House Connection (Water Meter)													7.9%	7.9%	7.9%	7.9%	7.9%	12.1%	12.1%	12.1%	12.1%	12.1%
	209	F/C	100%	209									17	17	17	17	17	25	25	25	25	25
		L/C	0%	0									0	0	0	0	0	0	0	0	0	0
C-24 House Connection (Water Meter during DNI)														20.0%	40.1%	24.0%	7.9%	7.9%				
	375	F/C	100%	375										75	150	90	30	30				
		L/C	0%	0										0	0	0	0	0				
C-25 House Connection (Pipe Installation and Water Meter during DNI)														13%	26%	23%	20%	20%				
	2,761	F/C	81%	2,236										285	571	504	438	438				
		L/C	19%	525										67	134	118	103	103				
C-26 House Connection (Pipe Installation)					10.1%	10.1%	10.1%	11.4%	11.4%	11.4%	11.4%	11.4%	10.4%	1.1%	1.1%							
	520	F/C	70%	364	37	37	37	42	42	42	42	42	38	4	4							
		L/C	30%	156	16	16	16	18	18	18	18	18	16	2	2							
C-27 House Connection (Pipe Installation and Water Meter)					2.4%	2.4%	2.4%	3.6%	3.6%	3.6%	3.6%	3.6%	3.7%	7.8%	7.8%	8.3%	8.3%	7.8%	7.8%	7.8%	7.8%	7.8%
	2,716	F/C	81%	2,200	52	52	52	79	79	79	79	79	81	171	171	182	182	172	172	172	172	172
		L/C	19%	516	12	12	12	19	19	19	19	19	19	40	40	43	43	40	40	40	40	40
Zone-Central Sub-total	58,527	F/C	71%	41,803	457	3,264	3,270	3,390	597	605	1,548	1,556	1,562	2,907	5,161	4,761	3,976	3,961	1,186	1,193	1,200	1,207
		L/C	29%	16,724	186	1,363	1,366	1,412	241	244	647	651	646	1,118	1,996	1,861	1,564	1,555	464	467	470	473
ZONE-East																						
D-16 Rehab (Replacement) of Distribution Main																				33.3%	33.3%	33.3%
	6,435	F/C	70%	4,504																1,501	1,501	1,501
		L/C	30%	1,931																644	644	644
D-17 New Distribution Main						9.8%	9.8%	9.8%			18.6%	18.6%	18.6%			5.0%	5.0%	5.0%				
	9,105	F/C	70%	6,374		622	622	622			1,185	1,185	1,185			318	318	318				
		L/C	30%	2,731		267	267	267			508	508	508			136	136	136				
D-17 (b) Rehab of Distribution Main																						
	1,244	F/C	70%	872															218	218	218	218
		L/C	30%	372															93	93	93	93
D-18 Flow Meter and Flow Control Valve (Set)						15.4%	15.4%	15.4%			13.0%	13.0%	13.0%			5.0%	5.0%	5.0%				
	70	F/C	100%	70		11	11	11			9	9	9			4	4	4				
		L/C	0%	0		0	0	0			0	0	0			0	0	0				
D-19 Rehab of Distribution Pipeline (Ave. 6 inch, Installed by DNI, Routine Work)					1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	12.4%	24.8%	24.8%	24.8%
	2,304	F/C	70%	1,613	15	15	15	15	15	15	15	15	15	15	15	15	15	15	200	399	399	399
		L/C	30%	691	7	7	7	7	7	7	7	7	7	7	7	7	7	7	86	171	171	171
D-20 Rehab of New Distribution Pipeline (Ave. 6 inch, Routine Work)					0.9%	1.3%	1.8%	2.2%	2.8%	3.3%	3.9%	4.4%	5.0%	5.6%	6.3%	6.9%	7.5%	8.2%	8.9%	9.6%	10.3%	11.0%
	1,302	F/C	70%	911	8	12	16	20	25	30	35	40	45	51	57	63	69	75	81	88	94	100
		L/C	30%	391	3.5	5	7	9	11	13	15	17	19	22	25	27	30	32	35	38	40	43
D-21 New Distribution Pipeline (Ave. 6 inch)					4.1%	4.1%	4.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.9%	5.9%	5.9%	5.9%	5.9%	6.5%	6.5%	6.5%	6.5%	6.5%
	7,048	F/C	70%	4,934	204	204	204	250	250	250	250	250	294	294	294	294	294	321	321	321	321	321
		L/C	30%	2,114	87.4	87	87	107	107	107	107	107	126	126	126	126	126	138	138	138	138	138

Unit: Rs. Million

Project Component		Base Cost (2007 Price)				Year																	
		Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
D-22	House Connection (Water Meter)													8.9%	8.9%	8.9%	8.9%	8.9%	11.1%	11.1%	11.1%	11.1%	11.1%
		172	F/C	100%	172									15	15	15	15	15	19	19	19	19	19
			L/C	0%	0									0	0	0	0	0	0	0	0	0	0
D-23	House Connection (Water Meter during DNI)																			14.3%	28.6%	28.6%	28.6%
		313	F/C	100%	313															45	89	89	89
			L/C	0%	0															0	0	0	0
D-24	House Connection (Pipe Installation and Water Meter during DNI)																			14.3%	28.6%	28.6%	28.6%
		523	F/C	81%	424															61	121	121	121
			L/C	19%	99															14	28	28	28
D-25	House Connection (Pipe Installation)					5.7%	5.7%	5.7%	6.8%	6.8%	6.8%	6.8%	6.8%	8.1%	8.1%	8.1%	8.1%	8.1%	8.1%				
		469	F/C	70%	328	19	19	19	22	22	22	22	22	27	27	27	27	27	27				
			L/C	30%	141	8	8	8	10	10	10	10	10	12	12	12	12	12	12				
D-26	House Connection (Pipe Installation and Water Meter)					3.2%	3.2%	3.2%	4.0%	4.0%	4.0%	4.0%	4.0%	4.6%	4.6%	4.6%	4.6%	4.6%	5.5%	10.4%	10.4%	10.4%	10.4%
		1,267	F/C	81%	1,026	33	33	33	41	41	41	41	41	48	48	48	48	48	57	106	106	106	106
			L/C	19%	241	8	8	8	10	10	10	10	10	11	11	11	11	11	13	25	25	25	25
ZONE-East Sub Total		30,252	F/C	71%	21,541	279	916	920	982	354	359	1,558	1,563	1,638	450	456	783	789	835	1,051	2,863	2,870	2,876
			L/C	29%	8,711	113	381	383	408	144	146	656	658	683	177	180	318	320	337	390	1,136	1,139	1,142
Total Base Cost (TBC)		214,073	F/C	67%	144,397	1,131	11,129	11,145	11,421	2,809	4,163	14,005	14,236	14,286	3,983	6,249	10,579	9,805	9,841	3,416	5,340	5,403	5,446
			L/C	33%	69,676	461	6,144	6,150	6,259	1,120	1,659	6,931	7,020	7,022	1,530	2,413	5,396	5,104	5,111	1,269	2,021	2,029	2,037

Project Component		Base Cost (2007 Price)				Year																	
		Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total Base Cost (TBC)		214,073	F/C	67%	144,397	1,131	11,129	11,145	11,421	2,809	4,163	14,005	14,236	14,286	3,983	6,249	10,579	9,805	9,841	3,416	5,340	5,403	5,446
			L/C	33%	69,676	461	6,144	6,150	6,259	1,120	1,659	6,931	7,020	7,022	1,530	2,413	5,396	5,104	5,111	1,269	2,021	2,029	2,037
E	Engineering Fees	16,055	F/C	70%	11,238	84	907	908	928	206	306	1,099	1,116	1,119	289	455	839	783	785	246	386	390	393
			L/C	30%	4,816	36	389	389	398	88	131	471	478	479	124	195	359	335	336	105	166	167	168
F	Land Acquisition	1,547	F/C	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			L/C	100%	1,547	1,547	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	Physical Contingency	11,583	F/C	67%	7,781	61	602	603	617	151	223	755	768	770	214	335	571	529	531	183	286	290	292
			L/C	33%	3,802	102	327	327	333	60	89	370	375	375	83	130	288	272	272	69	109	110	110
Sub-total (TBC+E+F+G)		243,257	F/C	67%	163,416	1,275	12,637	12,655	12,967	3,166	4,693	15,860	16,120	16,175	4,486	7,039	11,988	11,117	11,157	3,846	6,012	6,083	6,130
			L/C	33%	79,841	2,146	6,859	6,866	6,990	1,269	1,879	7,772	7,873	7,876	1,736	2,738	6,043	5,711	5,720	1,443	2,296	2,306	2,316
H	Price Contingency	80,792	F/C	30%	24,052	19	382	578	796	245	438	1,742	2,039	2,319	720	1,253	2,345	2,374	2,586	962	1,617	1,752	1,884
			L/C	70%	56,740	129	848	1,312	1,835	429	787	3,914	4,675	5,430	1,373	2,460	6,117	6,470	7,212	2,016	3,536	3,903	4,294
Sub-total (TBC+E+F+G+H)		324,049	F/C	58%	187,468	1,294	13,019	13,233	13,763	3,411	5,131	17,602	18,159	18,494	5,206	8,291	14,333	13,492	13,743	4,808	7,630	7,835	8,015
			L/C	42%	136,581	2,275	7,707	8,178	8,824	1,698	2,666	11,687	12,548	13,306	3,109	5,198	12,161	12,181	12,932	3,459	5,831	6,209	6,610
I	Project Administration	4,861	F/C	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			L/C	100%	4,861	54	311	321	339	77	117	439	461	477	125	202	397	385	400	124	202	211	219
Total Project Cost (TPC)		328,910	F/C	57%	187,468	1,294	13,019	13,233	13,763	3,411	5,131	17,602	18,159	18,494	5,206	8,291	14,333	13,492	13,743	4,808	7,630	7,835	8,015
			L/C	43%	141,441	2,329	8,017	8,499	9,163	1,774	2,783	12,126	13,009	13,783	3,234	5,400	12,558	12,566	13,332	3,583	6,093	6,420	6,829

	F/C	L/C
Engineering Fees	7.5%	7.5%
Physical Contingency	5.0%	5.0%
Price Contingency	1.5%	6.0%
Administration Cost		1.5%

APPENDIX – A102.2

Operation and Maintenance Cost of Water Supply Components

A102.2 Operation and Maintenance Cost of Water Supply Components

Unit: Rs. Million (Thousand Rs/year)

Category	Facility	Item	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bulk Water Supply System (Common)											
Raw Water Transmission Pumping Station	Dhabeji (K-I, Phase I) 24 mgd x 5 (Rehabilitation)	Operation Cost	96,428	96,428	96,428	96,428	96,428	96,428	96,428	96,428	96,428
		Maintenance Cost	1,414	1,414	1,414	1,414	1,414	1,414	1,414	1,414	1,414
		Total	97,842	97,842	97,842	97,842	97,842	97,842	97,842	97,842	97,842
	Dhabeji (KI, Phase II) 25 mgd x 5 (Rehabilitation)	Operation Cost	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686
		Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
		Total	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156
	Dhabeji (K-I, Phase III) 25 mgd x 5 (Rehabilitation)	Operation Cost	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686
		Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
		Total	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156
	Dhabeji (K-I, Phase IV) 25 mgd x 5 (Rehabilitation)	Operation Cost	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686
		Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
		Total	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156
	Dhabeji (K-II, 1998) 35 mgd x 5 (Rehabilitation)	Operation Cost	304,303	304,303	304,303	304,303	304,303	304,303	304,303	304,303	304,303
		Maintenance Cost	2,289	2,289	2,289	2,289	2,289	2,289	2,289	2,289	2,289
		Total	306,592	306,592	306,592	306,592	306,592	306,592	306,592	306,592	306,592
Bulk Water Supply System (Common) Total		Operation Cost	990,789	990,789	990,789	990,789	990,789	990,789	990,789	990,789	990,789
		Maintenance Cost	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113
		Total	998,902	998,902	998,902	998,902	998,902	998,902	998,902	998,902	998,902
Bulk Water Supply System (West)											
Filtration Plant	FP-Hub (K-III-2006) (Rehabilitation)	Operation Cost	73,148	73,148	73,148	73,148	73,148	73,148	73,148	73,148	73,148
		Maintenance Cost	4,432	4,432	4,432	4,432	4,432	4,432	4,432	4,432	4,432
		Total	77,580	77,580	77,580	77,580	77,580	77,580	77,580	77,580	77,580
	FP-West (K-IV) (New)	Operation Cost	0	0	0	0	0	0	0	0	0
		Maintenance Cost	0	0	0	0	0	0	0	0	0
		Total	0	0	0	0	0	0	0	0	0
Raw Water Transmission Pumping Station	Raw Water Transmission PS (W+C+E)	Operation Cost	0	0	0	0	445,959	512,519	512,519	512,519	512,519
		Maintenance Cost	0	0	0	0	3,097	3,097	3,097	3,097	3,097
		Total	0	0	0	0	449,056	515,616	515,616	515,616	515,616
Transmission Pumping Station	Transmission PS (TPS-W-West) (New)	Operation Cost	0	0	0	0	0	0	0	0	0
		Maintenance Cost	0	0	0	0	0	0	0	0	0
		Total	0	0	0	0	0	0	0	0	0
Distribution Pumping Station	DPS W-Orangi-Keamari	Operation Cost	0	0	0	0	0	0	0	0	0
		Maintenance Cost	0	0	0	0	0	0	0	0	0
		Total	0	0	0	0	0	0	0	0	0
Bulk Water Supply System (West) Total		Operation Cost	73,148	73,148	73,148	73,148	519,107	585,667	585,667	585,667	585,667
		Maintenance Cost	4,432	4,432	4,432	4,432	7,529	7,529	7,529	7,529	7,529
		Total	77,580	77,580	77,580	77,580	526,636	593,196	593,196	593,196	593,196
Bulk Water Supply System (Central)											
Filtration Plant	FP-NEK Old (Rehabilitation)	Operation Cost	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076
		Maintenance Cost	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385
		Total	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461
	FP-NEK New (Rehabilitation)	Operation Cost	90,630	90,630	90,630	90,630	90,630	90,630	90,630	90,630	90,630
		Maintenance Cost	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540
		Total	96,170	96,170	96,170	96,170	96,170	96,170	96,170	96,170	96,170
	FP-COD (K-I Phase I) (Rehabilitation)	Operation Cost	64,407	64,407	64,407	64,407	64,407	64,407	64,407	64,407	64,407
		Maintenance Cost	3,878	3,878	3,878	3,878	3,878	3,878	3,878	3,878	3,878
		Total	68,285	68,285	68,285	68,285	68,285	68,285	68,285	68,285	68,285
	FP-COD (K-I Phase II) (Rehabilitation)	Operation Cost	42,557	42,557	42,557	42,557	42,557	42,557	42,557	42,557	42,557
		Maintenance Cost	2,493	2,493	2,493	2,493	2,493	2,493	2,493	2,493	2,493
		Total	45,050	45,050	45,050	45,050	45,050	45,050	45,050	45,050	45,050
	FP-COD (Expansion)	Operation Cost	0	0	0	0	77,519	77,519	77,519	77,519	77,519
		Maintenance Cost	0	0	0	0	4,709	4,709	4,709	4,709	4,709
		Total	0	0	0	0	82,228	82,228	82,228	82,228	82,228
	FP-K-III (New)	Operation Cost	0	0	0	0	90,630	90,630	90,630	90,630	90,630
		Maintenance Cost	0	0	0	0	5,540	5,540	5,540	5,540	5,540
		Total	0	0	0	0	96,170	96,170	96,170	96,170	96,170
	FP-Central (K-IV) (New)	Operation Cost	0	0	0	0	116,850	116,850	116,850	116,850	116,850
		Maintenance Cost	0	0	0	0	7,202	7,202	7,202	7,202	7,202
		Total	0	0	0	0	124,052	124,052	124,052	124,052	124,052
Raw Water Transmission Pumping Station	NEK Old PS (1978) 12.5 mgd x 4 **(Rehabilitation)**	Operation Cost	37,791	37,791	37,791	37,791	37,791	37,791	37,791	37,791	37,791
		Maintenance Cost	417	417	417	417	3,097	3,097	3,097	3,097	3,097
		Total	38,208	38,208	38,208	38,208	40,888	40,888	40,888	40,888	40,888
	NEK Old PS (1978) 5 mgd x 6 **(Rehabilitation)**	Operation Cost	13,799	13,799	13,799	13,799	13,799	13,799	13,799	13,799	13,799
		Maintenance Cost	188	188	188	188	3,097	3,097	3,097	3,097	3,097
		Total	13,987	13,987	13,987	13,987	16,896	16,896	16,896	16,896	16,896
	Low Lift PS (1998) 35 mgd x 5 **(Rehabilitation)**	Operation Cost	35,537	35,537	35,537	35,537	35,537	35,537	35,537	35,537	35,537
		Maintenance Cost	325	325	325	325	3,097	3,097	3,097	3,097	3,097
		Total	35,862	35,862	35,862	35,862	38,634	38,634	38,634	38,634	38,634
Transmission Pumping Station	New Transmission PS (TPS-FP-COD)	Operation Cost	0	0	0	0	6,011	8,495	10,979	13,462	15,945
		Maintenance Cost	0	0	0	0	102	102	102	102	102
		Total	0	0	0	0	6,113	8,597	11,081	13,564	16,047
	New Transmission PS (TPS-FP-NEK New)	Operation Cost	0	0	0	0	7,070	10,610	14,152	17,693	21,234
		Maintenance Cost	0	0	0	0	146	146	146	146	146
		Total	0	0	0	0	7,216	10,756	14,298	17,839	21,380
	New Transmission PS (TPS-PF-Central)	Operation Cost	0	0	0	0	7,023	10,519	14,013	17,509	21,004
		Maintenance Cost	0	0	0	0	144	144	144	144	144
		Total	0	0	0	0	7,167	10,663	14,157	17,653	21,148
	New Transmission PS (TPS-High Lift)	Operation Cost	0	0	0	0	12,542	21,557	30,570	39,584	48,598
		Maintenance Cost	0	0	0	0	370	370	370	370	370
		Total	0	0	0	0	12,912	21,927	30,940	39,954	48,968
Distribution Pumping Station	DPSC-C01	Operation Cost	0	0	0	0	0	0	0	0	0
		Maintenance Cost	0	0	0	0	0	0	0	0	0
		Total	0	0	0	0	0	0	0	0	0
Bulk Water Supply System (Central) Total		Operation Cost	309,797	309,797	309,797	309,797	627,442	645,977	664,510	683,044	701,577
		Maintenance Cost	14,226	14,226	14,226	14,226	40,798	40,798	40,798	40,798	40,798
		Total	324,023	324,023	324,023	324,023	668,240	686,775	705,308	723,842	742,375

Category	Facility	Item	2017	2018	2019	2020	2021	2022	2023	2024	2025
Bulk Water Supply System (Common)											
Raw Water Transmission Pumping Station	Dhabeji (K-I, Phase I) 24 mgd x 5 (Rehabilitation)	Operation Cost	96,428	96,428	96,428	96,428	96,428	96,428	96,428	96,428	96,428
		Maintenance Cost	1,414	1,414	1,414	1,414	1,414	1,414	1,414	1,414	1,414
		Total	97,842	97,842	97,842	97,842	97,842	97,842	97,842	97,842	97,842
	Dhabeji (KI, Phase II) 25 mgd x 5 (Rehabilitation)	Operation Cost	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686
		Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
		Total	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156
	Dhabeji (K-I, Phase III) 25 mgd x 5 (Rehabilitation)	Operation Cost	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686
		Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
		Total	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156
	Dhabeji (K-I, Phase IV) 25 mgd x 5 (Rehabilitation)	Operation Cost	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686	196,686
		Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
		Total	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156	198,156
	Dhabeji (K-II, 1998) 35 mgd x 5 (Rehabilitation)	Operation Cost	304,303	304,303	304,303	304,303	304,303	304,303	304,303	304,303	304,303
		Maintenance Cost	2,289	2,289	2,289	2,289	2,289	2,289	2,289	2,289	2,289
		Total	306,592	306,592	306,592	306,592	306,592	306,592	306,592	306,592	306,592
Bulk Water Supply System (Common) Total		Operation Cost	990,789	990,789	990,789	990,789	990,789	990,789	990,789	990,789	990,789
		Maintenance Cost	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113
		Total	998,902	998,902	998,902	998,902	998,902	998,902	998,902	998,902	998,902
Bulk Water Supply System (West)											
Filtration Plant	FP-Hub (K-III-2006) (Rehabilitation)	Operation Cost	73,148	73,148	73,148	73,148	73,148	73,148	73,148	73,148	73,148
		Maintenance Cost	4,432	4,432	4,432	4,432	4,432	4,432	4,432	4,432	4,432
		Total	77,580	77,580	77,580	77,580	77,580	77,580	77,580	77,580	77,580
	FP-West (K-IV) (New)	Operation Cost	116,850	116,850	116,850	116,850	116,850	230,474	230,474	230,474	230,474
		Maintenance Cost	7,202	7,202	7,202	7,202	7,202	14,404	14,404	14,404	14,404
		Total	124,052	124,052	124,052	124,052	124,052	244,878	244,878	244,878	244,878
Raw Water Transmission Pumping Station	Raw Water Transmission PS (W+C+E)	Operation Cost	1,078,949	1,219,782	1,360,614	1,501,446	1,532,743	1,786,341	1,927,150	2,067,958	2,208,767
		Maintenance Cost	9,289	9,289	9,289	9,289	9,289	15,482	15,482	15,482	15,482
		Total	1,088,238	1,229,071	1,369,903	1,510,735	1,542,032	1,801,823	1,942,632	2,083,440	2,224,249
Transmission Pumping Station	Transmission PS (TPS-W-West) (New)	Operation Cost	5,460	7,391	9,323	11,254	13,186	18,590	23,994	29,398	34,801
		Maintenance Cost	79	79	79	79	79	257	257	257	257
		Total	5,539	7,470	9,402	11,333	13,265	18,847	24,251	29,655	35,058
Distribution Pumping Station	DPS W-Orangi-Keamari	Operation Cost	0	0	0	0	0	8,127	12,726	17,325	21,924
		Maintenance Cost	0	0	0	0	0	112	112	112	112
		Total	0	0	0	0	0	8,239	12,838	17,437	22,036
Bulk Water Supply System (West) Total		Operation Cost	1,274,407	1,417,171	1,559,935	1,702,698	1,735,927	2,116,680	2,267,492	2,418,303	2,569,114
		Maintenance Cost	21,003	21,003	21,003	21,003	21,003	34,687	34,687	34,687	34,687
		Total	1,295,410	1,438,174	1,580,938	1,723,701	1,756,930	2,151,367	2,302,179	2,452,990	2,603,801
Bulk Water Supply System (Central)											
Filtration Plant	FP-NEK Old (Rehabilitation)	Operation Cost	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076
		Maintenance Cost	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385
		Total	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461
	FP-NEK New (Rehabilitation)	Operation Cost	90,630	90,630	90,630	90,630	90,630	90,630	90,630	90,630	90,630
		Maintenance Cost	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540
		Total	96,170	96,170	96,170	96,170	96,170	96,170	96,170	96,170	96,170
	FP-COD (K-I Phase I) (Rehabilitation)	Operation Cost	64,407	64,407	64,407	64,407	64,407	64,407	64,407	64,407	64,407
		Maintenance Cost	3,878	3,878	3,878	3,878	3,878	3,878	3,878	3,878	3,878
		Total	68,285	68,285	68,285	68,285	68,285	68,285	68,285	68,285	68,285
	FP-COD (K-I Phase II) (Rehabilitation)	Operation Cost	42,557	42,557	42,557	42,557	42,557	42,557	42,557	42,557	42,557
		Maintenance Cost	2,493	2,493	2,493	2,493	2,493	2,493	2,493	2,493	2,493
		Total	45,050	45,050	45,050	45,050	45,050	45,050	45,050	45,050	45,050
	FP-COD (Expansion)	Operation Cost	77,519	77,519	77,519	77,519	77,519	77,519	77,519	77,519	77,519
		Maintenance Cost	4,709	4,709	4,709	4,709	4,709	4,709	4,709	4,709	4,709
		Total	82,228	82,228	82,228	82,228	82,228	82,228	82,228	82,228	82,228
	FP-K-III (New)	Operation Cost	90,630	90,630	90,630	90,630	90,630	90,630	90,630	90,630	90,630
		Maintenance Cost	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540
		Total	96,170	96,170	96,170	96,170	96,170	96,170	96,170	96,170	96,170
	FP-Central (K-IV) (New)	Operation Cost	116,850	116,850	116,850	116,850	116,850	116,850	116,850	116,850	116,850
		Maintenance Cost	7,202	7,202	7,202	7,202	7,202	7,202	7,202	7,202	7,202
		Total	124,052	124,052	124,052	124,052	124,052	124,052	124,052	124,052	124,052
Raw Water Transmission Pumping Station	NEK Old PS (1978) 12.5 mgd x 4 **(Rehabilitation)**	Operation Cost	37,791	37,791	37,791	37,791	37,791	37,791	37,791	37,791	37,791
		Maintenance Cost	9,289	9,289	9,289	9,289	9,289	15,482	15,482	15,482	15,482
		Total	47,080	47,080	47,080	47,080	47,080	53,273	53,273	53,273	53,273
	NEK Old PS (1978) 5 mgd x 6 **(Rehabilitation)**	Operation Cost	13,799	13,799	13,799	13,799	13,799	13,799	13,799	13,799	13,799
		Maintenance Cost	9,289	9,289	9,289	9,289	9,289	15,482	15,482	15,482	15,482
		Total	23,088	23,088	23,088	23,088	23,088	29,281	29,281	29,281	29,281
	Low Lift PS (1998) 35 mgd x 5 **(Rehabilitation)**	Operation Cost	35,537	35,537	35,537	35,537	35,537	35,537	35,537	35,537	35,537
		Maintenance Cost	9,289	9,289	9,289	9,289	9,289	15,482	15,482	15,482	15,482
		Total	44,826	44,826	44,826	44,826	44,826	51,019	51,019	51,019	51,019
Transmission Pumping Station	New Transmission PS (TPS-FP-COD)	Operation Cost	16,313	16,681	17,049	17,417	17,785	18,130	18,475	18,820	19,165
		Maintenance Cost	117	117	117	117	117	129	129	129	129
		Total	16,430	16,798	17,166	17,534	17,902	18,259	18,604	18,949	19,294
	New Transmission PS (TPS-FP-NEK New)	Operation Cost	21,234	21,234	21,234	21,234	21,234	21,234	21,234	21,234	21,234
		Maintenance Cost	146	146	146	146	146	146	146	146	146
		Total	21,380	21,380	21,380	21,380	21,380	21,380	21,380	21,380	21,380
	New Transmission PS (TPS-PF-Central)	Operation Cost	24,270	27,535	30,800	34,065	37,331	41,930	46,529	51,128	55,727
		Maintenance Cost	278	278	278	278	278	429	429	429	429
		Total	24,548	27,813	31,078	34,343	37,609	42,359	46,958	51,557	56,156
	New Transmission PS (TPS-High Lift)	Operation Cost	49,518	50,438	51,358	52,277	53,197	54,117	55,037	55,957	56,876
		Maintenance Cost	408	408	408	408	408	438	438	438	438
		Total	49,926	50,846	51,766	52,685	53,605	54,555	55,475	56,395	57,314
Distribution Pumping Station	DPSC-C01	Operation Cost	0	0	0	0	0	8,587	13,646	18,705	23,764
		Maintenance Cost	0	0	0	0	0	123	123	123	123
		Total	0	0	0	0	0	8,710	13,769	18,828	23,887
Bulk Water Supply System (Central) Total		Operation Cost	706,131	710,684	715,237	719,789	724,343	738,794	749,717	760,640	771,562
		Maintenance Cost	59,564	59,564	59,564	59,564	59,564	78,458	78,458	78,458	78,458
		Total	765,695	770,248	774,801	779,353	783,907	817,252	828,175	839,098	850,020

Unit: Rs. Million

			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Bulk Water Supply System (East)																				
Filtration Plant	Gharo (Old) FP (1943) **(Rehabilitation)**	Operation Cost	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966
		Maintenance Cost	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554
		Total	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520
	Gharo (New) FP (1953) **(Rehabilitation)**	Operation Cost	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966	11,966
		Maintenance Cost	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554	554
		Total	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520	12,520
	Pipri FP (K-I Phase II 1971) **(Rehabilitation)**	Operation Cost	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076
		Maintenance Cost	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385
		Total	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461
	Pipri FP (K-I Phase III 1978) **(Rehabilitation)**	Operation Cost	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076	25,076
		Maintenance Cost	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385	1,385
		Total	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461	26,461
	Pipri FP (K-III 2006) **(Rehabilitation)**	Operation Cost	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928	46,928
		Maintenance Cost	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770
		Total	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698	49,698
	FP-East (K-IV) (New)	Operation Cost	0	0	0	0	0	0	0	0	0	116,850	116,850	116,850	116,850	116,850	230,474	230,474	230,474	230,474
		Maintenance Cost	0	0	0	0	0	0	0	0	0	7,202	7,202	7,202	7,202	7,202	14,404	14,404	14,404	14,404
		Total	0	0	0	0	0	0	0	0	0	124,052	124,052	124,052	124,052	124,052	244,878	244,878	244,878	244,878
Raw Water Transmission Pumping Station	Gharo (Old) PS (1943) 5 mgd x 3 **(Rehabilitation)**	Operation Cost	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264
		Maintenance Cost	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
		Total	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389
	Gharo (Old) PS (1982) 2 mgd x 6 **(Rehabilitation)**	Operation Cost	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264	17,264
		Maintenance Cost	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
		Total	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389
	Gharo (Old) PS (2002) 5 mgd x 2 **(Rehabilitation)**	Operation Cost	10,380	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105
		Maintenance Cost	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83
		Total	10,463	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188	12,188
	Gharo (New) PS (1953) 10 mgd x 2 **(Rehabilitation)**	Operation Cost	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660	20,660
		Maintenance Cost	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209
		Total	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869	20,869
	Gharo (New) PS (1997) 2 mgd x 5 **(Rehabilitation)**	Operation Cost	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386	16,386
		Maintenance Cost	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
		Total	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516	16,516
	Gharo (New) PS (2002) 5 mgd x 2 **(Rehabilitation)**	Operation Cost	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105	12,105
		Maintenance Cost	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
		Total	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209	12,209
	Pipri PS (K-I Phase II 1971) 12.5 mgd x 6 **(Rehab)**	Operation Cost	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358	51,358
		Maintenance Cost	437	437	437	437	437	437	437	437	437	437	437	437	437	437	437	437	437	437
		Total	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795	51,795
	Pipri PS (K-I Phase IV 1994) 12.5 mgd x 4 **(Rehab)**	Operation Cost	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740	21,740
		Maintenance Cost	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
		Total	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888	21,888
	Pipri PS (K-III 2002) 4.32 mgd x 14 **(Rehab)**	Operation Cost	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300	65,300
		Maintenance Cost	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439	439
		Total	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739	65,739
Transmission Pumping Station	New Transmission PS (TPS-FP-East-01)	Operation Cost	0	0	0	0	0	0	0	0	0	8,954	14,382	19,808	25,236	30,662	32,617	34,571	36,526	38,480
		Maintenance Cost	0	0	0	0	0	0	0	0	0	223	223	223	223	223	287	287	287	287
		Total	0	0	0	0	0	0	0	0	0	9,177	14,605	20,031	25,459	30,885	32,904	34,858	36,813	38,767
	New Transmission PS (TPS-FP-East-02)	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,379	11,232	15,083	18,935
		Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	127	127	127
		Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,506	11,359	15,210	19,062
	New Transmission PS (TPS-Res-E02)	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,080	6,633	8,185	9,737
		Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	51	51	51
		Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,131	6,684	8,236	9,788
Distribution Pumping Station	DPS-E-E03	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,655	7,783	9,909	12,036
		Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	52	52	52
		Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,707	7,835	9,961	12,088
Bulk Water Supply System (East) Total		Operation Cost	353,469	355,194	355,194	355,194	355,194	355,194	355,194	355,194	355,194	480,998	486,426	491,852	497,280	502,706	636,399	645,887	655,371	664,856
		Maintenance Cost	8,449	8,449	8,449	8,449	8,449	8,449	8,449	8,449	8,449	15,874	15,874	15,874	15,874	15,874	23,370	23,370	23,370	23,370
		Total	361,918	363,643	363,643	363,643	363,643	363,643	363,643	363,643	363,643	496,872	502,300	507,726	513,154	518,580	659,769	669,257	678,741	688,226
Total		Operation Cost	1,727,203	1,728,928	1,728,928	1,728,928	2,492,532	2,577,627	2,596,160	2,614,694	2,633,227	3,452,325	3,605,070	3,757,813	3,910,556	3,953,765	4,482,662	4,653,885	4,825,103	4,996,321
		Maintenance Cost	35,220	35,220	35,220	35,220	64,889	64,889	64,889	64,889	64,889	104,554	104,554	104,554	104,554	104,554	144,628	144,628	144,628	144,628
		Total	1,762,423	1,764,148	1,764,148	1,764,148	2,557,421	2,642,516	2,661,049	2,679,583	2,698,116	3,556,879	3,709,624	3,862,367	4,015,110	4,058,319	4,627,290	4,798,513	4,969,731	5,140,949

APPENDIX – A102.3

Cost of Sewerage Components

A102.3 Cost of Sewerage Components

Unit: Rs. Million

Project Component		Base Cost (2007 Price)				Construction/Installation																	
		Total	Breakdown			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
ZONE-West																							
TP-1 and TP-3 District																							
A-1	Branch Sewer									5.3%	5.3%	5.3%	9.3%	9.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%
		6,357	F/C	23%	1,458					68	68	68	155	155	105	105	105	105	105	105	105	105	105
			L/C	77%	4,899					272	272	272	439	439	356	356	356	356	356	356	356	356	356
A-2	Sub-main Sewer									14.1%	14.1%	14.1%	9.8%	9.8%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%
		1,901	F/C	20%	380					54	54	54	37	37	16	16	16	16	16	16	16	16	16
			L/C	80%	1,521					214	214	214	150	150	64	64	64	64	64	64	64	64	64
A-3	Trunk Sewer									7.8%	7.8%	7.8%	38.4%	38.4%									
		2,407	F/C	20%	482					37	37	37	185	185									
			L/C	80%	1,925					149	149	149	739	739									
A-4	Sewage Treatment Plant									1.6%	1.6%	0.9%	26.1%	26.1%		7.0%	7.0%	7.8%	7.8%	7.0%	7.0%		
		13,337	F/C	62%	8,212					195	195	105	2,137	2,137		544	544	634	634	544	544		
			L/C	38%	5,125					22	22	12	1,343	1,343		394	394	404	404	394	394		
TP-1 and TP-3 District Sub-total		24,002	F/C	44%	10,532	0	0	0	0	354	354	264	2,514	2,514	121	665	665	755	755	665	665	121	121
			L/C	56%	13,470	0	0	0	0	657	657	647	2,671	2,671	421	814	814	825	825	814	814	421	421
TP-2 District																							
A-5	Branch Sewer									6.5%	6.5%	6.5%	11.1%	11.1%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
		2,326	F/C	22%	512					34	34	34	55	55	34	34	34	34	34	34	34	34	34
			L/C	78%	1,814					118	118	118	203	203	118	118	118	118	118	118	118	118	118
A-6	Sub-main Sewer									3.6%	3.6%	3.6%	28.6%	28.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%
		625	F/C	20%	125					5	5	5	36	36	5	5	5	5	5	5	5	5	5
			L/C	80%	500					18	18	18	143	143	18	18	18	18	18	18	18	18	18
A-7	Trunk Sewer					9.2%	9.2%	9.2%	9.2%				23.3%	23.3%						5.6%	5.6%	5.6%	
		1,171	F/C	20%	234	22	22	22	22				55	55						13	13	13	
			L/C	80%	937	86	86	86	86				219	219						52	52	52	
TP-2 District Sub-total		4,122	F/C	21%	871	22	22	22	22	38	38	38	145	145	38	38	38	38	38	51	51	51	38
			L/C	79%	3,251	86	86	86	86	135	135	135	564	564	135	135	135	135	135	188	188	188	135
ZONE-West Sub Total		28,124	F/C	41%	11,403	22	22	22	22	392	392	302	2,659	2,659	159	703	703	793	793	716	716	172	159
			L/C	59%	16,721	86	86	86	86	792	792	782	3,235	3,235	556	950	950	960	960	1,002	1,002	608	556
ZONE-Central																							
TP-1 and TP-3 District																							
B-1	Branch Sewer									5.2%	5.2%	5.2%	5.2%	5.2%	14.5%	14.5%	14.5%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%
		1,419	F/C	38%	545					25	25	25	25	25	89	89	89	25	25	25	25	25	25
			L/C	62%	874					48	48	48	48	48	117	117	117	48	48	48	48	48	48
B-2	Sub-main Sewer									3.6%	3.6%	3.6%	3.6%	3.6%	20.2%	20.2%	20.2%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%
		369	F/C	20%	74					3	3	3	3	3	15	15	15	3	3	3	3	3	3
			L/C	80%	295					11	11	11	11	11	60	60	60	11	11	11	11	11	11
B-3	Trunk Sewer														33.3%	33.3%	33.3%						
		203	F/C	20%	41										14	14	14						
			L/C	80%	162										54	54	54						
B-4	Pumping Station														50.0%	50.0%							
		572	F/C	80%	457										229	229							
			L/C	20%	115										58	58							
TP-1 and TP-3 District Sub-total		2,563	F/C	44%	1,117	0	0	0	0	28	28	28	28	28	346	346	117	28	28	28	28	28	28
			L/C	56%	1,446	0	0	0	0	58	58	58	58	58	288	288	230	58	58	58	58	58	58
TP-2 District																							
B-5	Branch Sewer									6.1%	6.1%	6.1%	6.1%	6.1%	11.1%	11.1%	11.1%	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%
		3,087	F/C	36%	1,104					72	72	72	72	72	103	103	103	72	72	72	72	72	72
			L/C	64%	1,983					115	115	115	115	115	239	239	239	115	115	115	115	115	115
B-6	Sub-main Sewer									3.6%	3.6%	3.6%	3.6%	3.6%	20.2%	20.2%	20.2%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%
		839	F/C	20%	168					6	6	6	6	6	34	34	34	6	6	6	6	6	6
			L/C	80%	671					24	24	24	24	24	136	136	136	24	24	24	24	24	24
B-7	Trunk Sewer														35.7%	35.7%	20.0%	20.0%	20.0%				
		1,406	F/C	20%	281										100	100	56	56	56				
			L/C	80%	1,125										402	402	225	225	225				
B-8	Pumping Station															50.0%	50.0%						
		1,007	F/C	80%	805											403	403						
			L/C	20%	202											101	101						
B-9	Sewage Treatment Plant														18.5%	18.5%	18.5%	15.1%	15.1%	5.4%	5.4%		
		12,762	F/C	59%	7,553										1,476	1,476	1,476	1,119	1,119	400	400		
			L/C	41%	5,209										885	885	885	810	810	289	289		
TP-2 District Sub-total		19,101	F/C	52%	9,911	0	0	0	0	78	78	78	78	78	1,714	2,116	2,072	1,254	1,254	478	478	78	78
			L/C	48%	9,190	0	0	0	0	139	139	139	139	139	1,662	1,763	1,586	1,175	1,175	429	429	139	139

Unit: Rs. Million

Project Component		Base Cost (2007 Price)			Construction/Installation																	
		Total	Breakdown		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
TP-4 District Sub-total																						
B-10	Branch Sewer								6.1%	6.1%	6.1%	6.1%	6.1%	9.1%	9.1%	9.1%	9.1%	9.1%	6.1%	6.1%	6.1%	6.1%
		7,460	F/C	24%	1,758				109	109	109	109	109	155	155	155	155	155	109	109	109	109
			L/C	76%	5,702				342	342	342	342	342	525	525	525	525	525	342	342	342	342
B-11	Sub-main Sewer								3.6%	3.6%	3.6%	3.6%	3.6%	13.6%	13.6%	13.6%	13.6%	13.6%	3.6%	3.6%	3.6%	3.6%
		2,337	F/C	20%	467				17	17	17	17	17	63	63	63	63	63	17	17	17	17
			L/C	80%	1,870				67	67	67	67	67	254	254	254	254	254	67	67	67	67
B-12	Trunk Sewer				10.9%	10.9%	10.9%	10.9%						11.3%	11.3%	11.3%	11.3%	11.3%				
		4,802	F/C	20%	961	105	105	105	105						109	109	109	109	109			
			L/C	80%	3,841	418	418	418	418						434	434	434	434	434			
B-13	Pumping Station													50.0%	50.0%							
		262	F/C	80%	209									105	105							
			L/C	20%	53									27	27							
TP-4 District Sub-total		14,861	F/C	23%	3,395	105	105	105	105	126	126	126	126	126	431	431	327	327	327	126	126	126	126
			L/C	77%	11,466	418	418	418	418	409	409	409	409	409	1,239	1,239	1,212	1,212	1,212	409	409	409	409
ZONE-Central Sub Total		36,525	F/C	39%	14,423	105	105	105	105	232	232	232	232	232	2,491	2,893	2,516	1,608	1,608	632	632	232	232
			L/C	61%	22,102	418	418	418	418	607	607	607	607	607	3,189	3,290	3,029	2,445	2,445	896	896	607	607
ZONE-East																						
TP-4 District																						
C-1	Branch Sewer								6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	8.7%	8.7%	8.7%	8.7%
		5,140	F/C	28%	1,421				95	95	95	95	95	95	95	95	95	95	118	118	118	118
			L/C	72%	3,719				240	240	240	240	240	240	240	240	240	240	330	330	330	330
C-2	Sub-main Sewer								3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	16.1%	16.1%	16.1%	16.1%
		1,268	F/C	20%	254				9	9	9	9	9	9	9	9	9	9	41	41	41	41
			L/C	80%	1,014				36	36	36	36	36	36	36	36	36	36	163	163	163	163
C-3	Trunk Sewer				6.8%	6.8%	6.8%	6.8%						17.2%	17.2%	17.2%			7.2%	7.2%	7.2%	
		3,197	F/C	20%	640	43	43	43	43						110	110	110			46	46	46	
			L/C	80%	2,557	173	173	173	173						439	439	439			183	183	183	
C-4	Pumping Station													40.1%	40.1%				9.9%	9.9%		
		966	F/C	77%	744										310	310				63	63		
			L/C	23%	222										78	78				34	34		
C-5	Sewage Treatment Plant				5.0%	5.0%	5.0%	4.2%	0.0%	0.0%	0.0%	10.5%	10.5%	7.8%	7.8%	9.2%	9.2%	9.2%	5.6%	5.6%	5.6%	
		30,054	F/C	57%	17,088	871	871	871	680	0	0	0	1,862	1,862	1,270	1,270	1,604	1,604	1,604	907	907	907	
			L/C	43%	12,966	625	625	625	578	0	0	0	1,280	1,280	1,078	1,078	1,162	1,162	1,162	770	770	770	
	(1) New Pumping Station, TP-4				7.4%	7.4%	7.4%					19.4%	19.4%			13.0%	13.0%	13.0%					
		3,222	F/C	80%	2,578	191	191	191				501	501			334	334	334					
			L/C	20%	644	48	48	48				125	125			84	84	84					
	(2) New Treatment Facilities, TP-4				4.7%	4.7%	4.7%	4.7%				9.4%	9.4%	8.8%	8.8%	8.8%	8.8%	8.8%	6.3%	6.3%	6.3%	
		26,832	F/C	54%	14,510	680	680	680	680.2			1,360	1,360	1,270	1,270	1,270	1,270	1,270	907	907	907	
			L/C	46%	12,322	578	578	578	577.6			1,155	1,155	1,078	1,078	1,078	1,078	1,078	770	770	770	
TP-4 District Sub-total		40,625	F/C	50%	20,147	915	915	915	724	104	104	104	1,966	1,966	1,793	1,793	1,818	1,708	1,708	1,174	1,174	1,111	158
			L/C	50%	20,478	798	798	798	750	276	276	276	1,557	1,557	1,871	1,871	1,877	1,438	1,438	1,480	1,480	1,446	493
ZONE-East Sub Total		40,625	F/C	50%	20,147	915	915	915	724	104	104	104	1,966	1,966	1,793	1,793	1,818	1,708	1,708	1,174	1,174	1,111	158
			L/C	50%	20,478	798	798	798	750	276	276	276	1,557	1,557	1,871	1,871	1,877	1,438	1,438	1,480	1,480	1,446	493
Inner 15 Town Sub Total		105,274	F/C	44%	45,973	1,041	1,041	1,041	850	728	728	638	4,857	4,857	4,443	5,389	5,037	4,110	4,110	2,521	2,521	1,516	550
			L/C	56%	59,301	1,301	1,301	1,301	1,254	1,675	1,675	1,665	5,398	5,398	5,615	6,110	5,855	4,843	4,843	3,378	3,378	2,661	1,655

Project Component		Base Cost (2007 Price)			Year																	
		Total	Breakdown		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total Base Cost (TBC)		**105,274**	F/C	44%	45,973	1,041	1,041	1,041	850	728	728	638	4,857	4,857	4,443	5,389	5,037	4,110	4,110	2,521	2,521	1,516	550
			L/C	56%	59,301	1,301	1,301	1,301	1,254	1,675	1,675	1,665	5,398	5,398	5,615	6,110	5,855	4,843	4,843	3,378	3,378	2,661	1,655
D	Engineering Fees	7,896	F/C	70%	5,527	123	123	123	110	126	126	121	538	538	528	604	572	470	470	310	310	219	116
			L/C	30%	2,369	53	53	53	47	54	54	52	231	231	226	259	245	201	201	133	133	94	50
E	Land Acquisition	18	F/C	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			L/C	100%	18	0	0	0	0	0	0	0	0	12	0	0	0	0	6	0	0	0	0
F	Physical Contingency	5,660	F/C	45%	2,575	58	58	58	48	43	43	38	270	270	249	300	280	229	229	142	142	87	33
			L/C	55%	3,085	68	68	68	65	86	86	86	281	282	292	318	305	252	253	176	176	138	85
Sub-total (TBC+D+E+F)		118,848	F/C	45%	54,075	1,222	1,222	1,222	1,008	897	897	797	5,665	5,665	5,220	6,292	5,889	4,809	4,809	2,972	2,972	1,822	699
			L/C	55%	64,773	1,421	1,421	1,421	1,366	1,816	1,816	1,803	5,910	5,923	6,133	6,687	6,405	5,297	5,303	3,686	3,686	2,893	1,790
G	Price Contingency	69,313	F/C	14%	9,477	18	37	56	62	69	84	88	717	812	838	1,120	1,152	1,027	1,115	744	799	525	215
			L/C	86%	59,836	85	176	272	359	614	760	908	3,510	4,084	4,851	6,007	6,483	6,001	6,687	5,148	5,678	4,897	3,319
Sub-total (TBC+D+E+F+G)		188,161	F/C	34%	63,552	1,240	1,259	1,278	1,070	966	981	884	6,382	6,477	6,058	7,412	7,041	5,836	5,924	3,716	3,772	2,347	914
			L/C	66%	124,609	1,507	1,597	1,693	1,725	2,430	2,575	2,711	9,420	10,006	10,984	12,694	12,888	11,297	11,989	8,834	9,364	7,789	5,109
H	Project Administration	2,823	F/C	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			L/C	100%	2,823	41	43	45	42	51	53	54	237	247	256	302	299	257	269	188	197	152	90
Total Project Cost (TPC)		190,984	F/C	33%	63,552	1,240	1,259	1,278	1,070	966	981	884	6,382	6,477	6,058	7,412	7,041	5,836	5,924	3,716	3,772	2,347	914
			L/C	67%	127,432	1,548	1,640	1,737	1,767	2,481	2,629	2,764	9,657	10,254	11,240	12,996	13,187	11,554	12,258	9,023	9,561	7,942	5,199

APPENDIX – A102.4

Operation and Maintenance Cost of Sewerage Components

A102.4 Operation and Maintenance Cost of Sewerage Components

Unit: Rs. Million

				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Zone West																					
TP-1 and TP-3 District	Trunk Sewer Branch Sewer		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Maintenance Cost	5,502	5,502	5,502	5,502	5,502	5,502	19,152	34,140	36,180	56,958	59,448	61,878	64,368	66,828	71,628	76,458	81,258	86,085
			Total	5,502	5,502	5,502	5,502	5,502	5,502	19,152	34,140	36,180	56,958	59,448	61,878	64,368	66,828	71,628	76,458	81,258	86,085
	STP	TP-1	Operation Cost	0	0	0	0	0	0	0	38,378	41,024	105,002	112,163	119,765	138,549	145,708	155,128	165,252	175,905	186,031
			Maintenance Cost	0	0	0	0	0	0	0	8,280	8,280	26,400	26,620	26,840	28,885	29,105	31,290	31,580	37,285	37,575
			Total	0	0	0	0	0	0	0	46,658	49,304	131,402	138,783	146,605	167,434	174,813	186,418	196,832	213,190	223,606
		TP-3	Operation Cost	9,357	9,357	9,357	9,357	9,357	9,357	32,433	35,142	36,892	39,631	39,891	40,140	40,401	40,660	42,335	44,011	45,686	47,360
			Maintenance Cost	1,635	1,635	1,635	1,635	1,635	1,635	8,895	8,895	8,895	8,895	8,895	8,895	8,895	8,895	8,895	8,895	8,895	8,895
			Total	10,992	10,992	10,992	10,992	10,992	10,992	41,328	44,037	45,787	48,526	48,786	49,035	49,296	49,555	51,230	52,906	54,581	56,255
	Total		Operation Cost	9,357	9,357	9,357	9,357	9,357	9,357	32,433	73,521	77,917	144,633	152,054	159,905	178,950	186,368	197,463	209,263	221,591	233,391
			Maintenance Cost	7,137	7,137	7,137	7,137	7,137	7,137	28,047	51,315	53,355	92,253	94,963	97,613	102,148	104,828	111,813	116,933	127,438	132,555
			Total	16,494	16,494	16,494	16,494	16,494	16,494	60,480	124,836	131,272	236,886	247,017	257,518	281,098	291,196	309,276	326,196	349,029	365,946
TP-2 District	Trunk Sewer Branch Sewer		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Maintenance Cost	0	0	0	0	1,989	1,989	6,459	11,604	12,264	16,704	16,704	16,704	16,704	19,434	21,684	23,904	26,154	28,578
			Total	0	0	0	0	1,989	1,989	6,459	11,604	12,264	16,704	16,704	16,704	16,704	19,434	21,684	23,904	26,154	28,578
Zone West Total			Operation Cost	9,357	9,357	9,357	9,357	9,357	9,357	32,433	73,521	77,917	144,633	152,054	159,905	178,950	186,368	197,463	209,263	221,591	233,391
			Maintenance Cost	7,137	7,137	7,137	7,137	9,126	9,126	34,506	62,919	65,619	108,957	111,667	114,317	118,852	124,262	133,497	140,837	153,592	161,133
			Total	16,494	16,494	16,494	16,494	18,483	18,483	66,939	136,440	143,536	253,590	263,721	274,222	297,802	310,630	330,960	350,100	375,183	394,524
Zone Central																					
TP-1 and TP-3 District	Trunk Sewer Branch Sewer		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Maintenance Cost	990	990	990	990	990	990	3,660	6,510	6,900	10,770	11,250	11,730	12,366	12,846	13,776	14,736	15,666	16,599
			Total	990	990	990	990	990	990	3,660	6,510	6,900	10,770	11,250	11,730	12,366	12,846	13,776	14,736	15,666	16,599
	PS	Jamila PS	Operation Cost	4,480	4,564	4,648	4,732	4,846	4,964	7,858	8,087	8,316	8,667	9,010	9,361	9,711	10,063	10,452	10,841	11,230	11,618
			Maintenance Cost	215	230	240	250	265	280	590	620	650	700	740	790	830	880	930	980	1,030	1,080
			Total	4,695	4,794	4,888	4,982	5,111	5,244	8,448	8,707	8,966	9,367	9,750	10,151	10,541	10,943	11,382	11,821	12,260	12,698
		Chakiwara PS	Operation Cost	2,600	2,637	2,673	2,710	2,758	2,807	4,078	4,176	4,273	4,419	4,574	4,721	4,867	5,021	5,183	5,346	5,517	5,678
			Maintenance Cost	85	90	95	100	105	110	240	250	260	280	300	320	330	350	370	390	410	430
			Total	2,685	2,727	2,768	2,810	2,863	2,917	4,318	4,426	4,533	4,699	4,874	5,041	5,197	5,371	5,553	5,736	5,927	6,108
	Total		Operation Cost	7,080	7,201	7,321	7,442	7,604	7,771	11,936	12,263	12,589	13,086	13,584	14,082	14,578	15,084	15,635	16,187	16,747	17,296
			Maintenance Cost	1,290	1,310	1,325	1,340	1,360	1,380	4,490	7,380	7,810	11,750	12,290	12,840	13,526	14,076	15,076	16,106	17,106	18,109
			Total	8,370	8,511	8,646	8,782	8,964	9,151	16,426	19,643	20,399	24,836	25,874	26,922	28,104	29,160	30,711	32,293	33,853	35,405
TP-2 District	Trunk Sewer Branch Sewer		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	21,582	25,212	28,875	31,845	34,845	37,839
			Total	0	0	0	0	0	0	0	0	0	0	0	0	21,582	25,212	28,875	31,845	34,845	37,839
	PS	Gulberg PS	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	16,184	21,520	25,212	28,921	32,631	36,323
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	670	840	1,040	1,240	1,440	1,640
			Total	0	0	0	0	0	0	0	0	0	0	0	0	16,854	22,360	26,252	30,161	34,071	37,963
		Clifton PS	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	18,188	19,693	20,735	21,796	22,839	23,881
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	700	790	850	910	970	1,030
			Total	0	0	0	0	0	0	0	0	0	0	0	0	18,888	20,483	21,585	22,706	23,809	24,911
	STP	TP-2	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	122,077	140,759	155,632	170,358	185,269	201,115
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	21,275	26,025	26,355	31,120	31,440	35,755
			Total	0	0	0	0	0	0	0	0	0	0	0	0	143,352	166,784	181,987	201,478	216,709	236,870
	Total		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	156,450	181,973	201,580	221,076	240,740	261,320
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	44,227	52,867	57,120	65,115	68,695	76,264
			Total	0	0	0	0	0	0	0	0	0	0	0	0	200,677	234,840	258,700	286,191	309,435	337,584
TP-4 District	Trunk Sewer Branch Sewer		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Maintenance Cost	0	0	0	0	13,029	14,379	15,729	17,079	18,429	27,039	35,619	44,229	52,809	61,419	73,530	84,270	95,010	105,741
			Total	0	0	0	0	13,029	14,379	15,729	17,079	18,429	27,039	35,619	44,229	52,809	61,419	73,530	84,270	95,010	105,741
	PS	Karachi Port PS	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	6,676	7,874	9,059	9,720	10,366	11,012	11,672
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	270	350	440	490	540	590	640
			Total	0	0	0	0	0	0	0	0	0	0	0	6,946	8,224	9,499	10,210	10,906	11,602	12,312
	Total		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	6,676	7,874	9,059	9,720	10,366	11,012	11,672
			Maintenance Cost	0	0	0	0	13,029	14,379	15,729	17,079	18,429	27,039	35,619	44,499	53,159	61,859	74,020	84,810	95,600	106,381
			Total	0	0	0	0	13,029	14,379	15,729	17,079	18,429	27,039	35,619	51,175	61,033	70,918	83,740	95,176	106,612	118,053
Total			Operation Cost	7,080	7,201	7,321	7,442	7,604	7,771	11,936	12,263	12,589	13,086	13,584	20,759	178,902	206,116	226,935	247,629	268,499	290,288
			Maintenance Cost	1,290	1,310	1,325	1,340	14,389	15,759	20,219	24,459	26,239	38,789	47,909	57,339	110,912	128,802	146,216	166,031	181,401	200,754
			Total	8,370	8,511	8,646	8,782	21,993	23,530	32,155	36,722	38,828	51,875	61,493	78,098	289,814	334,918	373,151	413,660	449,900	491,042
Zone East																					
TP-4 District	Trunk Sewer Branch Sewer		Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Maintenance Cost	0	0	0	0	7,254	7,974	8,724	9,444	10,194	14,844	19,524	24,174	29,646	34,296	40,146	45,966	51,786	58,080
			Total	0	0	0	0	7,254	7,974	8,724	9,444	10,194	14,844	19,524	24,174	29,646	34,296	40,146	45,966	51,786	58,080
	PS	Korangi PS	Operation Cost	0	0	0	0	7,447	7,922	8,399	8,875	9,350	11,460	13,579	15,698	20,027	22,146	24,637	27,119	29,612	32,094
			Maintenance Cost	0	0	0	0	320	370	420	470	520	570	800	1,030	1,250	1,480	1,710	1,970	2,240	2,510
			Total	0	0	0	0	7,767	8,292	8,819	9,345	9,870	12,030	14,379	16,728	21,277	23,626	26,347	29,089	31,852	34,604
		Bin Qasim PS	Operation Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,919	10,847
			Maintenance Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	430	580
			Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,349	11,427
	STP	TP-4	Operation Cost	0	0	0	0	51,075	56,125	59,939	63,753	67,568	100,111	141,441	184,898	239,607	284,034	338,566	400,158	455,926	510,495
			Maintenance Cost	0	0	0	0	12,045	17,500	17,670	17,840	18,000	29,575	35,930	42,220	53,860	60,140	66,765	78,600	90,435	97,065
			Total	0	0	0	0	63,120	73,625	77,609	81,593	85,568	129,686	177,371	227,118	293,467	344,174	405,331	478,758	546,361	607,560
	Total		Operation Cost	0	0	0	0	58,522	64,047	68,338	72,628	76,918	111,571	155,020	200,596	259,634	306,180	363,203	427,277	494,458	553,437
			Maintenance Cost	0	0	0	0	19,619	25,844	26,814	27,754	28,714	44,989	56,254	67,424	84,756	95,916	108,621	126,536	144,891	158,235
			Total	0	0	0	0	78,141	89,891	95,152	100,382	105,632	156,560	211,274	268,020	344,390	402,096	471,824	553,813	639,349	711,672
Total			Operation Cost	0	0	0	0	58,522	64,047	68,338	72,628	76,918	111,571	155,020	200,596	259,634	306,180	363,203	427,277	494,458	553,437
			Maintenance Cost	0	0	0	0	19,619	25,844	26,814	27,754	28,714	44,989	56,254	67,424	84,756	95,916	108,621	126,536	144,891	158,235
			Total	0	0	0	0	78,141	89,891	95,152	100,382	105,632	156,560	211,274	268,020	344,390	402,096	471,824	553,813	639,349	711,672
Inner 15 Towns Total			Operation Cost	16,437	16,558	16,678	16,799	75,483	81,175	112,707	158,412	167,424	269,290	320,658	381,260	617,486	698,664	787,601	884,169	984,548	1,077,116
			Maintenance Cost	8,427	8,447	8,462	8,477	43,134	50,729	81,539	115,132	120,572	192,735	215,830	239,080	314,520	348,980	388,334	433,404	479,884	520,122
			Total	24,864	25,005	25,140	25,276	118,617	131,904	194,246	273,544	287,996	462,025	536,488	620,340	932,006	1,047,644	1,175,935	1,317,573	1,464,432	1,597,238

CHAPTER 11

APPENDIX – A111.1

Purpose and Level of Considerations

A111.1 Purpose and Level of Considerations

(1) Purpose

The purpose of the Environmental and Social Considerations is to ensure that development options under consideration are environmentally and socially sound and sustainable and that the environmental consequences of the project are recognized early and taken into account in the project design. The procedure should follow the Pakistan Laws, and JICA's Guidelines for Environmental and Social Considerations are also taken into account.

The JICA Study Team is assisting the KW&SB to consider the environmental and social aspects of this study. The role of the JICA Study Team is to:

- Help the KW&SB implement the proper environmental and social considerations,
- Prepare an effective Master Plan and select priority project(s) which will not cause significant negative environmental or social impacts.
- Assist the KW&SB to consult with stakeholders when preparing the Master Plan and conducting the Feasibility Study to foster support for the projects.
- Ensure the positive information disclosure for accountability and promotion of participation of various stakeholders.

(2) Basic Approach

The Study Team will assist the KW&SB to do the proper environmental and social considerations in the process of preparation of Master Plan and conducting Feasibility Study in accordance with JICA's Guidelines for environmental and social considerations. In Basic Study stage, the Study Team in consultation with KW&SB, had conducted the survey on natural and environmental conditions to grasp the present situations of the Study area, and drafted the ToR for the IEE level study for M/P. In the Master Plan stage, the Study Team assisted KW&SB to implement the IEE level environmental and social considerations, and in the Feasibility Study stage, will assist to conduct the EIA level of considerations for the priority project(s). Throughout the Study, the Study Team has also been assisting the KW&SB with public consultations including informing the public of key issues at each stage of the Study.

(3) Level of Consideration Required by JICA

The Preparatory Study (which was conducted by JICA in 2005) concluded that this study requires considerations of environmental and social assessment. The categorization is in accordance with JICA's Guidelines for Environmental and Social Considerations, which were revised in 2004. The assessment scoping conducted in the Preparatory Study, all the environmental items were evaluated as either B, C or D. Further, a significant improvement of water quality and public health is expected by the project. Therefore, this project is evaluated overall as "category B"[1] in the preliminary assessment. In Basic Study and Master Plan stage, KW&SB in cooperation with the Study Team has not found any reasons to change its category of B.

[1] Based on the JICA Guidelines, the proposed projects are classified into one of three categories: "A", "B" or "C". The project classified as Category "A" is likely to have significant adverse impacts, and the project classified as Category "B" is likely to have less adverse impacts than those of Category "A" project. The project classified as Category "C" is likely to have minimal or no adverse impacts.

APPENDIX – A111.2

Legal and Administrative Framework for Environmental and Social Considerations in Pakistan

A 111.2 Legal and Administrative Framework for Environmental and Social Considerations in Pakistan

(1) Laws and Regulations

The major laws and regulations relative to the environmental and social consideration are as listed below:

a. Pakistan Environmental Protection Ordinance, 1983

The Ordinance for the first time established the Pakistan Environmental Protection Council and the Federal and Provincial Environmental Protection agencies. It also pioneered in the Pakistan, the requirement of preparing Environmental Impact Assessment (EIA) reports.

b. Pakistan Environmental Protection Act (PEPA) 1997

The Pakistan Environmental Protection Act 1997 is the most important environmental legislative instrument in Pakistan. This Act aims to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution and promotion of sustainable development.

(2) Administrative Framework

a. Pakistan Environmental Protection Council (PEPC)

PEPC was established in 1984 by Pakistan Environmental Protection Ordinance, 1983, headed by Prime Minister and one of the members is Minister of Environment. Its main roles are:

- Co-ordinate and supervise enforcement of the provision of Pakistan Environmental Protection act,
- Approve comprehensive national environmental policies and ensure their implementation,
- Approve the National Environmental Quality Standards.

b. Pakistan Environmental Protection Agency (Pakistan-EPA)

Pakistan-EPA exists under the PEPC. Pakistan-EPA is the regulatory institution entrusted with the functions of administering and enforcing the Act and its rules and regulations. These include:

- Take all necessary measures for the implementation of the national environmental policies,
- Ensure the enforcement of the National Environmental Quality Standards,
- Establish standards for the quality of environment,
- Establish systems and procedures for survey, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution.

c. Environmental Protection Agency of Government Sindh (EPA-Sindh)

In each province, Provincial Environmental Protection Agency (Provincial-EPA) is established, and Provincial-EPA is independent agency from Ministry of Environment and PEPA. Many of the federal agency's functions and powers have already been delegated to the Provincial-EPAs.

The main functions are advising & coordinating with government, semi-government organizations, industries, NGOs, and various development agencies on preventive measures for abatement of pollution.

- Coordination environmental policies and plan,
- Implementing PEPA, 1997 and entering NEQS,
- Rendering advice and assistance on environmental matters to various agencies,
- Establishment of monitoring system for effluents and emissions.

(3) EIA Procedures

Article 12 of Pakistan Environmental Protection Act 1997 states that no proponent of a project shall commence construction or operation unless he has filed with the Government Agencies designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental effects an environmental impact assessment shall be conducted, and he obtained from the Government Agency approval in respect thereof".

The legal procedures for IEE and EIA are promulgated in July 2000 (The Review of Initial Environmental and Environmental Impact Assessment Regulations, 2000). The regulations define the required procedures for "Policy and procedures for the filing, review and approval of environmental assessment" including responsibilities of EPA and other concerned agencies.

The Guidelines set out the key policy and procedural requirement, including a brief policy statement on the purpose of environmental assessment. The Guidelines also provide schedules of proposals that require either and IEE or EIA, which cover:

a. Initial environmental report (scoping, alternatives, site selection, format of IEE)
b. Assessing impacts (identification, analysis and prediction, baseline data)
c. Mitigation and impact management (and preparing an environmental management plan)
d. Reporting (drafting style, main features, shortcoming, other forms f presentation)
e. Review and decision-making (role, steps, remedial options, checks and balances)
f. Monitoring and auditing (systematic follow up, purpose, effective data management)
g. Project management (inter-disciplinary teams, programming & budgeting)

This water supply and sewerage project falling under the category specified in schedule II requires to file an EIA with the federal agency, i.e. EPA-Sindh. The procedures of EIA are as follows:

- ToR for EIA
- Selection of Consultants / Specialists
- Field Visit and Report Preparation
- Submission of the EIA report to the EPA-Sindh with review fee for EIA report
- Confirmation of document submitted by the EPA-Sindh (within 10 working days)
- Advertisement in the newspapers by EPA-Sindh (after 20-25 days of confirmation)
- No objection certificate by the EPA-Sindh (within 90 days of filing)
- Public Hearing (30 days after advertisement)

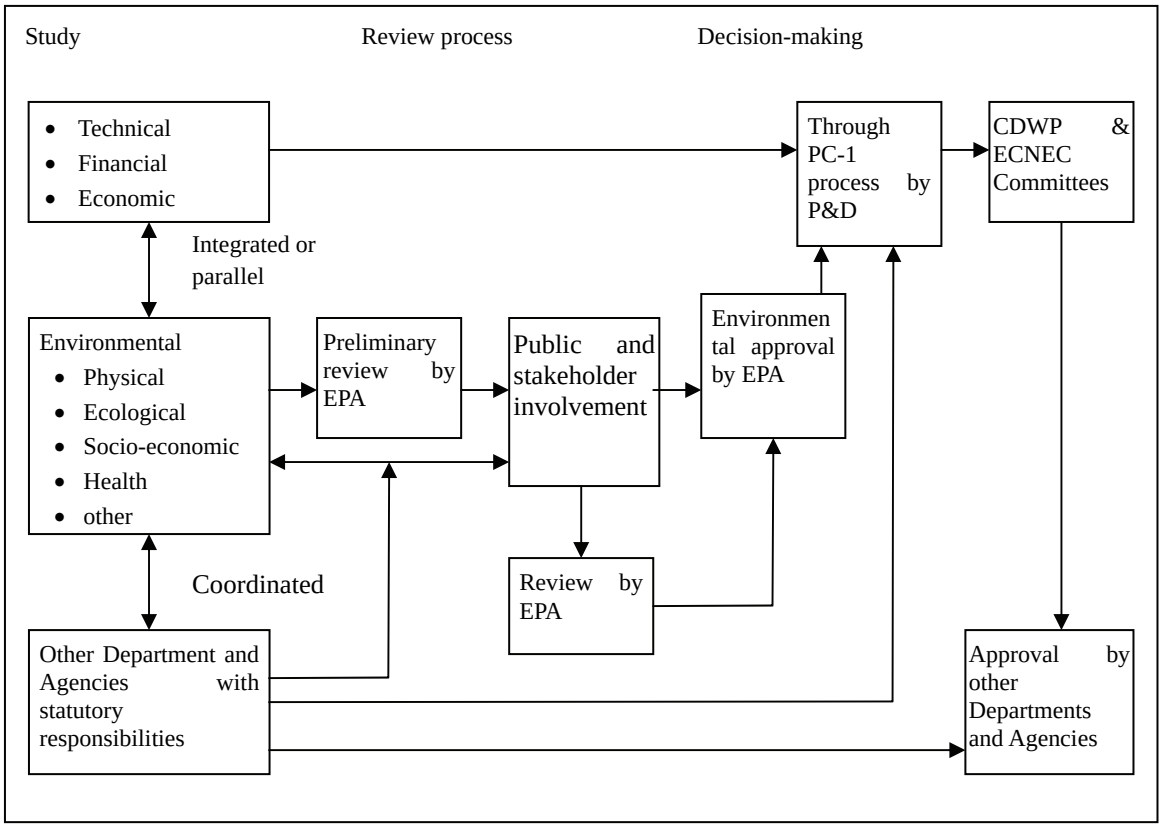


Figure A111.2.1 Decision-making Process

(4) Information disclosure and stakeholders participation

In principle, information on the environmental assessment is publicly disclosed. The policy of information disclosure and stakeholders participation is described under "Guidelines for Public Consultation, 1997, PEPA" which include:

- Consultation, involvement and participation
- Stakeholders
- Techniques for public consultation
  (principles, levels of involvement, tools, building trust)
- Effective public consultation
  (planning, stages of EIA where consultation is appropriate)
- Consensus building and dispute resolution
- Facilitating involvement
  (including the poor women, building community and NGO capacity)
- Establish committee for the environmental evaluation

(5) Land Acquisition Act and National Resettlement Policy

The acquisition of private properties for public purposes including development projects in Pakistan is governed by the Land Acquisition Act 1894 (LAA). It is comprised of 55 sections pertaining to area notification and surveys, acquisition, compensation and apportionment, awards and disputes resolution, penalties and exemptions. Section 4 allows preliminary notification for survey, section 6 provides for declaration of intended acquisition, section 8 deals with detailed survey and planning, section 11 to 15 and 23 to 28 provide for inquiry by the Land Collector into claims and values, and the setting of compensation levels, primarily through interpretation of market value. Section 16 and 17 provide for compulsory acquisition, while

section 18 allows for redress of grievance at the District level Civil Courts and above, if necessary.

In determining the amount of compensation shall take into consideration (i) the market value of the land at the date of the publication of the notification, (ii) the damage sustained by the taking of any standing crops or trees, (iii) the damage sustained by severing the land from his other land, (iv) the damage sustained by reason of the acquisition injuriously affecting his other property, moveable or immoveable in any other manner, or his earning, (v) if the person is compelled to change his residence or place of business in consequence of the acquisition of the land, the reasonable expenses incidental to such change, (vi) the damage resulting from diminution of the profits of the land between the time of the publication of the declaration and the time of the possession of the land. In addition to the market value of the land as above provided, the sum of fifteen percent on market value shall be awarded in consideration of the compulsory nature of the acquisition.

LAA has been the most commonly used law for acquisition of land and other properties for development projects. Although it lays down detailed procedures for the acquisition of private properties for public purposes and their compensation, the LAA dose not cover resettlement and rehabilitation of persons. Therefore, National Resettlement Policy was formulated in 2002 to ensure an equitable and uniform treatment of resettlement issues all over Pakistan. The Policy is applied to all development projects involving adverse social impacts, including land acquisition, loss of assets / income / business etc. The Policy also aims to compensate for the loss of income to those who loses communal property including common assets, productive assets, structures, other fixed assets, income and employment, community networks and services, pasture, water rights, public infrastructure like mosques, shrines, schools, graveyards etc.

The objectives of the Policy are:

- Avoid or minimize adverse social impacts in a project wherever possible and where adverse impacts cannot be avoided, the mitigation measures and resettlement activities should be conceived and executed as development programs and the affected persons be provided opportunity to share the project benefits,
- Project affected persons be provided with sufficient compensation and assistance for lost assets, that will assist them to improve or at least restore their living standards, income earning or production capacity to the pre-project levels,
- Provide a development opportunity to all vulnerable groups. The vulnerable population should receive special assistance to bring them at least to a minimum living standard at per with the pre-project level,
- All population adversely affected by the project should be eligible for sharing the social and economic benefits, envisaged after completion of the project.

(6) Others

Other laws and regulations which may be related to the environment are:

- Air Quality: Statutory Notification S.R.R.742 (1993)
- Noise: The Motor Vehicle Ordinance (1965) and Rules (1965)
- Toxic or Hazardous Substances: The Agricultural Pesticides Ordinance (1971) and Rules (1973)

APPENDIX – A111.3

Water Quality Standards

A 111.3 Water Quality Standards

(1) Drinking Water Quality Standards

The Pakistan Council for Research in Water Resource (PCRWR) and Pakistan Standard Institution (PSI) have already drafted Drinking Water Quality Standards at national level. However, the enforcement of these standards is still pending and not approved yet. At present, KW&SB does not have its own water quality standards for drinking water. WHO guidelines for drinking water are adopted as desired value of water filtration processes.

Table A111.3.1 WHO Guidelines

A. Bacteriological Qualities					
Source/Organisms		Guideline Value			
a. All water intended for drinking (E. Coli or thermo tolerant coliform bacteria)		Must not be detectable in any 100 ml sample			
b. treated water entering the distribution system (E. coli or thermo tolerant coliform and total coliform bacteria)		Must not be detectable in any 100 ml sample			
c. Treated water in the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)		In the case of large supplies, where sufficient samples are examined, must not be present in 95 % of samples taken throughout any 12-month period.			
B. Chemicals of Health Significance					
Inorganic	mg/l	Inorganic	mg/l	Inorganic	mg/l
Antimony	0.005	Copper	2.000	Molybdenum	0.070
Arsenic	0.010	Cyanide	0.070	Nickel	0.020
Barium	0.700	Fluoride	1.500	Nitrate (NO_3)	50.00
Boron	0.300	Lead	0.010	Nitrite (NO_2)	03.00
Cadmium	0.003	Manganese	0.500	Selenium	0.010
Chromium	0.050	Mercury	0.001		
C. Other Parameters					
Colour	15 TCU	1,2 dichlorobenzene	1-10	Hardness, pH	-
Taste, odour	-	1,4-dichlorobenzen	0.3-30	DO	0.05
Turbidity	5 NTU	Dichlorobenzen	5-50	Hydrogen	0.3
Toluene	24-170	Synthetic	-	Sulfide	0.1
Xylenes	20-1800	Detergents	0.2	Hydrogen	0.3
Ethyl-benzene	2.4-200	Aluminum	1.5	Manganese	250
Styrene	4-2600	Ammonia	250	Sodium	1000
Monochrolobenzen	10-120	Chloride Copper	1	Sulfate TDS Zinc	3
D. Disinfectants and Disinfectant by-Products					
Chlorine chlorophenol		600-1000	2,4,6-trichlorophenol		2-300
2,4-dichlorophenol		0.3-40	2-chlorophenol		0.1-10

(2) Effluent Standards

National Environmental Quality Standards for Municipal and Liquid Industrial Effluent is as below.

Table A111.3.2 National Environmental Quality Standards for Municipal and Liquid Industrial Effluent

S. No.	Parameter	Into inland water	Into sewage treatment[1]	Into sea[2]
1.	Temperature	=< 3℃	=< 3℃	=< 3℃
2.	PH value	6-9 pH	6-9 pH	6-9 pH
3.	5-days BOD_1 at 20℃	80 mg/l	250 mg/l	80 mg/l
4.	COD	150 mg/l	400 mg/l	400 mg/l
5.	Total suspended solids	200 mg/l	400 mg/l	200 mg/l
6.	Total dissolved solids	3500 mg/l	3500 mg/l	3500 mg/l
7.	Grease and oil	10 mg/l	10 mg/l	10 mg/l
8.	Phenolic compounds	0.1 mg/l	0.3 mg/l	0.3 mg/l
9.	Chroride (as Cl)	1000 mg/l	1000 mg/l	SC
10.	Fluoride (as F)	10 mg/l	10 mg/l	10 mg/l
11.	Cynide (as CN) total	1.0 mg/l	1.0 mg/l	1.0 mg/l
12.	An-ionic detergents (as MBAS)	20 mg/l	20 mg/l	20 mg/l
13.	Sulphate (SO4)	600 mg/l	1000 mg/l	SC
14.	Sulphide (S)	1.0 mg/l	1.0 mg/l	1.0 mg/l
15.	Ammonia (NH_3)	40 mg/l	40 mg/l	40 mg/l
16.	Pesticides, herbicides, fungicides and insecticides	0.15 mg/l	0.15 mg/l	0.15 mg/l
17.	Cadmium	0.1 mg/l	0.1 mg/l	0.1 mg/l
18.	Chromium (trivalent and hexavalent)	1.0 mg/l	1.0 mg/l	1.0 mg/l
19.	Copper	1.0 mg/l	1.0 mg/l	1.0 mg/l
20.	Lead	0.5 mg/l	0.5 mg/l	0.5 mg/l
21.	Mercury	0.01 mg/l	0.01 mg/l	0.01 mg/l
22.	Selenium	0.5 mg/l	0.5 mg/l	0.5 mg/l
23.	Nickel	1.0 mg/l	1.0 mg/l	1.0 mg/l
24.	Silver	1.0 mg/l	1.0 mg/l	1.0 mg/l
25.	Total toxic metals	2.0 mg/l	2.0 mg/l	2.0 mg/l
26.	Zinc	5.0 mg/l	5.0 mg/l	5.0 mg/l
27.	Arsenic	1.0 mg/l	1.0 mg/l	1.0 mg/l
28.	Barium	1.5 mg/l	1.5 mg/l	1.5 mg/l
29.	Iron	8.0 mg/l	8.0 mg/l	8.0 mg/l
30.	Manganese	1.5 mg/l	1.5 mg/l	1.5 mg/l
31.	Boron	6.0 mg/l	6.0 mg/l	6.0 mg/l
32.	Chlorine	1.0 mg/l	1.0 mg/l	1.0 mg/l

1: Applicable only when and where sewage treatment is operational and BOD=80 mg/l is achieved by the sewage treatment system.
2: Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries

APPENDIX – A111.4

Existing Environmental Conditions

A 111.4 Existing Environmental Conditions

1. Physical Environment

(1) Topography

Karachi City represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains and hillocks. Classified according to physiographic features, Karachi City District can be divided into three broad categories:

- Hilly region
- Alluvial plain
- Coastal areas

The metropolitan area is divided into two river streams namely Lyari and Malir Rivers. Gujjar and Orangi are the main tributaries of the Lyari River while Thaddo and Chakalo are the main tributaries of the Malir River. Among the various physiographic features, low flat-topped parallel hills devoid of vegetation, interspersed with sidespread plains and dry riverbeds are the main topographic characteristics of the city. The highest of the region is 75 m that gradually decreases to 1.5 m above mean sea level towards the coastline.

(2) Geology and Geomorphology

The present geological set-up of the city is largely composed of sandstone, shale of Nari, Gaj and Mancher formation ranges from Oligocene to recent. The study area comprises the hills, valleys and the coast as the physical features. Rocks are deposited under shallow marine to deltaic condition. On the basis of the water bearing properties, the lithostratigraphic units can be classified as consolidated and un-consolidated sediments. The project area extends in the north to south east direction, sloping towards the Arabian Sea. Physiographical classification of the area establishes three separate landforms, namely mountain highland, piedmont plain and the valley floor. According to the geological classification, the rocks of the entire region of Karachi and its suburbs, upper valleys of Lyari and Malir rivers are almost exclusively of the tertiary deposit belonging to the most recent geological period. The lower reach of the Lyari basin constitutes post-tertiary alluvial subsoil while the upper reach constitutes boulders and conglomerate. Malir River basin consists of alluvial deposits of boulders, gravels, sand and clay.

(3) Climate

As located on the coast, Karachi tends to have a relatively mild climate, with low average levels of precipitation (approximately 175 mm per year), which classifies the region as arid. The hottest month is May-June with the temperature ranging between 32 ºC and 35 ºC, the winter is relatively mild and with dry minimum temperatures of about 7 ºC. For most parts of the year, the relative humidity in Karachi is high. In the morning it ranges from 53 to 86 % and in the afternoon it ranges between 53 and 81 %. The relative humidity is at a minimum in the months of March to June while it is at highest during the monsoon months of July through September.

Table A111.4.1 Mean Monthly Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1996	18.0	21.1	25.9	28.8	30.9	32.3	30.7	28.3	28.7	28.4	23.5	19.7	26.4
1997	18.4	21.3	24.6	25.4	29.9	31.2	31.4	30.3	29.8	27.9	24.7	19.7	26.2
1998	19.4	20.8	25.8	29.9	32.0	32.4	30.7	29.6	31.0	29.3	25.2	21.9	27.3
1999	11.9	22.3	26.6	30.0	31.2	31.4	30.1	29.4	29.7	30.3	26.2	21.4	26.7
2000	19.5	21.4	25.6	30.0	30.9	31.7	30.4	29.2	29.5	29.6	25.7	21.5	27.1
2001	19.4	22.3	26.4	29.2	31.6	32.3	29.6	29.4	29.5	36.0	26.0	23.1	27.9
2002	19.9	21.0	26.4	29.6	31.3	31.6	29.5	28.3	28.0	29.4	25.1	21.4	26.8
2003	20.1	22.7	26.1	30.3	30.6	31.4	30.9	29.7	28.9	28.9	23.7	20.1	26.9
2004	19.7	22.2	27.7	30.2	32.0	32.1	30.6	29.5	29.0	28.1	24.3	22.4	27.3
2005	18.6	20.8	25.9	29.1	30.9	32.3	30.3	29.4	30.4	29.0	26.0	20.7	27.0

Source: Pakistan Meteorological Department

Table A111.4.2 Monthly Rainfall in Karachi (mm)

Manth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Max in day
1962	0	0	0	0	0	0	7.9	4.3	13.5	0	0	0.6	26.3	7.0
1963	0	0.1	0.1	0.6	1.4	0	0	1.9	0	0	0.6	0.2	4.9	1.9
1964	0.2	0.5	0	0	0	0.3	7.7	4.9	0.3	0	0	0	13.9	6.9
1965	0	0	0	0.8	0	0	10.6	1.9	0	0	0	0	13.4	6.6
1966	0	0	0.2	0	0	0	0	0	0	0	0	0	0.2	0.2
1967	0	0	13.0	2.4	0	1.1	24.8	9.9	0	0	0.1	1.4	52.7	12.0
1968	1.1	0.5	0	0	0	0.1	0.1	0.5	0	0	0	0.6	3.0	0.8
1969	0	0.1	0	0	0	0	3.8	0	0	0	0	0	3.9	2.9
1970	0.7	0.7	6.2	0	0	0.5	15.4	13.9	8.6	0	0	0	46.1	6.0
1971	Not Available													
1972	0	0.3	0	0	0	2.1	1.6	0	0	0	0	0.4	4.4	2.1
1973	0	0	0	0	0	0	20.8	3.2	0	0	0	1.5	25.5	12.2
1974	0	0.6	0	0	0	0	0	0.4	0	0.6	0	5.6	7.2	5.6
1975	13.7	21.2	3.0	0	0	0.2	0	73.2	21.1	0	0	0.3	132.7	31.6
1976	69.5	10.1	30.7	0	0	0	70.5	36.5	44.8	0	0	0	262.1	43.6
1977	10.3	0.5	0	0	0	34.8	302.6	44.8	88.5	0	52.0	0	533.5	207.0
1978	14.3	4.7	0	0	0	6.8	179.4	175.5	0.1	0	0	0	380.8	133.6
1979	1.7	96.0	0	0	0	3.4	0	262.5	0	3.9	0	13.5	381.0	166.0
1980	Not Available													
1981	0	25.0	73.4	3.6	0	0	40.2	43.4	0	0	0	0	185.6	34.0
1982	0	0	0	0	0	0	4.9	105.0	0	0	0	0	109.9	74.0
1983	0	3.7	0	29.8	0	0	52.0	171.7	23.9	0	0	0	281.1	37.4
1984	0.3	0	0.6	0	0	0	19.4	246.1	4.0	0	0	0	270.4	113.7
1985	0	0	0	47.6	0	0.5	79.6	25.0	0	0	0	0	152.7	37.0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	
1987	Not Available													
1988	1.0	0	0	0	0	0	64.0	14.0	0	0	0	0	79.0	35.0
1989	5.0	8.3	1.5	0	0	0	166.8	4.3	0	0	0.2	3.6	189.7	58.8
1990	25.3	23.5	0	0	0	0.4	0	77.9	7.7	0	0	0	134.8	57.2
1991	3.0	19.5	2.0	0	0	0	0	0	0	0	0	0	24.5	19.5
1992	19.4	8.0	0.9	0	0	0	73.9	138.2	22.6	0	0	0	263.0	91.7
1993	0.7	11.8	0	0	0	0	8.4	0	0	0	8.3	0	29.2	9.8
1994	2.2	2.5	0	0	0	0	268.3	116.4	61.7	0	0	11.0	462.1	39.3
1995	89.3	4.4	0.2	0	0	0	9.6	6.2	0	0	1.0	0	110.7	81.3
1996	13.0	33.2	9.6	0	0	30.0	12.8	0.4	0	0	0	0	99.0	33.2
1997	0	0	20.8	3.6	5.0	16.6	18.6	14.8	30.0	9.9	0.3	4.4	124.0	24.0
1998	9.1	4.3	4.9	0	0	28.0	9.9	0.5	0	3.9	0	0	60.6	19.0
1999	6.5	1.8	1.8	0	0.2	0	0.2	0	0	4.0	0	0	14.5	4.5
2000	Not Available													
2001	0	0	0	0	0	10.6	73.6	16.2	0	0	0	0	100.4	52.5
2002	0	2.4	0	0	0	0	0	52.2	0	0	0	0.1	54.7	47.0
2003	6.4	21.8	0	0	0	16.3	270.4	9.8	0	0	0	0	324.7	108.4
2004	13.7	0	0	0	0	0	3.0	5.6	0	39.3	0	4.3	65.9	26.3
2005	10.8	12.8	0	0	0	0	0	0.3	54.9	0	0	17.1	95.9	31.0
Average	7.9	8.0	4.2	2.2	0.2	3.8	45.5	42.0	9.5	1.5	1.6	1.6	128.1	43.1
Max	89.3	96.0	73.4	47.6	5.0	34.8	302.6	262.5	88.5	39.3	52.0	17.1	533.5	207.0

Source: 1). Monthly Metrological Register, Metrological Department. Government of Pakistan 2).CDPC. Metrological Department, Government of Pakistan Station: Metrological Observation Station, Karachi

(4) Wind Pattern

Strong coastal winds are the characteristic feature of the region. The wind direction during the southwest monsoon period is dominantly from the northeast and wind intensity is depending on the air pressure of the continent. The effect of this air pressure is also felt on the Karachi cost where the winter air pressure is 1018 hectopascal in January and summer air pressure is 998 hectopascal in July. Mean wind velocity varies from 5.3 miles per hour (m.p.h, 8.5 km / hour) in November to 12.8 m.p.h. (20.4 km/hour) in July. Remarkably strong winds blow mostly from southwest or west during from March till October. In the coastal regions, the wind velocities reach up to 25 m.p.h. (40 km / hour).

Table A111.4.3 Mean Monthly Wind Speed at noon (Knots)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1996	4.6	5.0	7.4	7.9	9.2	10.8	9.4	8.6	8.9	7.0	6.4	4.7	7.5
1997	6.3	7.4	8.8	9.9	10.3	10.7	9.5	9.2	6.5	5.9	3.7	4.5	7.9
1998	2.8	6.7	6.5	3.7	8.8	11.3	10.7	9.9	7.5	6.4	4.9	4.6	7.0
1999	2.3	6.2	7.1	7.3	8.5	11.2	10.6	9.4	9.7	6.6	5.8	4.0	7.4
2000	6.4	6.7	8.4	10.9	11.0	13.0	12.4	10.3	10.5	7.5	4.9	4.1	8.8
2001	4.5	5.7	7.9	9.5	12.2	12.3	8.5	9.8	8.2	5.7	4.2	4.3	7.7
2002	6.0	7.0	8.6	10.9	12.6	9.1	14.1	9.7	11.0	5.8	5.6	5.2	8.8
2003	7.1	8.3	9.2	10.1	11.2	10.5	7.9	9.6	7.3	6.2	4.7	4.1	8.0
2004	6.3	7.2	7.2	10.1	11.9	12.2	12.5	11.9	9.4	6.7	3.6	4.9	8.7
2005	4.5	6.9	7.8	9.5	10.1	9.9	11.2	10.7	8.1	5.9	2.1	4.5	7.6

Source: Pakistan Meteorological Department

Table A111.4.4 Mean Monthly Wind Direction at noon

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	N17W	S51W	S72W	S62W	S96W	S82W	S88W	S82W	S69W	S85W	S14W	S02W
1997	N03E	S62W	S84W	S68W	S65W	S71W	S65W	S63W	S62W	S65W	S45W	S59E
1998	S81W	S60W	S59W	S61W	S66W	S60W	S71W	S76W	S66W	S52W	S43W	S21W
1999	S48W	S73W	S54W	S61W	S56W	S54W	S61W	S61W	S67W	S55W	S56W	S16W
2000	S56W	N60W	S60W	S57W	S58W	S73W	S67W	S58W	S54W	S54W	S47W	S39N
2001	S54W	S43W	S42W	S45W	S48W	S45W	S52W	S59W	S44W	S56W	S45W	S06W
2002	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	S54W	S41W
2003	S51W	S38W	S45W	S52W	S46W	S44W	S41W	S50W	S43W	S48W	S49W	N17E
2004	N27W	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E
2005	N63W	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W

Source: Pakistan Meteorological Department

(5) Water Sources

Both surface and ground water sources are available and used in Karachi as water source. The following part describes main sources of surface and ground waters.

a. Surface Water

Kinjar Lake

It is the largest freshwater lake in Pakistan with very extensive reed-beds, particularly in the shallow western and northern parts. The lake is 24 km long by 6 km at its widest, and has an irregular shoreline of about 192 km. It was constructed in the 1930's from two smaller lakes, Kinjhar and Kalri, by the construction of a dam at Chilia Bangla and a 12 km long embankment along the east site. The maximum depth of the lake is 8 m.

Haleji Lake

It is located at 75 km east of Karachi in the Thatta district. It is a perennial freshwater lake with associated marshes and adjacent brackish seepage lagoons, set in a stony desert of limestone and sandstone bedroak. The lake was originally a saline lagoon formed by seasonal rainwater collected in a shallow depression. However, in the late 1930's the lagoon was converted into a reservoir to provide an additional water supply for Karachi. The saline water was drained out and embankments were constructed around the lake. The maximum depth is 5-6 m when fully flooded. The lake is about 3 km long and 1.6 km wide.

Hub Dam

The other principal source of surface water for Karachi is the Hub Dam. It is located 40 km west of Karachi, on the border between Baluchistan and the Sindh Provinces. It is a large reservoir constructed in 1981 next to the Hub River, on the arid plains north of Karachi. Harnessing of Hub River was completed long before the Independence. However, it was only after the creation of Pakistan that properly planned survey schemes were sanctioned for the utilization of water from the Hub and Malir rivers. As a result, detailed investigation was conducted, Hub Dam was proposed to be built at the present site just before the confluence of the Shorin Nallah and the Hub River. Hub Dam has a catchment area of 3,410 square miles (8,832 km^2). However, because of low and variable rainfall in the catchment and high evaporation rates, both drinking water and irrigation demands are met only at the 80% level. The water level in the reservoir fluctuates widely according to rainfall in the catchment area; the maximum depth is 46 m and the average is 19 m.

b. Groundwater

Karachi city falls in a dry and arid zone with scanty and intermittent rainfall with prolonged period of drought.

The Karachi District area comprises four (4) basin areas, namely:

- Malir River Basin
- Gadap Basin
- Lyari River Basin
- Hub River Basin (partial)

The groundwater exists in these basins within the alluvial deposits of Quaternary age and Manchar conglomerate, sandstone, Gaj sandstone, limestone, Nari sandstone and silica sand. Groundwater aquifer is available in different depths of different strata. Semi artesian condition has also been identified in deeper confined aquifers. The depths of aquifers and the water table in Karachi ranges from 20 feet (6 m) to 300 feet (91 m) below ground surface. The groundwater is recharged mainly by precipitation which falls in the watershed area of the basins. Since the major streams and nallahs are ephemeral in natures, most of the precipitation is lost through surface runoff. Some of this water percolates into the subsoil strata and contributes to recharge of groundwater.

At present, the groundwater is withdrawn from the open wells and tube wells. About 1000 existing dug wells and tube wells are provided with centrifugal or submersible pumps. The average pumping discharge of these wells has been estimated approximately as 80 gallons per minute (363 liter / min) that amounts to a discharge of 53 cusecs (1.5 m^3) against an estimated recharge of 91 cusecs (2.6 m^3). The balance of approximately 38 cusecs (1.1 m^3) represents a rough assessment of the present potential availability of groundwater sources. This quantity is partly represented in groundwater flows for springs, evaporation, evapo-transpiration and base flows of sub-soil storage. In the past, ground water at Dumlottee location was a major source of water for Karachi. The Khadeji, Thaddo Nallah, Mole tributary are the main sources of recharge

to the Malir Basin area. However, gradually with the passage of time and due to excessive lifting of sand from Malir River bed along with extensive use of ground water by farmers, the water table has dropped.

Continuous lowering of the water table is likely to result in intrusion of seawater into the Malir River Basin under natural seepage conditions and under induced conditions of recharge of saline seawater in the coastal aquifers of Karachi. This is an encroachment of the interface between seawater and freshwater, through intrusion and/or upcoming. Contamination by salty seawater can further increase the deterioration of the groundwater quality in the coastal aquifer.

There are some ground water sources along the coastal belt. However, the water is mostly saline and unsuitable for drinking. In many places within the Karachi coastal belt, groundwater is being used for domestic and household works and in some places the water is slightly saline. The areas where groundwater is used include the Cape Monze area, Buleji, Shamspir, Clifton and in areas adjacent to the Korangi Creek near the Rehri Village. Further inland, the sites include Mauripur, Lower Lyari area, around the Karachi Port, Kharadar, Methadar and Defence Housing Authority. The water table near the Karachi coast is assessed to be between 3-7 feet (0.9-2.1 m) to 20-60 feet (6.1-18.3m) in the landward areas.

c. Sea Water and Coastal Oceanography

The Karachi coastal zone lies in the north-eastern corner of the Pakistan coast bordering the northern Arabian Sea. The coastal oceanographic features of the Karachi coastal zone are therefore very much under the influence of the oceanographic characteristics of the northern Arabian Sea. The unique oceanographic features of the northern Arabian Sea such as high salinity, low precipitation, high evaporation rates, reversal of sea water circulation during the two monsoon periods, and high primary production rates, prevail all along the coastal and near-shore waters of the Karachi coastal belt. However, due to the small depths of the in-shore and backwaters, certain factors such as turbulence, turbidity, high suspended solids, littoral drift and organic and inorganic pollutants are more pronounced in the coastal waters within the coastal zone of Karachi.

The annual range of sea-surface temperatures along the Karachi coast is 19 ºC to 31 ºC. The average variations of seawater salinity in the coastal waters usually range between 35,000 ppm to 37,000 ppm. The seawater salinities in the Karachi harbour generally range from 33,000 ppm to 37,000 ppm and are very much influenced by the input of freshwater discharged by the Lyari River. The seawater salinities in the greater part of the inter-tidal creeks of the Indus Delta near Karachi remain between 37,000 ppm to 41,000 ppm for the most part of the year. The seawater circulation pattern along the coast of Karachi can be grouped into three types, namely: clockwise circulation, anti-clockwise circulation and mixed circulation. The analysis of the long period tidal data recorded at Karachi Port reveals that the 'Mean Sea Level', is rising at a rate of about 1.1 mm/year. The waves on the coast vary with the seasons. Tides along the Karachi coast are semi-diurnal that is one tidal cycle, and diurnal inequality is also present. In the daily cycle there are two high waters and two low waters which vary considerably from each other in tidal heights. The speed of the seawater current is generally low, about 0.5 knot. The speed increases up to 1 knot during monsoon. The direction is directly related to the prevailing wind system.

(6) Ambient Air Quality

The main source of ambient air pollution in Karachi are vehicle emissions, waste burning, suspended solid and 'dirty fuels' for production purposes used by small scale businesses. Air pollution levels in Karachi and other urban centres of Pakistan are extremely high compared with the international standards and are rising every year. According to the Ministry of Environment, 40% of the urban population of Pakistan faces health risks from pollution.

In Karachi, recent air quality surveys indicate a positive correlation between the incidences of ailments/symptoms and ambient air pollution from the transport sector. Higher than acceptable levels of major category pollutants, pollutant levels considered very harmful to human health are being recorded in Karachi. These include: carbon monoxide, sulphur dioxide, nitrogen oxides, particulate matter and ozone. In the areas where air quality was measured, sources of pollution are mainly transport vehicles and three wheelers.

Table A111.4.5 Air Pollutant Level in Karachi City

Year	TSP (ug/m^3)	PM_{10} (ug/m^3)	NO_X (ppb)	SO_2 (ppb)	O_3 (ppb)	Methane (ppm)
1999	210	164	16	12	11	0.5
2003	349	182	21	17	17	0.7
2004	375	194	29	24	19	6.5
% Increase / Decrease from 1999 to 2004	78	18	80	105	68	1300

Source: SUPARCO Baseline Ambient Air Quality Studies; World Bank (2005)

(7) Ambient Noise

Karachi is the hub of industrial and commercial activities in Sindh. In 1994, a survey was done to assess the degree of noise pollution in Karachi. Noise analysis data was collected for 16 hour periods and carried out in 72 selected sites. The local train whistling up-to 113 db was the worst polluter. The National Logistic Cell (NLC) trawler emitting 96 db came next. Similarly, other forms of vehicular traffic such as motorcycle, three wheelers etc. were the main contributors to high levels of noise pollution in the city. Noise levels varying from 87 to 99db were recorded at the harbour and the vegetable/meat market areas. Even near places such as hospitals high noise levels (81 to 82 db) were recorded. It is felt that rapid urbanization is contributing to increasing levels of ambient noise in the city, particularly sources from various forms of vehicular traffic. Increase in the number of vehicles, traffic jams, lack of maintenance of vehicles, traffic jams all contribute to this growing pollution threat.

2. Biological Environment

(1) Protected Areas and Sensitive Habitats/Reserves

In Pakistan there exists a system of protected areas for the protection of endangered species, habitats, ecosystems, archeological sites, monuments, buildings and other cultural heritage. Protected areas in Pakistan can be broadly categorized into two groups, namely:

- Ecosystems; and
- Archaeological and cultural sites

Ecosystems include protected areas such as wildlife reserves, national parks, game reserves. The official classification of notified protected ecosystem in Pakistan is i) National Park ii) Wildlife Sanctuary iii) Game Reserve. In addition, there are protected forests, village forests, and state forests. The main features of a 'National Park' include protection and preservation of scenery, flora, fauna in its natural state and preserving areas of outstanding scenic merit and natural forest. The main features of a 'Wildlife Sanctuary' include areas with undisturbed breeding grounds, prohibited or regulated public areas and areas prohibiting non-exploitation of forests. The government may, by notification in the official gazette, declare any area to be a wildlife sanctuary and may demarcate it in a manner as it sees fit. The government may declare an area as a 'Game Reserve' where hunting and shooting of wild animals is not allowed; except under a special permit, which may specify the maximum numbers of animals or birds that may be killed or captured in the area and the period for which such permits will be valid.

Archaeological sites and monuments are specifically protected by the Antiquities Act 1975, while the 'Guidelines for Sensitive and Critical Areas' of the Pakistan Environmental Protection Act 1997 focus on the protection of the existing sites. New sites may also be notified through the federal or provincial archaeology departments**.**

(2) Bio-diversity – Fauna and Flora

a. Coastal Bio-diversity

The vegetation along the Karachi coast is dominated by mangrove forests. Eight species have been documented with *Avicennia marina* being the most abundant (95%). Dense mangroves are present in the Korangi and Phitti creeks. This ecosystem provides habitat for wildlife of terrestrial and marine origin. The mammals of the mangrove forest include tropical dolphins, porpoises and occasionally visitors such as toothed whales. Little information is available on the reptiles, however, three species of lizards, one species of poisonous snakes and two species of marine snakes have been reported. The common fauna and flora of the relatively less polluted areas within the backwaters of Karachi include the gastropod *(Poteamides cinglatus)*, the barnacles *(Balanus amphitrite, Euraphia withersii)*, mud skipper fish *(periophthalmus dussemerie)*, the fiddler crab (Uca lacteal), the sea weed *(Entermorpha intestinales, Ulva reticulates)***.**

The sandy shores of the Karachi coast has four main groups of macro marine organisms, namely, crabs, gastropods, interstitial fauna and cast off sea weed along the high water zone as well as floating near the coastal waters. The Hawks Bay and Sandspit beaches are one of the most important green turtle *(Chelonya mydas)* nesting sites in the world. The coastal creeks and backwaters attract a number of migratory birds, particularly water fowl (for details see section on Wetlands). The pelagic fauna of the creeks near Karachi includes fishes, *Siphonophores* and *Ctenophores*. The pelagic flora includes floating sea weeds. The demersal fauna of the area includes shrimps and demersal fish.

b. Land based vegetation

The characteristic vegetation on the 'Hills' in Karachi are *xerophytic*, growing on the slopes as well as on the hills. *Inula granteoides* is the most common species found on the top of the hills. Next to it are *Blepharis scindia, Aristida mutabilis* and *Aristida adscenions*. Shrubs like *Commiphora wightii, Euphorbia caducifolia, Crewia tenax* and *Grewia villosa* are the major constituents of the vegetation on the slopes. Northern and north-eastern sides of the hills show better vegetation growth as compared to the southern and western exposures.

On the 'Alluvial Plain', vegetation is composed of deciduous *xerophytic* shrubs, forming open communities. A few of them are progressing towards climax, while others remain under various physiographic and edaphic control. The pioneer plants are *Corchorus depressus, Launaea nudicaulis, Salvia santolinifolia, Fagonia Arabica, Tibulus terrestris, Zygophyllum simplex, Cucumis prophetarium, Sida ovata* alongwith the grasses *Aristida mutabilis* and *Eleusine compressa* followed by herbs of *Cassia holosericea, Cassia senna, Aerva javanica* and *Indigofera oblongifolia.*

On the 'Dry Stream Beds' around Karachi, pioneer species are *Pteropyrum oleveri, Rhazya stricta* which are found in the heart of the dry stream beds because these two plants comparatively require shallow water depth. These plants are followed by *Nerium odorum* which is succeeded by *Gymnosporia Montana, Rhus mysorensis*, and *Tamarix articulate*, on the either sides of the dry banks, plants of *Rhus mysorensis, Acacia jacquemonti* and *Gymnosporia Montana* nurse the seedlings of *Eiphorbia caucifolia* which later on dominates over them.

The land in Karachi also supports vegetation in the 'Cultivated Fields'. Near Manghopir are found sulphur springs and sweet water streams. The area gives an appearance of an oasis. Date palm groves are dominant, besides date palm *Ricinus communis, Vinca rosea* and some vegetables are also commonly grown. *Euphorbia tirucalli* is commonly grown as shelterbelts around the cultivated fields. In Malir where sweet sub-soil water is available, vegetable and fruit trees grow by the help of tube-well irrigation. The common fruit trees grown here are *Mangifera indica, Phoenix sylvestris, Carica papaya, Psidium gaujava, Zizyphus jujube, Musa sapientum* and *Anona squamosa*. In addition, the Hub Dam area and Gadap are also vegetable growing areas.

(3) Wetland Resources

Some important wetlands located within and in the vicinity of Karachi city are discussed below;

a. Kinjhar (Kalri) Lake

The lake and surrounding areas are state owned (Government of Sindh). The site was listed as a 'Wetland of International Importance' under the 'Ramsar Convention', in July 1976, and declared a 'Wildlife Sanctuary', in March 1977 under Section 14 of the Sindh Wildlife Protection Ordinance 1972. Commercial fishing, domestic water supply for Karachi city, scientific research and public recreation are the dominant land uses. Unsustainable fishing activities constitute the major threat to the ecosystem**.**

b. Haleji Lake

The lake and the surrounding areas are state owned (Government of Sindh). The area was declared a 'Wildlife Sanctuary' (1,704 ha), in March 1977 under Section 14 of the Sindh Wildlife Protection Ordinance 1972. Haleji Lake Wildlife Sanctuary was listed as a 'Wetland of International Importance', in July 1976. Fishing and domestic water supply to Karachi City constitute the principal uses of the lake. Illegal fishing, hunting and increased siltation and eutrophication are the major threats to the ecosystem.

c. Hadero Lake

It is located 85 km east of Karachi in the district of Thatta. The lake and stony desert to the north and west are state owned (Government of Sindh). The area was declared as a 'Wildlife Sanctuary' (1,321 ha), in March 1977 under Section 14 of the Sindh Wildlife Protection Ordinance 1972. Commercial/sport fishing and excavation of stone for road construction in the adjacent areas are currently practiced. Excessive fishing, illegal hunting and indiscriminate removal of superficial layers of limestone are the major threats to the ecosystem.

d. Hub Dam

The Dam is state owned while the adjacent areas are privately owned communal lands. Its reservoir is protected within the 'Hub Dam Wildlife Sanctuary' (27,219 ha), established in 1972. Fishing activities take place while the reservoir provides drinking water to Karachi city and water for irrigating agricultural land in Lasbella District, Baluchistan. Fishing activities cause some disturbance to waterfowl population and the Dam has had detrimental effects on the ecology of the downstream of the estuarine system. The Dam is considered to have the highest fishery potential among the smaller reservoirs in Pakistan.

e. Hawks Bay/Sandspit Beaches and adjacent creeks

The beaches are located on the coast southwest of Karachi City. They are gently sloping sand beaches with open sandy offshore approaches stretching for about 20 km along the Arabian Sea coast west from Manora Point at the mouth of Karachi harbour, and there are a complex of creeks and shallow tidal lagoons with extensive inter-tidal mudflats and some mangrove swamps behind the beach. The eastern part of the beach (Sand spit) is all sand and the western part (Hawks Bay) has some rocky areas. The site is one of the regions of most important green turtle nesting site.

The green turtles are recognized as endangered species by the Sindh Government. Beach recreation is the main land use. There are many beach huts built along the beach and human usage of the beach resulting in generation of garbage (that attracts predators such as dogs/crows), night lightening etc. are having harmful effects on the nesting turtles and their hatchlings. In addition, the beach huts (often built in violation of the relevant building laws) are encroaching on prime turtle nesting space.

The adjoining creek system is one of the most important areas for wintering, passage and summering shorebirds in Pakistan, and also supports significant amount of cormorants, flamingos, ducks, gulls and terns.

f. Clifton Beach

Located on the coast south of Karachi City, it is a long sandy beach with adjacent tidal mudflats, backed by sand dunes. The sand dunes have practically no vegetation on their seaward slope. Land use status is public recreational beach. Part of the mudflats have been lost as a result of dyke construction while significant amount of sewage from the Defence Housing Authority / Clifton Cantonment area is discharged directly to the Clifton beach, spoiling its environment and recreational value.

g. Korangi and Gharo Creeks

The creeks are located about 20-30 km southeast of Karachi, at the northern extremity of the Indus Delta. The site is a complex of large tidal creeks with extensive mangrove swamps and inter-tidal mudflats, near the southeastern outskirts of Karachi. The creek system was originally developed as a part of the Indus Delta, but is no longer hydraulically connected to the delta. The tidal range is about 2m. The creeks are state owned and under the administration of the Port Qasim Authority. Surrounding areas are privately owned. An area of 80,743 ha, including 48,286 ha of mangroves, has been declared as a 'Protected Forest' and is managed by the Sindh Forest Department. Grazing by domestic livestock in the mangroves, the cutting of mangrove branches for cattle fodder, and fishing are the principal uses. The creeks provide a supply of water for nearby industries and are uses as a transportation network. There are several large industrial developments, many fishing villages and a port in the area. The mangrove ecosystem is of considerable importance as a breeding and nursery ground for many species of fish and shrimps of economic value. The two major threats to the area are pollution (mostly sourced from the nearby industrial establishments) and over-exploitation of natural resources.

3. Socio-Cultural Environment

(1) Population

It is now estimated that Karachi's population is approximately 13 million (9.8 million in the 1998 census). Currently an estimated 350,000 persons are added to the population every year. Another estimate puts the increase at 33,000 households annually. The city contains close to 33% of the population of Sindh and 7.5% of the population of Pakistan. In the early period of Karachi's growth, after the creation of Pakistan, migration played an important role. This trend continued over the years.

Table A111.4.6 Karachi's Population Growth

Year	Population	Increase/Decrease Over Last Census / Survey	No. of Years in Between	Percent Increase / Decrease	Average Annual Growth Rate
1941	435,887	135,108	10	44.90	3.70
1951	1,137,667	701,780	10	161.00	11.50
1961	2,044,044	906,377	10	79.70	6.05
1972	3,606,746	1,562,702	11	76.50	5.00
1981	5,437,984	1,831,238	9	50.80	4.96
1998	9,802,134	4,540,422	17	86.29	3.52

Source: Government of Pakistan Census Reports.

Table A111.4.7 Population of Municipal Corporations and Cantonment Areas by Sex (1998 Census)

Municipal Corporations / Cantonment areas	Total	Male	Female
Municipal Corporation East.	2,612,158	1,392,079	1,220,079
Cantonment area Faisal Drigh Road	133,856	72,281	61,575
Municipal Corporation west	1,899,566	1,038,346	861,220
Manora Cantonment	10,008	6,036	3,972
Municipal Corporation South	1,504,461	807,619	696,842
Karachi Cantonment & Clifton Cantonment	240,577	135,746	104,831
Municipal Corporation Central	2,277,931	1,200,536	1,077,395
Municipal Corporation Malir	447,282	254,767	192,515
Malir Cantonment & Korangi Creek Cantonment	78641	47485	31156

Source: Development Statistics of Sindh, 2003

Table A111.4.8 Population of Katchi Abadi

	1970s (1978)	1980s (1985)	Most Recent (1988)	2000 (Projection)
Katchi abadi population	2,000,000	2,600,000	3,400,000	7,070,000
No. of Katchi abadi Households	227,000	356,000	465,000	960,000

Source: Karachi Land and Housing Study: Dr. D. Dowall/KDA-MPD, 1989.
Shelter for Low Income Communities: Inception Report on Sindh: World Bank, October 19990

(2) Land Use and Urban Planning

a. Land

In 1870, the urbanized area of the Karachi District was 13 km^2, the 1971 census report gives the figure of 289 km^2, the 1974 Master Plan defined metropolitan Karachi as 349 km^2 and the 1988 Karachi Development Plan gives a figure of 3,520 km^2. The area of Karachi District is 3,527 km^2. At the current rate of urban land conversion of about 6,780 acres (27 km^2) per year, Karachi will outstrip its present boundaries.

In Karachi, nearly 400,000 acres (1,618 km^2) of the 425,000 acres (1,719 km^2) makes up its metropolitan area and account for 94% of all land in the district are in some form of public ownership. Land for development is transferred from the Government of Sindh to the city development agencies that plan and develop land as per their rules and regulations and make plots available to private developers, cooperative societies and individuals for construction purposes. These development authorities also set aside land for social and physical infrastructure development and for commercial and recreational purposes. In addition to formal sector development, there is a lot of informal development. Around 1000 acres (4.0 km^2) of government land is encroached upon for developing squatter settlements (Katchi Abadis) each year. Almost 50% of the city population lives in these Katchi Abadis.

b. Urban Planning

The key urban master planning exercises carried out for Karachi City are briefly discussed below:

The Karachi Development Plan 2000

On the expiry of the 1974-85 Karachi Master Plan period, the Karachi Development Plan 2000 was initiated by the KDA with UNDP assistance. The plan document was completed in 1990. Essentially the plan consisted of a computer model that would monitor developments in Karachi so that investments could be directed appropriately. It also contained important recommendations for planning and a related institutional set-up which included the setting up of an independent Karachi Division Physical Planning Agency (KDPPA) supported by a steering committee and an implementation board. Building control in this agreement was to be subject to the KDPPA. However, the monitoring and related planning exercise could not be carried out without a constant supply of data for which no system was proposed by the plan. This and other related factors rendered the entire set-up created for the Karachi Development Plan 2000 ineffective. In addition, the plan was never authorised as its Steering Committee could not meet to approve it.

Master Plan 2020 for the Development of Karachi

A project for the formulation of a Master Plan 2020 for Karachi City is presently being carried out within the Master Plan Group of Offices (MPGO) of the City District Government Karachi (CDGK). The present planning exercise focuses on updating conditions, improving the technical tools, adding new tools to planning, new spatial planning, change of land use, relationship between land use and zoning regulations, rate of growth of squatter settlements and change in urban profile, etc.

(3) Transport and Traffic

Karachi has 14,854 intra-city buses, which is privately owned and operated on designated routes. In addition, it has 513 inter-city buses as well. These buses do not have proper terminals, workshops or depots for their use. There are also 13,613 taxis and 23,337 rickshaws in the city. According to the Regional Transport Authority (RTA) figures, 72% of all commuters using buses travel by Karachi's 8,773 mini-buses. The mini-buses are owned by individuals. Karachi's traffic is the main cause of air and noise pollution in the city. Much of the heavy traffic is related to port based activities. Because of the problems with the piped network in Karachi and the urgency of the water demand, water tanker deliveries now comprise as much as 25% of all water supply in the city, delivering about 95 mgd and constituting a major component of the daily traffic load in the city. It is estimated that about 4000 'general public' tanker deliveries are made per day to un-served and water scarce areas of the city.

The railway system in Karachi comprises the main line which runs from Keamari through Karachi City, Karachi Cantonment, Landhi, Bin Qasim and to the rest of Pakistan.

(4) Socio-economic Activities

a. Health

Karachi has a variety of medical facilities. It has all sorts of hospitals, clinics and dispensaries, both in the public and private sectors. However, a vast majority of the population also get treatment from medical practitioners, both qualified and unqualified and by hakims (traditional doctors using herbal medicines). Most of these doctors operate from small, one room clinics and have no proper diagnostic facilities. There is no record of the number of such clinics. However, they greatly outnumber the formal sector health facilities. This is particularly the case in informal settlements. According to one survey, there are over 400 private clinics in Orangi and only 18 government and proper formal sector health facilities.

b. Education

In Karachi, according to the 1981 census, the literacy rate was 57% as compared to 26% in the whole Pakistan. According to a survey conducted by the Applied Economic Research Centre in 1987, the literacy rate in the planned areas was 76% and 48.6% in unplanned areas. The Government of Sindh, the federal government, the City Government and the private sector are the main providers of education in Karachi. However, owing to the inadequacy of the government educational facilities, such facilities have been greatly supplemented by the private sector.

Social indicators representing the whole of Karachi may be misleading since there are major differences between the social indicators for the city's planned areas and Katchi Abadis. There are also major differences in social indicators among low-income settlements themselves. The data also shows that better incomes do not necessarily mean better social indicators.

c. Economy

Karachi is the financial capital of Pakistan; it has the greatest share of GDP and generates approximately 65% of the national revenue. Karachi has Pakistan's largest port, and it was the federal capital for the first two decades after independence. Estimates from the mid 1980's reveal that Karachi has made considerable contribution to the economy of the country. Karachi's per capita income is two and a half times that of the national average. In terms of large scale manufacturing industry, for example, Karachi still has a share of around one third in the national value added for the sector. In terms of contribution to the energy sector (electricity and gas), the transport, communication and storage sector, as well as the wholesale and trade sector, Karachi's contribution in each of these areas is at least 25% of the country's value addition.

The footprint of the corporate multinationals is on the increase in Pakistan and headquarters of a majority of the large corporate players are based in Karachi. For example, the headquarters of all the multinational banks operating in Pakistan (14 out of a total of 39 commercial banks operating in Pakistan) are located on the Wall Street of Karachi – the I.I. Chundrigar Road. A high percentage of the population also works in the informal sectors. However, unemployment is still over 10% and income disparities are quite prominent. Almost 50% of the population lives in squatter settlements (Katchi Abadis) with limited access to public utilities and gainful employment opportunities.

(5) Solid Waste Management

Karachi does not possess a properly functioning garbage management system. Garbage is often dumped in nallahs, open drains and sewer manholes, thus clogging the system, causing sewage overflows and system breakdowns.

Karachi generates about 6,113 tons of solid waste every day. About 5,057 tons is collected and 1,057 tons is not collected. About 10% of this waste is removed at source by housewives and sold to about 15,000 *kabaris* who pick up the waste from households. This solid waste consists

of glass, plastic, metal and paper. In addition, another 600 tons of solid waste is collected from *kutchra kundis* and from the streets and markets by waste pickers. This waste consists of paper, rags, plastic, metal objects, glass and bones.

Sweepers employed by the municipal agencies or hired by residents, provide door-to-door garbage collection service. From the households, the waste is taken to neighbourhood collection points (concrete/steel bins) stationed at roadsides, on pathways, in parks and playgrounds. The garbage may also be dumped openly in storm drains, parks/playgrounds, back lanes etc. In such places, garbage is either burnt or is collected by the municipal agencies and transported to the landfill sites located in the outskirts of the city, one at Jam Chakro, Surjani Town and the other at Gond Pass, Hub River Road, 30-35 km from the city centre.

In the absence of any officially provided service in the recycle/reuse of solid waste, the informal sector has filled this gap to a great extent. The informal sector comprises of an organized chain of actors, starting from the rag pickers on the streets to the recycling factory owners. It is a flourishing business, which at a conservative estimate, accounts for 15%-20% of the total generated waste of the city. This sector provides employment to more than 55,000 families and had an annual turnover of Rs.1.2 billion. More than 1,000 recycling units are operative in the informal sector.

About 2.7 tons of waste is generated by 200 hospitals having total number of beds of 9,000. It contains 540 kg hazardous waste and 2,160 kg non-hazardous waste. For disposing of hospital waste, some private and government run hospitals have installed imported/locally developed waste incinerators. The City District Government has also installed two waste incinerators in the city. They cater only for the waste of about 140 health care units and are presently running at very low efficiency.

In the areas not covered by the City Government such as the cantonment areas, Clifton, Malir, Faisal and Korangi cantonments there are 34 vehicles that collect an estimated 311 tons of garbage each day, which incurs a daily cost of Rs.197, 000 for sweeping and transportation.

Table A111.4.9 Solid Waste Management Statistics

Town	Waste generated Tons per day	Waste Lifted Tons per day	Waste Lifted Unattended / Backlog
Gadap	350 tons	320 tons	30 tons
Korangi	360 tons	272 tons	88 tons
Malir	280 tons	270 tons	10 tons
Gulberg	330 tons	330 tons	Zero
North Nazimabad	375 tons	336 tons	39 tons
Liaquatabad	800 tons	594 tons	206 tons
Baldia	400 tons	302 tons	98 tons
SITE	167 tons	153 tons	14 tons
Landhi	370 tons	324 tons	46 tons
North Karachi	365 tons	280 tons	85 tons
Keamari	220 tons	180 tons	40 tons
Shah Faisal	105 tons	105 tons	Zero
Orangi Town	346 tons	240 tons	106 tons
Gulshan-e-Iqbal	400 tons	318 tons	82 tons
Bin Qasim	65 tons	27 tons	38 tons
Lyari	350 tons	300 tons	50 tons
Jamshed	330 tons	252 tons	78 tons
Saddar	500 tons	454 tons	46 tons

Source: Development Statistics of Sindh, 2003

(6) Cultural Assets

Karachi has a very rich built heritages. Most of them are located in the old city. The heritages consist of residential, public and institutional buildings such as hospitals, municipal offices, courts, prisons, halls, auditoriums, libraries, churches, schools and colleges and warehousing in the port area. Most of these buildings are of the early British period. Many of these heritages have been destroyed, both in the Saddar area and in the old city. Under the Sindh Cultural Heritage (Preservation) Act 1994, a large number of buildings (about 900) have been listed as protected buildings and their demolition is illegal under the Act. There are also a number of cultural sites in and around Karachi which record its long and complex history.

(7) Water Rights

The 'Constitution' of Pakistan protects the life of its people and obliges the State to secure the well being of the people and to provide for all the citizens, within the available resources of the country, facilitates for adequate livelihood and basic necessities of life. In 1994, the Supreme Court of Pakistan interpreted the constitutionally protected right to life and dignity to include the right to a healthy environment. Furthermore, the State is urged to promote, with special care, the economic interests of poorer classes or areas. According to the 'Constitution', water is a provincial subject. However, the Government of Pakistan has also to perform a number of functions and responsibilities in the water sector, mostly relating to inter-provincial matters. With regards to rights and interests in water, any individual has the right to complain about actual or proposed executive or legislative acts and failures of any authorities with respect to the use, distribution or control of water. With regard to the access to safe drinking water, the Supreme Court of Pakistan specified in another case in 1994, that mining companies have violated the rights of citizens by polluting local drinking water supplies. The Court expanded the Article 9 of the right to life and said that it is a right to every person to have unpolluted water, wherever he lives.

(8) Industrial Activities

After the creation of Pakistan, the strategy adopted for industrialisation in the Sindh province promoted the creation of planned industrial estates and an engineering base. The first industrial estate established was the Sindh Industrial Trading Estate (S.I.T.E) beyond the Lyari River in Karachi in 1947, which was meant to be the industrial hub of the country, not just Sindh. S.I.T.E. was provided with infrastructure such as water, roads and a sewerage network with the specific condition that it would be used only if the effluent from the factories were treated according to the requirements of the Factory Act 1934. Industrial estates in Landhi (1953), Korangi (1959) and North Karachi Township (early 1970) were established subsequently. About 70% of the total industry of Pakistan is located in Karachi.

Nearly 30 mgd (136,000 m^3 / day) of water is being provided to industrial sites located at S.I.T.E, Korangi, Landhi, F.B Area, North Karachi and elsewhere in the city. However, none of the industrial estates in Karachi is served with effluent collection and conveyance system. So the effluents are not collected and conveyed to the KW&SB treatment plants and instead are discharged mostly untreated into the sea via the Malir and Lyari Rivers.

S.I.T.E covers an area of about 1,600 ha and 2,000 industrial units. The effluents of S.I.T.E area are discharged into the Lyari River and ultimately into the Manora Channel of Karachi Harbour. The Landhi Industrial Trading Estate (L.I.T.E) and the Korangi Industrial Area discharge their effluents that include heavy metals, organic matter, oils, greases and a host of toxic chemicals into Malir River, that ultimately discharges them, along with domestic wastes, on the tidal flats of the Gizri Creek, from where the highly polluted waste water moves to the Arabian Sea.

APPENDIX – A111.5

Project Description

A 111.5 Project Description

1. Water Supply Facilities Proposed in M/P

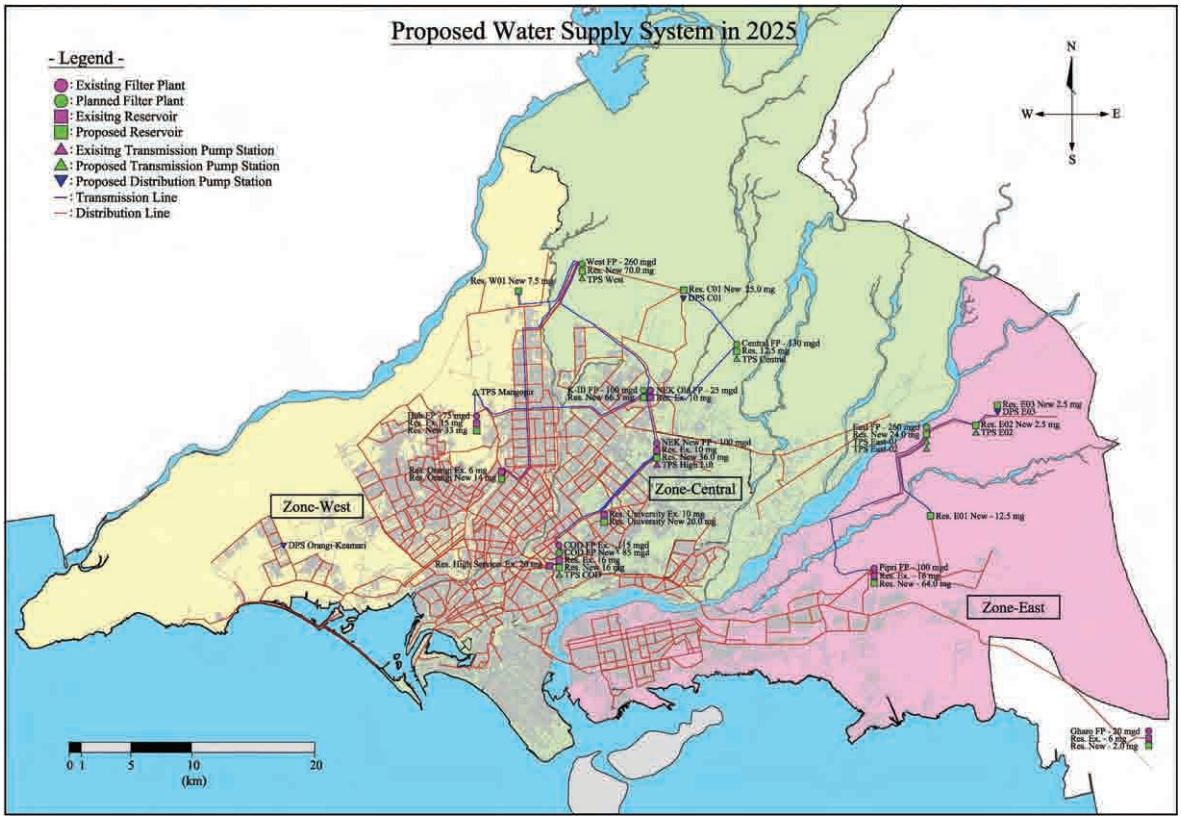
The following tables show the components of the Master Plan for the Karachi Water Supply System. The facilities of upper 3 lines of the **Table A111.5.1** (bulk water canal / conduit, bulk pumping station, filtration plant) are proposed by KW&SB as K-IV project, Greater Karachi Water Supply Scheme (Executive Summary, May 2007).

Table A111.5.1 Components of Bulk Water Supply System

Facility	Proposed	Rehabilitation/ Replacement
Bulk Water Canal/Conduit	780 mgd	620 mgd
Bulk Pumping Station	6 P/Ss	15 P/Ss
Filtration Plant	835 mgd (5 F/Ps)	435 mgd (6 F/Ps)
Transmission Pumping Station	7 P/Ss	2 P/Ss
Transmission Main	129 km	17 km
Distribution Reservoir	8 nos.	8 nos.
Distribution Pumping Station	3 P/Ss	-

Table A111.5.2 Components of Retail Water Supply System

Facility	Proposed				Rehabilitation/ Replacement			
Zone	West	Central	East	Total	West	Central	East	Total
Trunk Distribution Main (km)	406	364	152	922	273	259	153	685
Distribution Network Main (km)	2,539	3,152	2,349	8,041	3,751	4,208	1,220	9,179
by DNI	-	-	-	-	2,578	3,069	681	6,329
by other than DNI	-	-	-	-	1,173	1,139	539	2,850
House Connection (×1,000)	454	564	420	1,438	1,119	900	378	2,398
by DNI	-	-	-		553	784	283	1,620
by other than DNI	-	-	-		566	116	95	778



A111.5.1 Water Supply System Plan in 2025

The detail of the proposed water supply system plan is described in **Chapter 3** "Water Supply Master Plan" of Main Report.

2. Sewerage Facilities Proposed in M/P

The Sewerage Master Plan for 2025 is shown in **Figure A111.5.2** and **Table A111.5.3**.

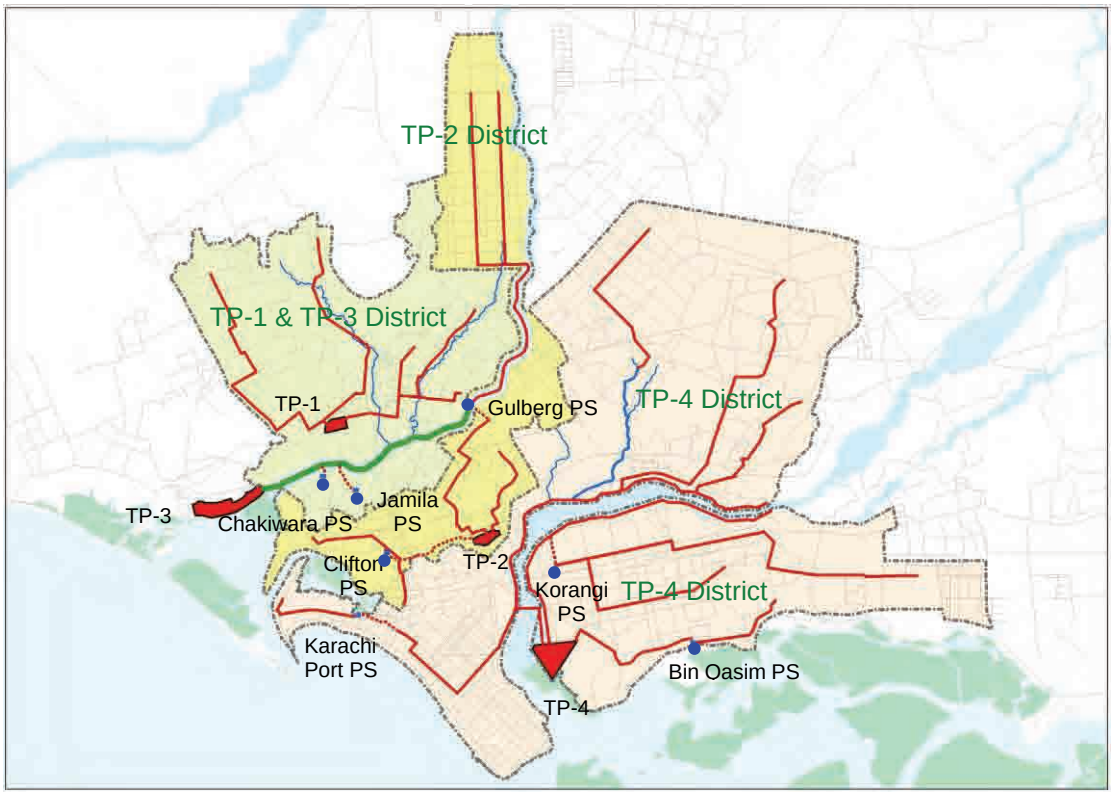


Figure A111.5.2 Location Map of Sewerage Master Plan

Table A111.5.3 Sewerage Master Plan for 2025

	TP-1 (extension)	TP-3 (existing)	TP-2 (extension)	TP-4 (new)
District area (km^2)	145.3		100.4	340.2
Population	8,849,000		5,013,000	11,720,000
Branch Sewer Length (km)	3,365		2,163	5,336
Trunk Sewer Length (km)	44.9		96.0	125.8
Diameter / size	42 inch to 3500×2000×1		42 inch to 4000×2000×1	42 inch to 3500×3000×2
Pumping Station Capacity (m^3/m)	Jamila PS (existing): 112.8 Chakiwara PS: 45.1		Gulberg PS (new): 170.6 Clifton PS(existing): 107.7	Korangi PS (existing): 289.0 Bin Qasim PS (new): 59.9 Karachi Port PS (new): 66.3
Location of TP	SITE Town	Keamari Town	Jamshed Town	Korangi Creek Cantonment
TP Site area (ha)	49	221	49	168
Capacity (m^3/d) (mgd)	500,000 (110)	245,000 (54)	490,000 (108)	1,290,000 (284)
Influent BOD (mg/l)	600	600	600	600
Effulent BOD (mg/l)	80	80	80	80
Sewage Treatment Process	UASB + HRTF	Wastewater stabilization pond	UASB + HRTF	UASB + HRTF
Sludge Treatment Facilities	GT + MD	DB	GT + MD	GT + DB / MD
Treated Sewage Discharge Point	Lyari River	Arabian sea (swamp area of Karachi Bay)	Malir River	Malir River

Note: UASB for upflow anaerobic sludge blanket, HRTF for high rate trickling filter, GT for gravity thickening, DB for drying bed, MD for Mechanical dewatering,

The details of proposed facilities are described in **Section 4.3** “proposed Master Plan” of Main Report.

APPENDIX – A111.6

Environmental Scoping

A 111.6 Environmental Scoping

(1) Water Supply Scheme

No	Environmental Items	Evaluation	Reason
Socio-Economic Environment			
1	Resettlement	B	Land acquisition may be necessary in response to the M/P.
2	Local economy such as employment and livelihood	B	Adverse affects on the living conditions of inhabitants by changes in land use due to the project.
		D	Positive impact is also expected such as increase of employment in construction phase.
3	Land use and utilization of local resources	C	Detailed information is necessary and project site need to be decided to assess the type and level of impact.
4	Social institutions such as social infrastructure and local decision-making institutions	D	No impact is expected.
5	Existing social infrastructures and services	B	Traffice congestion during the construction phase may be expected.
6	The poor, indigenous of ethnic people	D	No serious impact is expected by new water supply system.
7	Misdistribution of benefit and damage	D	No serious impact is expected by new water supply system, since the service will be provided to where demand exists.
8	Local conflict of interests	B	Water is supplied by water tanker which is operated by the Ranger to the households without house connection.
9	Gender	D	No impact is expected.
10	Children's rights	D	No impact is expected.
11	Cultural heritage	D	No cultural properties will be damaged by the water supply system construction.
12	Infectious diseases such as HIV / AIDS	D	No impact is expected.
13	Water rights and rights of common	B	There may be a possibility of adverse impact on the additional water right from the Indus River.
14	Public health condition	D	The sanitary condition will be improved by clear water supply increase.
		B	Some impacts may be expected on water quality of water bodies by increase of sewage.
15	Hazards (risk, etc.)	D	No significant hazards are expected.
Natural Environment			
16	Topography and geology	D	No large-scale alteration of topography and geology will be required in the study area.
17	Soil erosion	D	No large-scale alteration of topography and geology will be required in the study area.
18	Groundwater	D	No significant amount of groundwater is extracted by the project.
19	Hydrological situation	D	No significant impact.
20	Sea / coastal zone	D	The water filtration plants will be constructed 30 kms away from the sea / coastal zone. The effulent may not influence the sea / coastal zone.
21	Fauna and flora	D	There is no record of valuable species of fauna and flora around the proposed water supply facilities.
22	Meteorology	D	No impact is assumed due to the water supply system improvement project.
23	Landscape	C	Water filtration plants and reservoirs may influence landscape to some extent. This could be mitigated by

No	Environmental Items	Evaluation	Reason
			the appropriate facility design.
Pollution			
24	Air pollution	B	Construction and operation of the filtration plants and installation of pipes may increase levels of exhaust and suspended particulate.
25	Water pollution	D	No impact is expected.
26	Soil pollution	D	No significant impact is expected.
27	Waste	B	The spoil will be generated during installation of pipelines and development of reservoirs.
28	Noise and vibration	B	Some noise and vibration may occur during construction due to heavy construction equipment.
29	Ground subsidence	D	No groundwater extraction expected by construction works.
30	Offensive odors	D	No particular odor is expected from water supply faciities.

Reference: "Guidelines for Environmental and Social Considerations", JICA, 2004 (some modifications being made.)
A: Serious impact is expected
B: Some impact is expected
C: Extent of impact is unknown (examination is needed. Impact may become clear as study progress)
D: No impact is expected. IEE / EIA is not necessary.

(2) Sewerage Scheme

No	Environmental Items	Evaluation	Reason
Socio-Economic Environment			
1	Resettlement	B	Land acquisition may be necessary in response to M/P.
2	Local economy such as employment and livelihood	B	Adverse affects on the living conditions of inhabitants by changes in land use due to the project. Positive impact is also expected such as increase of employment in construction phase.
3	Land use and utilization of local resources	B	Detailed information is necessary and project site need to be decided to assess the type and level of impact.
4	Social institutions such as social infrastructure and local decision-making institutions	D	No impact is expected.
5	Existing social infrastructures and services	B	Traffic congestion during the construction phase may be expected.
6	The poor, indigenous of ethnic people	D	No serious impact is expected by new sewerage system.
7	Misdistribution of benefit and damage	D	No serious impact is expected by sewerage system, since the service will be provided to where demand exists.
8	Local conflict of interests	D	No impact is expected.
9	Gender	D	No impact is expected.
10	Children's rights	D	No impact is expected.
11	Cultural heritage	D	No f cultural properties will be damaged in the area due to the sewage facilities.
12	Infectious diseases such as HIV / AIDS	D	No impact is expected.
13	Water rights and rights of common	D	Water right problem is not expected.
14	Public health condition	D	The sewage treatment system provision will improve public health conditions
15	Hazards (risk, etc.)	D	No significant hazards impacts are expected.
Natural Environment			
16	Topography and geology	D	No large-scale alteration of topography and geology will be required in the study area.

No	Environmental Items	Evaluation	Reason
17	Soil erosion	D	Extensive excavation will not take place, and no large-scale alteration of topography and geology will be required in the study area.
18	Groundwater	D	No large-scale construction works, which will extract significant amount of groundwater, are expected.
19	Hydrological situation	D	Sewerage system improvement will contribute to improve hydrological conditions in drains and rivers.
		B	The effluent from the treatment plants may be discharged into the rivers. 4 tunk sewers and pressure main are crossing Malir and Lyari Rivers.
20	Sea / coastal zone	D	At present, sea/coastal zone is polluted by untreated sewage which flows from the rivers. The proposed facilities will improve the sea/coastal zone.
		B	The effluent from the sewage treatment plant may be dischaged to the sea.
21	Fauna and flora	D	There is no record of valuable species of fauna and flora around the proposed sewerage facilities.
22	Meteorology	D	No impact is assumed due to the sewage treatment system improvement project.
23	Landscape	B	Sewage treatment plants may influence landscape to some extent. This could be mitigated by the appropriate facility design.
Pollution			
24	Air pollution	B	Construction works may be done close to settlement and social infrastructure.
25	Water pollution	B	Water qulity will be significantly improved after the sewarage system is improved. Though effluent and sludge should be considered.
26	Soil pollution	B	If the sewage sludge is disposed of to land, there may be some risk of soil contamination.
27	Waste	B	Not large quantity of construction wastes will be generated. The sludge from the sewage treatment plant will be treated and appropriately disposed of.
28	Noise and vibration	B	Some noise and vibration may occur during construction due to heavy construction equipment.
29	Ground subsidence	D	No groundwater extraction expected by construction works.
30	Offensive odors	B	Odor may emit from the sewage treatment plants.

Reference: “Guidelines for Environmental and Social Considerations”, JICA, 2004 (some modifications being made.)
A: Serious impact is expected
B: Some impact is expected
C: Extent of impact is unknown (examination is needed. Impact may become clear as study progress)
D: No impact is expected. IEE / EIA is not necessary.

APPENDIX – A111.7

Analysis of Alternatives

A 111.7 Analysis of Alternatives

1. Project Benefits and Positive Impacts

The main objective of the water supply and sewerage project is to improve the living condition, public health and hygiene and improve the standard of living, and to encourage economic growth. Therefore, the project is expected to have the following benefits and positive impacts:

- Expanded water supply service areas,
- Increased amount of water distribution and continuous water supply,
- Improvement of water quality supplied,
- Reduced non-revenue water including water leakage,
- Improvement of the water quality of the rivers / sea by collection and treatment of sewage prior to its discharge to rivers / sea and improvement of the river / coastal water environment,
- Reduced risks of diseases by a proper collection, treatment and disposal of sewage, and enhancement of the human health,
- Improvement of sanitation conditions in the cities,
- Increased economic activities (such as commercial and industrial), improved employment opportunities, and economic growth,
- Improvements to public health which will then result in higher economic activity and productivity,
- Increased local employment opportunities during the construction phase of the project, either as direct labour for construction or as provide services at the construction sites.

2. With / Without Project

With this project, the benefits and positive impacts mentioned above will be expected. If the project is not implemented, the situation could be as follows.

- Severe water shortage will be happen as the population in Karachi City is increasing in future,
- The leakage rate will remain high and the big amount of water will be wasted,
- Untreated sewage will continuously contaminate receiving bodies such as nallah, rivers and sea,
- The public health condition will become worse due to water shortage, continuous drain and river water contamination and the health risk will be increased,
- The sea / coastal water environment will become worse.

3. Alternatives of Water Sources

The alternatives of water sources are surface water in Karachi, Indus River, groundwater, and desalination, and reuse of treated effluent.

(1) Surface Water

The source of surface water is rainwater. The features of rainfall in Karachi are as follows;

- Annual average rainfall in Karachi is very little, about 130 mm,
- About 70 % of annual rainfall occurs in July and August, there is little rainfall in the rest of the year,

There is very little and irregular precipitation in Karachi, it is therefore very difficult to use local surface water as a source of water supply in Karachi.

a. Malir and Lyari Rivers

The natural water is very little in those rivers. In the northern mountain areas, the ground surface is not covered with trees or grasses and the topsoil is clayish, thus the rain cannot permeate easily into the ground. Most rainwater flow directly into the sea soon after rainfall. Therefore, the rivers flowing through the city cannot be used as a source of water supply from the viewpoints of water quality and quantity.

b. Hub Dam

Hub Dam was constructed in 1983. The rainwater in the basin is collected in the dam and used as a source of water supply for Karachi. The dam is designed to supply 100 mgd (450,000 m^3/day) of water for Karachi, but the supply is not stable because of little rainwater. The recent situations of Hub Dam are as follows:

- During the eight years from 1995 to 2003, the dam was never filled up,
- During the three years from 2000 to 2002, the dam was dried up,
- In July 2003, the dam was filled up for the first time since 1995,
- In mid May 2006, the life storage of the dam was only 5.8 % of its design capacity.

At present, 75 mgd of water is used for the water supply and it is difficult to take more water from Hub Dam due to the unstable water storage.

(2) Indus River

The Indus River System Authority (IRSA) Act, 1992 was promulgated to decide the apportionment of Indus water to each province in Pakistan. The existing water right for Karachi is 1,200 cusecs (44 m^3/s). The existing water right has been exhausted with the completion of the K-III project in May 2006. Now CDGK has requested the additional water right (1,200 cusecs) to Federal Government and this will be the most possible new water sources for Karachi water supply (see **Section 3.2.2**).

(3) Groundwater

There are about 1,000 wells in Karachi and the annual average withdrawal is 1.5 m^3/s. KW&SB study in 2004 and our assessment indicated that the permissible yield from groundwater sources in Karachi is so small that barely meets the present level of withdrawal. Under these circumstances, there is no realistic prospect of developing new groundwater sources to meet the future water demand in Karachi (see **Section 3.2.2**).

(4) Desalination

This is studied in the 1985 Water Supply Master Plan and concluded that the cost of desalination for the foreseeable future was prohibitive and only if technological is developed to considerably reduce the costs of energy would it likely to become attractive for Karachi.

During the last two decades, there has been no remarkable technical breakthrough which substantially reduces capital and recurrent costs of sea water desalination. The conclusion of the 1985 water supply master plan study therefore still remains effective even at present and most likely it will continue to remain valid in foreseeable future (see **Section 3.2.2**).

(5) Reuse of Treated Effluent

At present, the treated effluent from TP-3 is conveyed to Pakistan Air Force and used as plant watering, and at Pakistan Still Mill treatment plant, the effluent is used at a golf course and an orchard. The water quality survey conducted by JICA Study Team showed that the water quality of treated effluent did not meet the standards in dry season. In addition to this, the effluent which meets the standards of BOD_5: 80mg/l is not appropriate for water sources.

Compared with the above water sources, Indus River seems to be the most feasible and viable option. The request for the additional intake from Indus River is already under process by K-IV project, Greater Karachi Water Supply Scheme (Executive Summary, May 2007) and JICA Study Team prepares the Master Plan based on the K-IV project Greater Karachi Water Supply Scheme (Executive Summary, May 2007).

4. Alternatives of Transmission System for Water Supply

In M/P, it is proposed to divide Karachi into three hydraulic zones each separated from the others by two major rivers i.e. Malir and Lyari Rivers. Within each zone, the alternatives for water transmission system are discussed (see **Appendix A73.1** for the detail). In each zone, three alternatives of distribution system are compared and are modelled for hydraulic calculation and compared in terms of cost and difficulty in operation.

5. Alternative Study for Sewerage System

The alternatives are studied from the technical, environmental, social and economic view points. The detail examination of alternatives is conducted in **Section 8.2** and **Table 82.3.1**.

Alternative 1 is arranged so that each sewer district does not stretch beyond Lyari or Malir River. Alternatives 2 and 3 are primarily modified Alternative 1 and the difference between Alternatives 2 and 3 is how to divert the flow exceeding the capacity of TP-2 to other sewer districts.

Table A.111.7.1 Alternative Study for Sewerage System

	Alternative 1	Alternative 2	Alternative 3
How to accept increased sewage	To replace and extend existing 3 TPs To implement new TP-4	To replace and extend existing 3 TPs To implement new TP-4	To replace and extend existing 3 TPs To implement new TP-4 and TP-5
District layout	TP-1 & TP-3: right bank of Lyari except New Karachi and Godap, some part of left side of Lyari River TP-2: New Karachi and Godap, a part of area between Lyari and Malir Rivers TP-4: Large part of area between Lyari and Malir Rivers and whole left bank of Malir River	TP-1 & TP-3: same as Alternative 1 TP-2: New Karachi and Godap, whole area between lyari and Malir Rivers TP-4: whole left bank of Malir River	TP-1 & TP-3: same as Alternative 1 TP-2: same as Alternative 1 TP-4: whole left bank area of Malir TP-5: Area between Lyari and Malir Rivers except area of TP-2
Trunk sewer / interceptor / Pressure main	Trunk sewer: some sewers to TP-1, from New karachi to TP-2 Pressure main: Clifton PS to TP-2 Interceptor: Lyari (right) to TP-3, Malir (right) to TP-4 crossing Malir River, Malir (left) to TP-4	Trunk sewer: some sewers to TP-1, from New karachi to TP-2 Pressure main: Clifton PS to TP-2 Interceptor: Lyari (right) to TP-3, Malir (right) to TP-2, Malir (left) to TP-4	Trunk sewer: some sewers to TP-1, from New karachi to TP-2 Pressure main: Clifton PS to TP-2 Interceptor: Lyari (right) to TP-3, Malir (right) to TP-5, Malir (left) to TP-4
Pumping station	Jamila, Chakiwara, Iqbal, Clifton, Korangi, Bin Qasim, Karachi Port	Jamila, Chakiwara, Iqbal, Clifton, Korangi, Bin Qasim, Karachi Port, Jamshed, DHA	Jamila, Chakiwara, Iqbal, Clifton, Korangi, Bin Qasim, Karachi Port
Sewage Treatment Plants	TP-1: 110 mgd (500,000 m^3/d) TP-2: 108 mgd (490,000 m^3/d) TP-3: 54 mgd (245,000 m^3/d) TP-4: 284 mgd (1,290,000 m^3/d)	TP-1: 110 mgd (500,000 m^3/d) TP-2: 273 mgd (1,240,000 m^3/d) TP-3: 54 mgd (245,000 m^3/d) TP-4: 119 mgd (540,000 m^3/d)	TP-1: 110 mgd (500,000 m^3/d) TP-2: 108 mgd (490,000 m^3/d) TP-3: 54 mgd (245,000 m^3/d) TP-4: 119 mgd (540,000 m^3/d) TP-5: 167 mgd (750,000 m^3/d)
Environmental and Social Considerations	Impact by land acquisition is less than other alternatives (3 new PSs).	Impact by land acquisition is larger than Alternative 1 (5 new TPs). Risk of hazard is high due to high energy consumption and sophisticated O&M skill.	Impact by land acquisition is large compared with other alternatives (75 ha for TP-5 and 3 new TPs).

Alternative 1 has technical advantage that the energy saving process can be adopted in all four TPs, but additional stretch crossing Malir River is required compared with other alternatives. From the environmental and social view points, the land acquisition could be small as no land is required for new TP compared with other alternatives. The construction and O&M cost for 30 years are smaller. Alternative 2 has the advantage that no new trunk sewer crossing Malir River is required and land acquisition for net TP is not required, however, has the disadvantage of adopting more efficient process for TP-2. It will require the high construction and O&M cost, high energy and sophisticated operation skills and lead high risk of environmental pollution during power failure. Alternative 3 proposes two new TPs. TP-5 will require 75 ha of land and the impact by land acquisition is large compared with other alternatives.

Compared with 3 alternatives, it is concluded that alternative 1 is recommended from technical, economical, environmental and social view points.

APPENDIX – A111.8

Results of Impact Assessment and Recommended Mitigation Measures

A 111.8 Results of Impact Assessment and Recommended Mitigation Measures

1. Water Supply System

As K-IV project, Greater Karachi Water Supply Scheme (Executive Summary, May 2007) which includes the pumping stations, canal and conduits to bring raw water from Kinjar Lake to Karachi, reservoir lagoons and three water filtration plants is under the process of approval from the Federal Government, JICA Study Team prepared the M/P based on this K-IV project. The necessary facilities from these three filtration plants to meet the water demand are proposed. Thus, the impact assessment has to be conducted for the facilities which JICA Study Team proposes. However, some recommendations are made for K-IV Project and that is described in **Section 3**.

Table A111.8.1 Summary of Impact and Mitigation Measures for Water Supply System (1/2)

No	Environmental Items	Adverse Impact	Duration	Proposed Mitigation Measures
1	Resettlement	8 new reservoirs and 9 expansion reservoirs are proposed in M/P and the land acquisition for these facilities are necessary.	Permanent	Minimization of resettlement is important. 8 new and 9 expansion reservoirs are proposed. All 8 new reservoirs are proposed in arid and vacant area which is not used for any purpose. 5 reservoirs among 9 expansions are located away from the city and enough space for expansion of the facilities near existing locations is available. Land acquisition is necessary but no resettlement is expected to occur. 2 reservoirs named Orangi and High Service are not used at present. The Orangi requires some land for expansion but there is some space available and the implemented capacity of High Service is larger than the proposed capacity, the replacement will be done within the existing site area thus the land acquisition and resettlement are not required. For COD and University reservoirs, some space in existing boundary and additional land acqisition will meet the requirement (see Appendix 111.8.1).
2	Local economy such as employment and livelihood	Adverse affects on the living conditions of inhabitants by changes in land use due to the project.	Permanent	As most of the proposed reservoirs are located in arid and vacant area, no significant change is expected in local economy. If the site is private properties, sale of lands to KW&SB may bring profits to landowners. The land should be acquired by following the Land Acquisition Act.
3	Land use and utilization of local resources	Land use will be changed by land acqisition for new facilities.	Permanent	Change in land use is not significant. The site of all 8 new and 9 expansion reservoires are selected in arid and vacant area.
4	Existing social infrastructures and services	Serious disruptions of vehicular traffic and pedestrian, traffic jams, bottlenecks, delays and inconveniences to general public will be expected.	Temporary	The impact is temporary (during construction phase) and with short duration. The annoncement before the construction, diversion of traffic, and construction of temporary roads will mitigate the impact.
5	Local conflict of interests	Water is supplied by water tanker which is operated by the Ranger to the households without house connection.	Permanent	The water supply facilities will be constructed step by step till 2025, the demand for tank-cars water supply will not decrease immediately. KW&SB have to consult with the Rangers.
6	Water rights and rights of common	There may be a possibility of adverse impact on the additional water right from the Indus River.	Permanent	No additional water intake from Indus river is required till 2025. (K-IV project which requires additional water intake is under request.)
7	Public health condition	During construction phase, the residents near reservoirs and trunk sewers will be affected due to deteriorated air and water quality, noise, etc. Some impacts may be expected on water quality of water bodies by increase of sewage.	Temporary Permanent	The effect will be temporary and their duration will not be long. Sprinkling water, prevention of soils from silting up the nallahs, maintenance of equipments will reduce the impacts. Sewerage system is proposed with water supply system, therefore the impact is negligible.

Table A111.8.1 Summary of Impact and Mitigation Measures for Water Supply System (2/2)

No	Environmental Items	Adverse Impact	Duration	Proposed Mitigation Measures
8	Landscape	Construction of reservoirs may influence landscape to some extent but it affects only close residents.	Permanent	This could be mitigated by the appropriate facility design. Plantation of trees in and around the facilities would also mitigate the impact.
9	Air pollution	Localized increase in dust due to excavation & earthwork, temporary increase in the levels of SO_2/NOx, from construction equipment and vehicles.	Temporary	Dust control through spinkling / washing of construction sites and access roads particularly in congested areas. Preventive maintenance of construction equipment and vehicles to meet emission standards will be necessary.
10	Waste	The spoil will be generated during installation of pipelines and development of reservoirs.	Temporary	The spoil should be disposed of in a proper manner at the disposal sites. The top soil removed during excavation should be separately stored to be used in green belts, buffer zones or spread over agricultural land.
11	Noise and vibration	Some noise and vibration may occur during construction due to construction work, transportation and heavy construction equipment.	Temporary	Noises and vibration will be intermittent and of short duration mostly during daytime. Equipment maintenance should be strengthened to keep them at low noise and sound barriers should be installed if needed. There will be no permanent facility that creates noise / vibration.

(1) Resettlement

The land for water supply facilities such as distribution reservoirs and pumping stations is needed.

The land required for the distribution reservoirs and existing land use are shown below.

Table A111.8.2 Land Information of Proposed Distribution Reservoirs

Sr.	Name of Facility	Required Land	Existing land use
1	Hub	4.2 ha	It will locate adjacent to existing Hub FP. Existing site has enough room to extend the capacity and the area around the FP is arid and vacant area.
2	Orangi	2.2 ha	The existing reservoir has some more lands to extend within the boundary.
3	West	7.6 ha	It will locate adjacent to KW&SB proposed West FP. This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement.
4	W01	0.6 ha	W01 will be located outside the city. This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement
5	COD	2.6 ha	It will locate adjacent to existing COD FP. The existing FP has some more lands to extend within the boundary. If not enough, the land across the road may be used for extension.
6	NEK old	7.4 ha	It will locate adjacent to existing NEK old FP. This area has enough vacant land for extension.
7	NEK new	4.0 ha	It will locate adjacent to existing NEK new FP. Within the existing bounary of FP, enough land is availabe and it is not difficult acquire some more land near this FP.
8	University	2.2 ha	This is located in central area of the city. Some more lands are available within the exisitng boundary and adjacent land should be acuqired.
9	High service	2.2 ha	The existing reservoir has some more lands to extend within the boundary.
10	Central	1.4 ha	It will locate adjacent to KW&SB proposed Central FP. This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement.
11	C-01	2.7 ha	C01 will be located outside the city. This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement.
12	Gharo	0.7 ha	It will locate adjacent to existing Gharo FP. The esisting area has enough capacity for extension. The settlement exists but these are houses of KW&SB officers. Around the FP, vacant land is available.
13	Pipri	7.2 ha	It will locate adjacent to existing Pipri FP. The esisting area has enough capacity for extension. Some houses and villages exists around the FP site but it is possible to acquire lands near FP if the existing area is not enough.
14	East	2.6 ha	It will locate adjacent to KW&SB proposed East FP. This area is arid, and some small villages exist near the proposed site. The vacant land is available near the site and there lands should be utilised not to affect the people living aroud this area.
15	E01	1.4 ha	This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement
16	E02	0.3 ha	This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement
17	E03	0.3 ha	This area is arid, no settlement and no villages exist, thus no problem of land acquisition and resettlement

The locations are checked by the satellite image, most of the lands are vacant and settlement does not exist near the proposed site. The 8 new reservoirs of West, W01, Central, C01, East, E01, E02 and E03 are located outside the city, no settlements, no villages exist in these arid lands. Five reservoirs among nine expansions are located away from the city and enough space for expansion of the facilities near existing locations is available. Thus no resettlement problem will occur. Two reservoirs named Orangi and High Service are not used at present. The Orangi requires some land for expansion but there is some space available and the implemented capacity of High Service is larger than the proposed capacity, the replacement will be done within the existing site area thus the land acquisition and resettlement are not required.

For COD and University distribution reservoirs, these areas are developed shown in figure below.

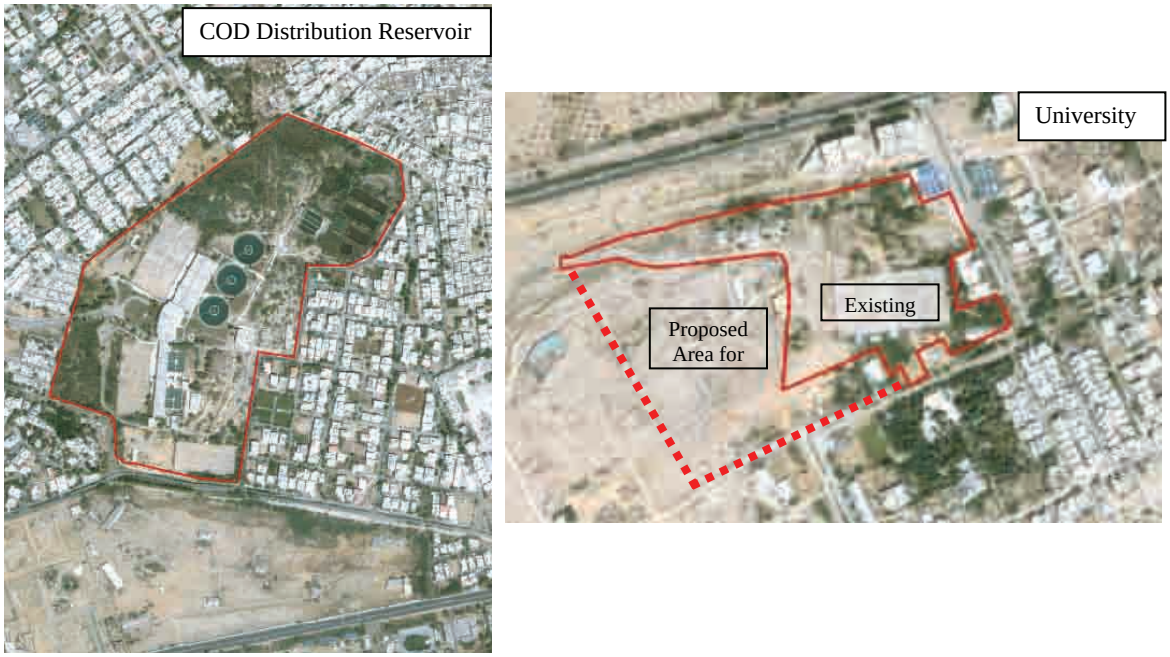


Figure A111.8.1 Proposed Site for Two Distribution Reservoirs

The existing capacity of COD is 16 mgd and will be expanded to 32 mgd. The existing site has some room and new reservoir should be built within the boundary as much as possible. But if not possible, the land across the road may be used for extension. University distribution reservoir has 10 mgd and will expand to 30 mgd. The land is enough capacity for new reservoir.

New pumping stations are proposed in the M/P. Each required land is small (0.5 ha at largest) and these facilities will be located the place where no settlement exists. The location can be modified.

(2) Local economy such as employment and livelihood

In general the construction of the water supply facilities such as pumping stations and pipelines will have some positive impact on the economy of a few families who may get financial benefits by employment as construction labourers for a year or two, improving their annual income. The sale of private lands to the KW&SB may also bring profits to landowners. The procedures of the acquisition of private properties are decided by the Land Acquisition Act 1894 and KW&SB

have to follow the procedures when the lands for proposed facilities are acquired.

(3) Land use and utilization of local resources

Some changes of land use may occur due to the land acquisition for proposed facilities for pumping stations and reservoirs. But as mentioned in (1) Resettlement, the most of the required lands are arid land or the expansion can be possible within the present site, the land use will not be affected.

(4) Existing social infrastructure and services

Significant impacts are predicted to the surrounding traffic especially in congested areas by installation of transmission and trunk distribution mains along the main roads of the city. Especially in the central of the city, several large diameter trunk distribution mains will be installed along University Road, road to Orangi Reservoir, road through New Karachi, the serious impact will be expected (see **Appendix A77.1**). Further development of the distribution network mains all along the small or big access roads within the city will seriously disrupt vehicular traffic within the city and have significant impact on pedestrian access and commerce and routine activities.

The impacts will be temporal and careful management can partially mitigate this impact, but some disruption is unavoidable. To mitigate this impact, the schedule of installation of pipelines should be informed in advance, traffic control should be done and relief road should be proposed.

(5) Local conflict of interests

The areas where are not in the service area by any water supply or low service quality of water supply are watered by tank-cars which belongs to private sectors from 9 bases of Bowser Filling Stations in the city area. The operations and managements of these Bowser Filling Stations and tank-cars are under Rangers. The details about these systems are not clear. Monthly water consumption recorded by Ranger in 2004 is 507 MG. As the water supply service area will be expanded by Master Plan, it will affect the sales by tank-cars of Rangers.

However, as the water supply facilities will be constructed step by step till 2025, the demand for tank-cars water supply will not decrease immediately. KW&SB have to consult with them on this matter.

(6) Water lights and rights of common

There may be adverse impact on the additional water right from the Indus River. The apportionment of water from Indus River is decided under the Indus River System Authority (IPSA) Act, 1992 and no city/province can increase the water intake from the Indus River without approval.

As the K-IV project by KW&SB requires additional 1,200 cusecs intake from Indus River, CDGK has already requested to Federal Government granting an additional water right of 1,200 cusecs for Karachi water supply system. As the water supply demand till 2025 will meet by this additional water intake, no water intake is proposed in the Master Plan.

(7) Public health condition

The sanitary condition will be improved by clear water supply increase, but may impact water quality of public water bodies such as rivers and sea because the volume of sewage may increase in proportion to water supply. As the sewerage facilities are also proposed with the water supply facilities, the impact of increased sewage by improved water supply system will be minimized.

Water supply disruption will be inevitable during extension / rehabilitation works, which may cause public health problems and general nuisances. In addition to this, there will be slight adverse impact on the pubic health of the residents near the construction sites of water pipelines during construction due to deteriorated air quality, water quality and noise, etc. However, the effects will be temporary and their duration will not be long.

(8) Landscape

During laying of pipelines such as transmission mains, trunk mains will be unaesthetic because of dumping of construction materials, dusty atmosphere, water spreading, muddy soil all around project site. Broken pavements and opened roads would add up giving an unaesthetic look to the construction site. However the impact will be temporary and localized.

Some pumping stations may be constructed in the residential area, it is important to harmonize the facilities with the surrounding environment. Adoption of appropriate design and plantation of trees in and around the site would mitigate the impact.

(9) Air pollution

SPM (suspended particulate matter) would be the predominant pollutant affecting the air quality during the construction phase of water pipes. The soil of the project area is likely to generate considerable quantities of dust, especially during dry condition. Dust will be generated mainly during excavation of the treatment unit along with transportation activities and open storage of fine earth materials. Dust control through sprinkling / washing of construction sites will be effective. Mostly the automobile traffic and construction machineries will generate undesirable gaseous pollutants. However, this would not lead to any tangible effect, as the expected traffic volume is low. The preventive maintenance of construction equipment and vehicles to meet emission standards will be necessary.

(10) Waste

The spoil will be generated during installation of pipelines such as transmission and trunk distribution mains by way of rejected plant materials, bushes during site clearing, excess earth, etc. The spoil will have to be disposed of in a proper manner at the pre-identified safe disposal sites. If not disposed in an environmentally compatible manner, it will create minor adverse impacts in the surrounding area.

(11) Noise and vibration

During the construction period, noise and vibration will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (bull dozers, scrapers, concrete mixers, pumps, vibrators, cranes, compressors etc.) that are known to emit sounds with moderate to high decibel value. The construction activity will increase the noise levels up to 80 to 90 dB(A) at peak hours. Noise and vibration generated from sources mentioned above will be intermittent and of short duration mostly during daytime. Therefore, no significant impact is anticipated on account of noise generation around the project site. However, the workers are likely to be exposed to high noise levels that may affect them.

2. Sewerage System

In general, sewerage facilities have positive impacts on health, sanitation and living conditions. However, sewerage facilities need to be carefully planned, sited, designed, constructed, operated and maintained, otherwise projects are likely to have a negative impact overall, and will fail to yield the full benefits for which the investment was made and will adversely affect other aspects of the environment.

Table A111.8.3 Summary of Impact and Mitigation Measures for Sewerage System (1/2)

No	Environmental Items	Impact	Duration	Mitigation Measures
1	Resettlement	Treatment plants and pumping stations are proposed and land acquisition is necessary.	Permanent	Proposed site for TP-4 is vacant and KW&SB allegedly has already acquired. Sites for pumping stations are vacant land thus no resettlement may occur.
2	Local economy such as employment and livelihood	Adverse affects on the living conditions of inhabitants by changes in land use due to the project.	Permanent	As proposed treatment plants and pumping stations are located in vacant area, no significant change is expected in local economy.
3	Land use and utilization of local resources	Land use will be changed by land acqisition for new facilities.	Permanent	As proposed treatment plants and pumping stations are located in arid and vacant area, no significant change is expected in land use.
4	Existing social infrastructures and services	Considerable disruptions of vehicular traffic and pedestrian, traffic jams, bottlenecks, delays and inconveniences to general public will be expected.	Temporary	The impact is temporary (during construction phase) and with short duration. The announcement before the construction, diversion of traffic, and construction of temporary roads will mitigate the impact.
5	Public health condition	During construction phase, the residents near treatment plant and trunk sewers will be affected due to deteriorated air and water quality, noise, etc.	Temporary	The effect will be temporary and their duration will not be long. Sprinkling water, maintenance of equipments/machineries which is used for construction to reduce the air pollution will reduce the impacts.
6	Hydrological situation	The effluent from the treatment plants will be discharged into the rivers. 4 trunk sewers will be crossing either Malir or Lyari River.	Permanent	The present amount of effluent will increase by proposed Master Plan but the capacity of receiving body will be enough for the increased effluent. Two existing pressure mains are crossing the Lyari River. During dry season, the river flow is small and impact could be small.
7	Sea / coastal zone	The effluent from the sewage treatment plant will be discharged to the sea.	Permanent	If the treatment plants are properly operated and maintained to meet the effluent standard, no significant adverse impact is expected.
8	Landscape	Treatment plant and pumping station might pose an unaesthetic sight but it affects only limited number of residents.	Permanent	This could be mitigated by the appropriate facility design. Treatment plant should be located away from the densely populated residential areas.
9	Air pollution	Localised increase in dust due to excavation & earthwork, temporary increase in the levels of SO_2/NOx, from construction equipment and	Temporary	Dust control through sprinkling /washing of construction sites and access roads particularly in congested areas Preventive maintenance of construction equipment and vehicles to meet emission
10	Water pollution	Overflow of sewers and breakdown of treatment plant will lead to failure in meeting the requisite standards. Poor performance will affect the proposed reuse for irrigation, and also the receiving water body.	Permanent	Preventive maintenance of all components should be performed regularly. TP should be maintained properly and proper response plan must be prepared and all workers must be trained to tackle emergencies.

Table A111.8.3 Summary of Impact and Mitigation Measures for Sewerage System (2/2)

No	Environmental Items	Impact	Duration	Mitigation Measures
11	Soil pollution	If the sludge is disposed of to land, there may be some risk of soil contamination.	Permanent	The sludge should be disposed of in specified landfill site.
12	Waste	The debris will be generated during installation of sewers and TPs. Sewage treatment plants will generate the considerable sludge in the treatment process.	Temporary Permanent	The debris should be disposed of in a proper manner at the pre-identified disposal sites. The sludge from the sewage treatment plant should be disposed of in a specified
13	Noise and vibration	Some noise and vibration may occur during construction due to heavy construction machineries.	Temporary	Noises and vibration will be intermittent and of short duration mostly during daytime. Equipment maintenance should be strengthened to keep them at low noise and sound barriers should be installed if needed. There will be no permanent facility that creates noise / vibration.
14	Offensive odors	Odor may emit from the sewage treatment plants.	Permanent	Odor emission is unavoidable, but it can be minimized by appropriate operation and maintenance. Setting of buffer zone might be an option to minimize odor problem.

(1) Resettlement

Table A111.8.4 shows the required land area, existing land use for each proposed facilities.

Table A111.8.4 Required Land for Sewerage Facilities

Sr.	Name of Facility	Site	Required Land (ha)	Existing land use	Type of ownership
1	TP-1 (extension)	SITE town	0 ha	Existing TP site	-
2	TP-2 (extension)	Jamshed town	0 ha	Existing TP site	-
3	TP-4	Korangi Creek Cantonment	168 ha	Vacant land	CDGK
4	Gulberg PS	Gulberg	0.5 ha	Vacant land	N.A.
5	Bin Qasim PS	Bin Qasim	0.5 ha	Vacant land	N.A.
6	Karachi Port PS	Keamari	0.5 Ha	Vacant land	N.A.

TP-1 and TP-2 will be extended within the present site area because no additional land is available. For TP-4, 168 ha of land should be acquired. The site is proposed by KW&SB in the report of "Greater Karachi Sewerage Plan (S-III)" and it is said that CDGK has already acquired this site. The Team has confirmed the location by satellite image and site visit (**Figure A111.8.2**). The area is vacant and the surrounding area is used as yard for some construction materials and base for trucks. There are no houses at the proposed site and the resettlement may not occur.

Figure A111.8.2 Proposed Location for TP-4

For the three pumping stations (Gulberg, Bin Qasim, and Karachi Port), the required land is less than 0.5 ha at largest and the vacant land will be available around the proposed area, which is confirmed by satellite image and site visit.

(2) Local economy such as employment and livelihood

In general the construction of the sewerage facilities such as sewer lying and sewage treatment

plant will have some positive impact on the economy of a few families who may get financial benefits by employment as construction labourers for a year or two, improving their annual income. The sale of private lands to the KW&SB may also bring profits to landowners in the area. The land acquisition by KW&SB should follow the laws on Land Acquisition and National Resettlement Policy.

(3) Land use and utilization of local resources

The land use will be affected by land acquisition of proposed sewerage facilities. At present the lands for proposed 3 new PSs are vacant and not used for agriculture or commercial purpose. Thus the effect by land acquisition may not be serious.

(4) Existing social infrastructures and services

Korangi area which TP-4 is proposed is the industrial area and traffic is heavy in this area. The additional traffic due to treatment plant construction activity will add further to congestion. The impact is temporally but the attention should be paid in selection of the routes to bring construction materials. The installation of trunk sewers, pressure mains and interceptors are proposed within the city and this will cause the heavy traffic congestion especially in Clifton, Saddar and DHA area. During the installation of the sewers, one side of the road will be closed and traffic control is necessary. In addition to this, the schedule of installation of sewers should be informed in advance and relief road should be proposed to mitigate the impacts.

(5) Public health condition

The provision of sewerage facility will improve the public health condition as the sewage will be treated properly and the positive impacts will be expected. There will be slight adverse impact on the public health of the residents near the treatment plant site and sewers during construction due to deteriorated air quality and water quality, noise etc. However the effect will be temporary and their duration will not be long. Sprinkling water, prevention of soils from silting up the nallahs, maintenance of equipments will reduce the impacts.

(6) Hydrological situation

Sewerage system improvement will contribute to improving the hydrological conditions in nallahs, rivers and sea. The effluent from the TPs is discharged into Lyari River, Malir River and swamp area and finally into the Arabian Sea. The treatment capacity of TP-1 and TP-2 will be extended and the effluent to be discharged will be also increased. The effluent from TP-1 and TP-2 flows into the nallahs and goes to rivers, these nallahs have enough capacity to receive the increased effluent. However, some repairs and strengthening of nallah structure may be necessary. The amount of effluent from TP-3 will be same as before. The effluent from TP-4 will be discharged into the Malir River directly where has enough capacity to accept the amount of effluent.

The trunk sewers will be installed by crossing Lyari and Malir Rivers and two pressure mains which are crossing Lyari River will be replaced. The installation of these pipes will be conducted by open-cut method and the river flows have to be changed or stopped during construction. The river bed is wide compared with river flows during dry season, therefore the installation should be conducted during dry season so that no serious impact may be expected.

(7) Sea / coastal zone

The present situation of coastal zone will be improved by the sewerage system improvement as the untreated sewage which flows into Arabian Sea at present will be decreased. The effluent from TPs will be discharged into the Arabian Sea via nallah, Lyari and Malir RIvers. The effluent will meat the national environmental quality standards for municipal and liquid industrial effluent of Pakistan so that no significant adverse impact may be expected.

(8) Landscape

During construction of TP and installation of sewer lines will be unaesthetic because of dumping of construction materials, dusty atmosphere, water spreading, and muddy soil all around project site. Broken pavements and opened roads would add up giving an unaesthetic look to the construction site. However the impact will be temporary and localized.

Sewage treatment plant may be constructed within the city, it is important to harmonize the facilities with the surrounding environment. The proposed TP-4 site is located in industrial site thus no serious impact will be expected. Adoption of appropriate facility design, plantation of trees in and around the facilities would mitigate the impact.

(9) Air pollution

SPM would be the predominant pollutant affecting the air quality during the construction phase of TP and sewers. The soil of the project area is likely to generate considerable quantities of dust, especially during dry condition. Dust will be generated mainly during excavation of the treatment unit along with transportation activities and open storage of fine earth materials. Mostly the automobile traffic and construction machineries will generate undesirable gaseous pollutants. However, this would not lead to any tangible effect, as the expected traffic volume is low. Equipment and vehicles producing excessive emissions of exhaust gases due to any mechanical fault shall not be allowed for operation. Regular maintenance of vehicles and equipment should be carried out, and dust control through sprinkling/washing of construction sites can also mitigate the impact.

(10) Water pollution

The impact of the sewage treatment on the receiving water bodies such as rivers and sea will be highly positive, as the untreated sewage at present will be treated and discharged into rivers and sea.

The treated sewage from TP is discharged into the Lyari and Malir Rivers and Arabian Sea. The result of water quality survey conducted by JICA Study Team showed that Lyari River and Malir River are highly polluted (Lyari River: BOD_5 1,228, Malir River: BOD_5 123 in dry season). The treated sewage which meets the effluent standards of Pakistan will improve the present water quality of rivers and sea by treating the raw sewage and discharging the effluent.

Overflow of sewers and breakdown of treatment plant and poor performance will affect the proposed reuse of effluent and the receiving water bodies. TPs should be maintained properly, proper response plan must be prepared and all workers must be trained to tackle emergencies.

(11) Soil pollution

Currently, the sludge from the treatment plants is digested and treated on sludge drying beds in the existing TPs. The dried sludge is loaded to the trucks and provided to the farmers as soil conditioner free of charge. This will be applied to the new TP (TP-4). If the landfilling is chosen, the disposal should be conducted in environmentally sound manner in specified landfill site.

(12) Waste

The spoil will be generated during construction of the treatment plant by way of rejected plant materials, bushes during site clearing, excess earth, etc. The spoil will have to be disposed of in a proper manner at the pre-identified safe disposal sites. Suitable dumping sites will have to be identified near the proposed TP site for any of the options. If not disposed in an environmentally compatible manner, it will create minor adverse impacts in the surrounding area.

Sludge is composed of by-products generated through the water and sewage treatment.

Especially for sewage sludge, it contains both compounds of agricultural value (including organics, nitrogen, phosphorus and potassium, and to a lesser extent, calcium, sulphur and magnesium), and pollutants which usually consist of heavy metals, organic pollutants and pathogens. The characteristics of sludge depend on the original pollution load of the treated water, and also on the technical characteristics of the wastewater and sludge treatment carried out.

If the influent does not contain high level of pollutants and the sludge is properly treated, sludge can be recycled to agriculture (landspreading), or landfilling. Currently, the sludge is digested and treated on sludge drying beds in the existing TP. The dried sludge is loaded to the trucks and provided to the farmers as soil conditioner free of charge. This will be applied to the new TP (TP-4). Some amount of sludge will be provided for development of green area which is proposed in the "Karachi Strategic Development Plan 2020" by CDGK free of charge. If the dried sludge will be disposed of, it should be done in environmentally sound manner at appropriate location.

(13) Noise and vibration

During the construction period, noise and vibration will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (bull dozers, scrapers, concrete mixers, pumps, vibrators, cranes, compressors etc.) that are known to emit sounds with moderate to high decibel value. The construction activity will increase the noise levels up to 80 to 90 dB(A) at peak hours. Noise and vibration generated from sources mentioned above will be intermittent and of short duration mostly during daytime. Therefore, no significant impact is anticipated on account of noise generation around the project site. However, the workers are likely to be exposed to high noise levels that may affect them.

TP does not involve a lot of mechanical and motor driven equipment such as aerators or blowers and so noise levels are insignificant. Therefore, in view of the treatment technology chosen, it is concluded that the TP will not contribute to or increase the ambient background noise and vibration levels in the area.

(14) Offensive odours

TP will generally generate odour without proper operation. In TP, the majority of the odour comes from the sludge handling system such as sludge drying beds.

In the water awareness survey conducted by JICA Study Team, interviews were conducted to 100 residents around the existing three TPs (29 samples from TP-1, 17 from TP-2, 54 from TP-3) to gain an awareness of the TPs. In the interview, perception of seriousness of the odour from the TPs was asked as a question and its result is shown in the table below.

Table A111.8.5 Perception of Odour Problem from TPs

Level of seriousness of the odour	TP-1 (29 samples)	TP-2 (17 samples)	TP-3 (54 samples)	Area Average (100 samples)
No problem	83.0 %	65.0 %	88.0 %	79.0 %
Very serious	0.0 %	9.1 %	6.0 %	5.3 %
Serious	6.8 %	11.2 %	6.0 %	8.6 %
Not very serious	10.2 %	14.7 %	0.0 %	7.1 %

According to the results of interview, most of the respondents feel that there is no problem of odour by existing TPs, however, some of the respondents have problem to some extent. The source of odour was not clear by the survey, but the possible source may be the nallah where the garbage is accumulated and effluent from the TP become stagnant and the sludge drying beds within the TPs.

It is the most effective mitigation measure that the TP should be operated and maintained properly. For other measures, the sludge drying bed should be located away from the residential area as far as possible and creating buffer zone with trees is recommended to mitigate the impact.

3. K-IV Project by KW&SB

For the water supply system, K-IV project, Greater Karachi Water Supply Scheme (Executive Summary, May 2007) which includes the pumping stations, canal and conduits to bring raw water from Kinjar Lake to Karachi, reservoir lagoons and three water filtration plants with distribution reservoirs is prepared by KW&SB and under the process of approval from the Federal Government. The impact assessment is not conducted on K-IV components but some recommendations are made regarding K-IV Project.

K-IV Project requires 10,140 acres (4,104 ha) of land.

Table A111.8.6 Required Land by K-IV Project

Component	Land Acquisition
1000 inches (300 meters) ROW Corridor	9,340 acres (3,780 ha)
520 MG Reservoirs & Filtration Plants (3 nos.)	450 acres (182 ha)
Pumping Stations & Staff Housing (2 nos.)	200 acres (81 ha)
Intake & Misc. Structures	150 acres (61 ha)
Total Land Requirement	**10,140 acres (4,104 ha)**

(Source) K-IV Project, Greater Karachi Water Supply Scheme (Executive Summary, May 2007)

The several routes of corridor which bring the raw water from Kinjar Lake to Karachi were studied and the one route was selected considering the maximum use of natural gradient, villages and housings scattered area to avoid land acquisition and ROW problems, and low O&M cost. The selected route was checked by JICA Study Team using satellite image and it is concluded that no serious impact will be expected by the proposed corridor as the most parts of the land are vacant and arid area. However, if any villages are found on the selected route, the route should be modified to minimise the impacts in the detail design stage.

KIV-east filtration plant will be located near the small village and the agricultural land should be acquired. Near the proposed site, it seems the vacant land is available, thus KW&SB have to make efforts to minimise the impacts by land acquisition by modification of the location. For KIV-central and KIV-west filtration plants, the proposed locations are vacant and arid area, thus no serious impact will be expected.

If the resettlement cannot be avoidable, then KW&SB should strictly comply with the Land Acquisition Act 1894 and National Resettlement Policy to compensate for the lost private properties.

The corridor which brings raw water from Kinjar Lake to Karachi is 124 km long and this corridor will cross over the railway for three times, Super Highway, Malir River, and several nallahs. The corridor has 300 meter width and the attention have to be paid not to disturb the railway, Super Highway and river / nallahs. In addition to this, several farm roads / village roads seems to be blocked by the corridor. The traffic may not heavy but these roads may be closely related to the village life, KW&SB have to build the relief road or another road not to disturb the village life and not to split the community.

APPENDIX – A111.9

Environmental and Social Consideration in F/S Stage

A 111.9 Environmental and Social Consideration in F/S Stage

1. EIA Requirement

This project is fallen on the category which requires EIA according to the Pakistan regulations.

The Case No. ECNEC-82/3/2004, dated 27-07-2004 which is the part of No.F.2/3/2004-Com "Minutes and decisions for the meeting of the Executive Committee of the National Economic Council (ECNEC)"describes that "In case of development projects having environmental implications, an Environmental Impact Assessment (EIA) report should invariably be submitted along with the project document at the time of getting approval" (the letter is attached in **Section A111.11**). The "project document" is PC-1 which is the application documents for approval of project implementation. Thus, the EIA report should be prepared before getting approval of implementation and it is not required at the feasibility study stage of this project. This is also confirmed by EPA-Sindh.

At the Feasibility Study Stage, the environmental and social considerations will be conducted to assess the impact caused by the priority project, to mitigate the impacts and propose the monitoring plan, and that will be the basis of the EIA report which will be prepared at the time of submitting PC-1 documents by KW&SB.

2. TOR for the Environmental and Social Considerations in F/S Stage

(1) Purpose

The Master Plan of water supply and sewerage system in Karachi will permit to achieve better public health performances and to upgrade the quality of the living environment. Citizens of Karachi will be the direct beneficiaries of this plan. The full achievement of such objectives is, however, related to the favourable selection of sites for proposed facilities, their technical design and their suitable operation and maintenance.

The purpose of environmental and social considerations is to make sure that the proposed project will not cause the pollution and nuisances from the urban area to the natural area, or from one community to the other, according to the new conditions of construction / operation of water supply and sewerage facilities. From the environmental point of view, the project must achieve objectives like the following:

- Social environment: improvement of living conditions and health, sustainable and fair distribution of the benefits of the project, participation of public, development of amenity potentials.
- Natural environment: restoration of natural habitats, preservation of water resources, protection of the natural resources base and livelihood, protection of valuable natural assets.
- Institutional side: capacity to manage the impacts through measures to be undertaken, and capacity to follow-up environmental conditions during implementation of the project.

The objectives of the Environmental and Social Considerations of the priority project are;

- To review the existing environmental conditions in the area related to the priority project,
- To assess any significant adverse or negative impacts during construction and operation of the proposed facilities in the Priority Projects,

- To propose countermeasures for mitigating impacts and environmental monitoring plan

(2) Study Area

The study area shall be limited to the expected development area of Feasibility Study up to the year 2016 in Karachi.

(3) Study Period

The Environmental and Social Considerations shall be conducted for the Priority Projects selected in the Master Plan. The exact study period will be between middle of January to March 2008.

(4) Scope of Work

The following shall be covered by Environmental and Social Considerations;

- A review of the results of IEE-level study,
- A description of the relevant aspects of the existing natural and socio-economic environment,
- Identification and quantification (to the extent possible) of the potential positive and negative impacts during construction and operation phases of the projects,
- A comparison of project alternatives in terms of environmental and socio-economic impacts,
- Recommendation of possible mitigation measures for any significant impacts that are identified, and
- Formulation of a monitoring programme for the significant environmental issues.

Regarding collection and analysis of baseline environmental data, existing sources of information should be used as much as possible in this Study. In addition, a site survey shall be carried out to collect required data and information specific to the site conditions of the proposed water supply and sewerage facilities.

(5) TOR for the Public Consultation of F/S

The 3rd stakeholder meeting will be held by the KW&SB in cooperation with the JICA Study Team during the F/S stage. At this stage of public consultation, the stakeholders living just nearby the proposed water supply and sewerage facilities such as water purification and sewage treatment plants, reservoirs, etc. should be consulted more intensively with regards to the environmental and social considerations.

In the 3rd stakeholder meeting, the following presentations will be expected to the stakeholders by the KW&SB, with support from the JICA Study Team.

- Outlines of the Study and public participation
- Explanation of the priority projects for water supply and sewerage
- Explanation of the possible environmental and social impacts and mitigation measures
- Obtain the comments / opinions from the participants and reflect them to the study

APPENDIX – A111.10

Public Consultation

A 111.10 Public Consultation

1. Approaches

It is important to consult with the stakeholders to foster support for the projects. As a basic approach, stakeholders' participation was called for from an early stage of the Study to consider a wide range of environmental and social impacts. Three stakeholder meetings are planned to be held by KW&SB in collaboration with the Study Team during the study period after each important stage, shown in **Figure A111.10.1**.

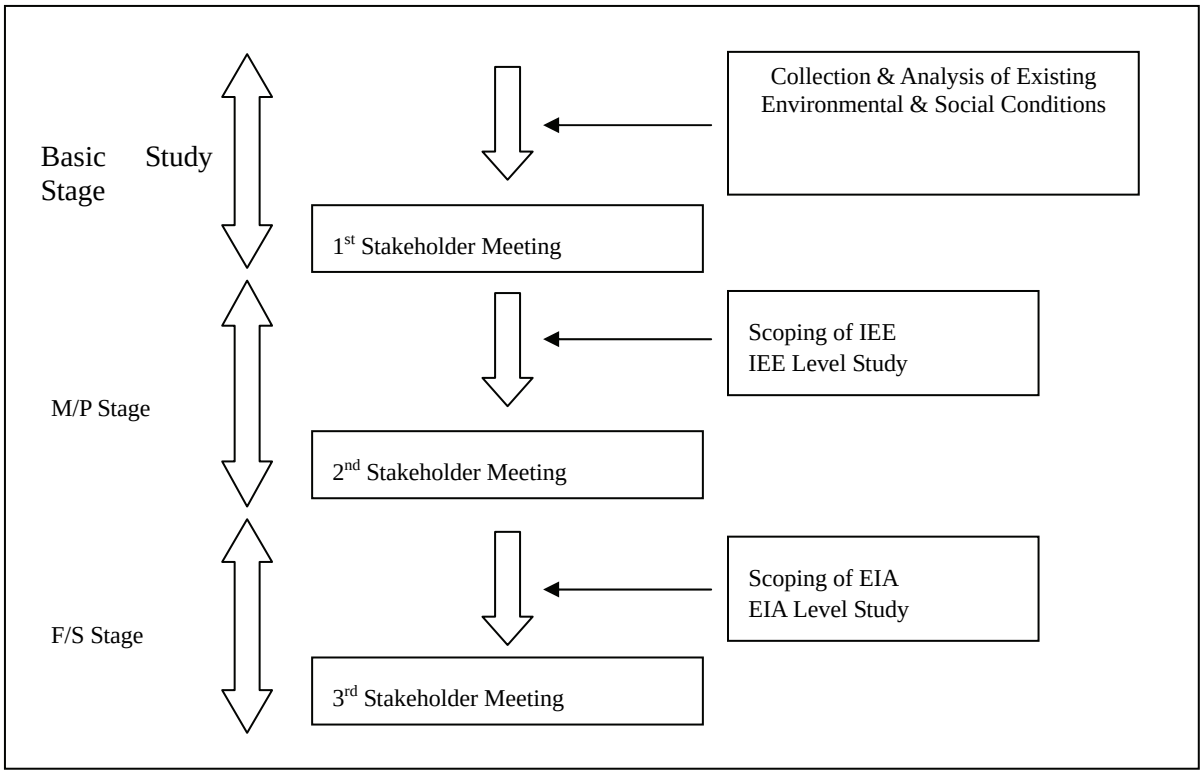


Figure A111.10.1 Implementation schedule of Environmental and Social Considerations

The table below shows the schedule for the stakeholder consultation meetings.

Table A110.10.1 Schedule for the Stakeholder Consultation Meetings

Stakeholder Meeting	Agenda	Timing
1st	- Explanation of JICA Study - JICA Guidelines for Environmental and Social Considerations - Plan for Public Consultation sessions, scope of environmental and social considerations	7 september 2007
2nd	- Progress of the Study - Water Supply and Sewerage System Master Plan - Results of environmental and social considerations - Scope of environmental and social consideration study at F/S stage	Finalization stage of M/P
3rd	- Explanation of priority projects - Results of the environmental and social consderation study - Results and recommendations of the JICA Study	Finalization stage of F/S

2. Selection of Stakeholder

The selection of stakeholder is done by KW&SB in collaboration with JICA Study Team, and the stakeholders are categorised as follows.

- People in the Study area and people who will be affected by the proposed projects, including socially vulnerable people,
- Ministries and relevant governmental agencies
- Local governments such as town and counsel,
- International organizations and donors
- NGOs
- Universities and research institutions
- Private sector including bulk users

Main stakeholders will be identified and selected regularly based on the roles and responsibilities of each stakeholder at each stage of the public consultations.

3. First Stakeholder Meeting

The first stakeholder meeting was organized by KW&SB, CDGK in collaboration with JICA Study Team, and held on 7 September 2006 at Regent Plaza Hotel. The aim of the meeting was to inform about the JICA Study, findings on water supply and sewerage system, immediate remedies, to explain the approaches for environmental and social considerations including scope of IEE level study, and to consult with the stakeholders.

(1) Participants

The stakeholders were selected by KW&SB in collaboration with JICA Study Team and invitation letters were sent to the invitees from 25 August 2006. At this stage, as the contents of M/P are not fixed yet, it is difficult to specify who will be affected directly or indirectly by the project. The main objective is to inform about the approaches to environmental and social considerations, thus, as the representative of the people, Town Nazims (town head) who are elected directly by the people were invited. The following table shows the category and number of participants.

Table A111.10.2 Number of Attendants at the First Stakeholder Meeting

City District government	4	Universities & research institutions	4
Town Nazims	7	NGOs	3
Government of Sindh	4	International organizations & donors	3
Bulk consumers	14	Cantonment Board & DHA	1
KW&SB	37	Media	7
JICA Study Team	10	TOTAL	94

(2) Programme

The programme of the first stakeholder meeting is shown below:

Table A111.10.3 Programme of First Stakeholder Meeting

11:30 – 11:35	Recitation of Holy Quran
11:35 – 11:40	Opening remarks (Brig. Ifitikhar Haider, MD, KW&SB)
11:40 – 12:15	Presentation I: Outline of JICA Study (Mr. Sawara, Team Leader) Presentation II: Findings on water supply and sewerage system, and immediate remedies (Mr. Sawara, Team Leader, Mr. Nakao, Sewerage Planning)
12:15 – 12:35	Coffee Break
12:35 – 12:40	Brief speech by Brig. Ifitikhar Haider, MD, KW&SB
12:40 – 13:00	Presentation III: Approaches of Environmental and Socil Considerations (Ms. Yamada, Environmental & Social Considerations)
13:00 – 13:55	Questions and Answers
13:55 – 14:00	Closing Remarks (Ms. Nasreen Jalil, City Naib Nazima, CDGK)

(3) Main Topics Discussed

The minutes of first stakeholder meeting are shown in **Section 5**. The main topics discussed in the meeting are summarized below:

- Many Master (M/Ps) were prepared in the late 1980s but never implemented. Various agencies have their own M/Ps so the Study Team should incorporate all the M/Ps into future JICA M/P. Real stakeholders such as towns, citizens should be invited. To this comments, KW&SB answered that the Study Team would go through other M/Ps. About the stakeholders, the representative of Town i.e. Town Nazims are invited to the meeting.
- There is the opinion that the treatment plants are not properly working and the nallahs turned into the sewers. To this comment, treatment plants are working but not at full capacity due to the encroachment on the drainage. CDGK will take the action to remove all the encroaching premises to utilise the nallah / drainage for their original use.
- There is the suggestion to use another water source such as rain harvesting or groundwater, not only Indus River and Hub Dam. The amount of water necessary for Karachi City is huge and the groundwater is not sufficient for water supply according to the study already carried out. Another source is required and desalination is one option that will be considered.

4. Second Stakeholder Meeting

The second stakeholder meeting was proposed to be held at the end of M/P stage to inform the public of the contents of M/P and result of environmental and social considerations in M/P. JICA discussed with KW&SB about the holding of second stakeholder meeting as the KW&SB should organize the meeting and take action. As the K-IV project and S-3 Project, the former is under PC-1 process and the latter is at pre-qualification stage of consultants, are included in the M/P, KW&SB was reluctant to disclose the information to the public at this stage.

Therefore, the stakeholder meeting to inform the public of the contents of M/P and results of environmental and social considerations was not held.

5. Minutes of First Stakeholder Meeting

Minutes of First Stakeholder Meeting

The Study on Water Supply and Sewerage System in Karachi

Karachi Water & Sewerage Board (KW&SB), City District Government Karachi(CDGK) in collaboration with JICA Study Team, organised the First Stakeholder Meeting on 7th of September 2006 at Regent Plaza Hotel.

The meeting started at 11:30 with Recitation of Holy Quran, followed by opening speech by Managing Director (MD), KW&SB.

1. Opening Speech by Brig. Kftikhar Haider, MD, KW&SB

He opened the Stakeholder Meeting with thanks to participation in the meeting. He told that this meeting was important for KW&SB because KW&SB are going to prepare M/P up to 2025 assisted by JICA. He briefly introduced the JICA Study for the M/P preparation and emphasised the importance of the meeting to get the stakeholders' opinion to be incorporated into the Study, so that the current problems of Karachi would be solved.

2. Presentation by Mr. Sawara, Team Leader and Mr. Nakao, in charge of Sewerage Planning, JICA Study Team

Mr. Sawara briefly explained the JICA Study, of its history, the components, schedule, study organisation and findings of water supply system based on the basic study. He emphasized that the improving service quality through Distribution Network Improvement (DNI) would be the only way to break the vicious circle of water supply system. He also introduced the quick impact programmes to implement an experimental project in a small, hydraulically-isolated distribution network area. If this programme is found successful, then the area should gradually be expanded.

Mr. Nakao explained the present situations of sewerage system by showing the photos, such as direct sewage discharge to drains / nallah, houses encroachment on drains, and sewage treatment plants. He pointed out the problems of sewerage system in Karachi and he announced that based on these findings both water supply and sewerage sectors, Master Plan targeting the year 2025 will be prepared and it will be presented to the stakeholders in the next stakeholder meeting which will be held in May 2007.

3. Speech by Brig. Kftikhar Haider, MD, KW&SB

He clarified the concept of DNI that Mr. Sawara explained. KW&SB conducted the restructuring of KW&SB and in this process the concept of the area-based management system is introduced. At this stage, the Study Team proposed the concept of DNI plan and this concept is coincide with KW&SB restructuring process. The concept of DNI is to choose one or two towns / area as a model and to improve the distribution of water supply, so that we can see how to solve the problems. He appreciated the concept of DHI proposed by the Study Team and added that this concept would work well.

4. Presentation by Ms. Yamada, in charge of Environmental & Social Considerations

Ms. Yamada explained that the initiative to conduct the environmental and social considerations is primarily held by Pakistan side, i.e. KW&SB and JICA Study Team supports the KW&SB to implement the proper considerations, to consult with the stakeholders and to disclose the information. The environmental and social considerations should be done based on Pakistan

Law and JICA's Guidelines. She explained the procedures of environmental and social considerations, IEE, EIA and stakeholder meeting. The contents of IEE level study which will be conducted in the M/P and environmental items to be checked were also explained.

5. Question & Answer

(1) Prof. Muhammad Nauman, Coordinator, CREED

He thanked to JICA for taking basic studies and master plan preparation for Karachi, that is most desirable. He said that a Master Plan for Karachi City was prepared in the late 1980s but never implemented. Various agencies have their own Master Plans, so JICA & donors must urge Govt. of Pakistan to make this city controlled by one agency, that should be City Government. He added that a Master Plan of Karachi City was being made by hired consultants without consultation with stakeholders, citizens and town planners, that is dangerous. He pointed out that there was no water shortage but that the problem was distribution system and equitable distribution. The poor do not get enough water. Another problem he raised was that the TP 1,2&3 were built (rehabilitated) by ADB in late 1990s but none of them was working. He suggested that real stakeholders be involved such as citizens and real town planners, that JICA have to make sure that EIA should be done because a lot of mega projects had been implemented without EIA. He also suggested to consider the privatisation.

Mrs. Nasreen Jalil, City Naib Nazima replied that:

The stakeholders are already involved in this meeting and the comprehensive plan for Karachi water supply and sewerage system will be prepared. She agreed that the many master plans are made by not implemented, but CDGK has a master plan which will be completed by January 2007 and it will be implemented. She also agreed that Karachi should be controlled by one agency that is CDGK. Town Nazims are present here working in consultation with JICA Study Team so that you cannot say that the towns are not included. Cantonment and DHA are included in the whole process of water supply and sewerage system. She also admitted that the distribution system was a mess. TPs are working but not at full capacity due to the encroachment on the drainage. CDGK will take the drastic step to remove all the encroaching premises to utilise the nallah / drainage for their original use. It is decided that Rs 7 billion is being spent to install for 2 more TPs to treat all the generated sewage so that the sea life will be no more in danger. As for 3 TPs, KW&SB, CDGK and JICA Study Team will be working together to solve these problems.

(2) Mr. Farhan Anwar, Project Coordinator, Water & Sanitation Program – South Asia, The World Bank

He said that this proposal was interesting. He would like to know that any criteria had been established so far to select project area.

Brig. Kftikhar Haider, MD, KW&SB answered that:

The plan is under preparation, and the criteria were mostly made based on which areas will be selected in consultation with Town Nazims, stakeholders and the City Nazim. The criteria will be soon announced.

(3) Ms. Rahat Najam, Senior Wetlands Conservation Officer, WWF-Pakistan

She suggested that in the next phase, when the stakeholder meeting is organised, rather than consultation workshop, you will find more issues other than you have identified as a team, because the issues were from the civil society, and they would know the solution. It is easier for you to prepare a M/P which will be acceptable to the people.

Brig. Kftikhar Haider, MD, KW&SB answered that:
This is a good suggestion. This is the first stakeholder meeting to inform about what KW&SB and the JICA Study Team are doing. This is a small introduction of the future plan which we will be made next year. This is an introduction meeting and will have the separate meeting with stakeholders for their comments and suggestions and then the separate meeting will be held with civil society and NGOs to incorporate their opinions into the Study.

(4) Mr. Mir Nasir Abbas, Director General, SKAA
He asked that in the model project roposed by Mr. Sawara how to eliminate the use of suction pumps and illegal connection. Another question is how Katch Abadis will be incorporated into the Study area.

Mr. Sawara, Team Leader, JICA Study Team answered to the first question that:
The reason why people use the suction pump is to get more water, in case enough water is not supplied and the water pressure is low. So start from a small experimental area where the water is supplied 24 hours a day, water quality is guaranteed, the use of suction pumps is banned, meters are installed with a tariff which discourages overuse of water to rationalise consumption. If it the experiment successful, the area will be gradually expanded.

Mr. Mir Nasir Abbas, Director General, SKAA again commented that:
KW&SB has to improve in its performance, and the capacity building because there are shortcomings especially in the revenue collection. Another question is Katch Abadis, 40 % of urban population, how will they be included in the project.

Brig. Kftikhar Haider, MD, KW&SB answered that:
Institutional capacity building is included in JICA Study, it will be improved, so will revenue collection. Katch Abadis is included in the Study area, and it will be improving. He added that Rs. 800,000 would be allocated to each KAs to improve the water supply system.

(5) Mr. S.M.Yahya, Senior Scientific Officer, EPA-Sindh
No doubt that EIA is a tool to improve the study target to achieve the study need and enhance the positive environmental impacts. He mentioned that the solid waste management is one of the major problems of this mega city and considerable facilities are needed that requires a comprehensive study.

Brig. Kftikhar Haider, MD, KW&SB answered that:
It is a good idea offering cooperation of environmental study. Environmental aspects and considerations will be a part of the master plan because we understand the sewerage and drainage systems play major role in environmental protection. We will carry out this study in detail with JICA Study Team.

(6) Mr. Khalid Siddiqui, Chief (PP&H), Planning & Development Department, Governement of Sindh
He said that a lot of projects and huge investment in water supply and sewerage sectors have been made. JICA Study Team should go through the other schemes conducted in the water supply and sewerage sectors. The second suggestion is to find new water sources like groundwater and rain water not only in Hub and Indus rivers. The third suggestion is to look into the separate system of sewerage and drainage in future in the M/P, because nallahs are already turned into sewers.

Brig. Kftikhar Haider, MD, KW&SB answered that:
The JICA Study and other projects are concurrently in progress and it is discussed with Mr. Sawara and the other projects will be incorporated into the Study.

Unfortunately Karachi's sewerage system depends on both the nallahs and sewer lines. Since 1997 onwards, efforts have been made to separate the sewerage system from storm water drains and nallahs and bring them back to the original use. This project is still ongoing.

The amount of water required for Karachi is a huge, 640 million gallon per day. The ground water is not sufficient for water supply in Karachi according to the study already carried out. Another option for water source is desalinated one that will be considered.

(7) Fisher Fork Forum, Karachi
How much water can be taken from Indus River will be proposed in the JICA Study. One thing to keep in mind is that people living in Indus Delta is short of water, too.

People will never have the water meter in the house. As far as the equitable distribution of water is concerned, there is another alternative. For example, you can mobilize the people, make the groups for equitable distribution of water. But installing the water meter may lead to the protest by the people. I do not think this will work.

Brig. Kftikhar Haider, MD, KW&SB answered that:
Regarding the opinion that Karachi impacts the Indus River, when no rains or in worst case, Indus has 4.5 lac cusec flow. Karachi has consume only 1200 cusec in the last 15 years, till 2020-25 same 1200 cusec, so that will be no more than 2400 cusec. This amount of water taken by Karachi from Indus is very negligible with no effects.

Mr. Sawara, Team Leader, JICA Study Team answered to the first question that:
Everyone agrees that quantity, quality and pressure has to be improved. However, this must be accompanied by efficient metering, a new water tariff and collection system. Without this the DNI will not be successful. Also meters form a boundary of responsibility between supplier and customer worldwide. This is internationally recognized and makes the customer responsible for leakage, losses, wastage on his side of the meter. We must recognize the scarcity of water resources in Karachi with annual rainfall as low as 200mm/year.

(8) Dr. Moazzam Ali Khan, Incharge Director, Institute of Environmental Studies, Karachi University

He mentioned that in most of such studies, usually academic institutes and research organisations are ignored but they are the people who are really working on such issues. His institute is working on water quality monitoring, waster water, efficiency of sewage treatment. He asked that in this study, JICA Study Team has any system to monitor the water quality since the water quality is the problem in Karachi. He also asked the JICA Study Team has any baseline data and the reliability of the data. He also asked that in this Study, what type of treatment is proposed, biological or biochemical. To apply the tariff based on the use of water, the concept of 3 R system – Reduce, Reuse & Recycle is necessary to solve the problems related to water in Karachi.

Mr. Nakao, Sewerage Planning, JICA Study Team answered to the first question that:
In this study, we do not have continuous water quality monitoring programme but measured the quality of rivers, nallahs, influent and effluent of treatment plants in the dry & wet seasons. As

for the treatment system, two kinds are applied, trickling filter and ponds. Both are appropriate in Karachi because they use little energy and are easy to operate, but they need regular operation and maintenance.

Brig. Kftikhar Haider, MD, KW&SB answered that:
He added about the treatment system that in the future, the combination of mechanical and biochemical treatment processes will be used so that it requires less land. About the baseline data, KW&SB has the complete chemical unit and water quality is checked. The quality at the treatment plan is good but the water gets polluted through the distribution system. Now CDGK thinks about the small area based treatment plant so that the clean water will be distributed to customers in the area.

(9) Mr. Salim Ahmed, SE (Baldia Town), KW&SB
There is a problem with pollution of the water supply in the distribution network. In the area with no proper water distribution system, people are making connections to trunk mains and do not follow the proper procedures. They don't mind the illegal connection cause the leakage. The people do not understand, they must be educated, we must start at town level.

Mrs. Nasreen Jalil, City Naib Nazima replied that:
She agreed and this will be taken up by the CDGK. It is necessary to educate the citizens of Karachi, which will be taken up.

6. Closing Remarks, City Naib Nazima, CDGK
The stakeholder meeting was concluded with thanks to stakeholders, participants, NGOs, KW&SB and JICA Study Team. The M/P for water supply and sewerage system is a step forward to modernise the city and social and economic development. The need for the participation and close cooperation of all the people concerned is emphasised. Continuous discussion and dialogue will be needed on regular basis.

Annex 1: List of the Participants

Annex 1: List of Participants

No.	Organisation	Name	Position / Designation
1	City District Government Karachi (CDGK)	Mrs Nasreen Jalil	City Naib Nazima
2	CDGK	Mr Shahzor Khan	Representative, Works & Service Department
3	CDGK	Mr Syed Ali Nauman	Representative, Works & Service Department
4	CDGK	Mr. Iftikkhar Ali Kaim Khani	EDO, Master Plan Department
5	Korangi Town	Mr. M. Arif Khan Advocate	Nazim, Korangi Town
6	Shah Faisal Town	Mr Javed	Coordinator
7	Gulshan Town Town	Mushtaq Ali	Representative
8	Gulshan Town Town	Moiz Qazi	Representative
9	Saddar Town	Mr. Nasir Khan Taimon	Naib Nazim, Saddar Town
10	Keamari Town	Mr. Muhammad Latif	Town Municipal Officer, Keamari Town
11	Orangi Town	Mr Abdul Haque	Nazim, Orangi Town
12	Sindh Environmental Protection Agency (SEPA)	S.M Yahya	Sr. Scientific Officer
13	Government of Sindh	Mr. Khalid Siddiqui	Chief (PP&H), Planning & Development Department
14	Government of Sindh	Mr. Mir Nasir Abbas	Director General, SKAA (Sindh Katch Abadis Authority)
15	Government of Sindh	Syed Riaz un Nabi	Director General, SKAA (Sindh Katch Abadis Authority)
16	Karachi University	Dr Moazzam Ali Khan	Incharge Director, Institute of Environment Studies
17	Dawood Engineering Collage	Arch. Badar - US-Saqib Ali Khan	Assistant Professor, Architecture & Planning (DAP/DCET)
18	Pakistan Council for Scientific and Industrial Research (PCSIR)	Dr. Tanzil Haider Usmani	Director General
19	Pakistan Council for Scientific and Industrial Research (PCSIR)	Mr Ghulam Hussain Shaikh	Head, Center of Environment Studies
20	WWF (World Wide Fund for Nature)	Mrs Rahat Jabeen	Representative
21	CREED	Prof. Muhammad Nauman	Coordinator, CREED
22	Pakistan Fisherfolk Forum (PFF)	Mr Ikramullah	Representative
23	WSP-SA	Mr. Farhan Anwar	Consultant
24	JICA	Mr K Tamaki	Project Formulation Advisor , Karachi Project Officer
25	JICA	Mr. S. Talib Fatah	Karachi Project Officer
26	Landhi Association of Trade and Industry (LATI)	Mr Shakeel Ali Malik	Representative
27	Karachi Port Trust (KPT)	Mr. Muhammad Nawaz Khan	Chief Engineer
28	CAA (Civil Aviation Authority)	Lt Col® Zafar Iqbal Faruqi	GM Works (Civil)
29	Pakistan Ranger	Lt Col Muhammad Javed Iqbal	Nominated by DG Rangers
30	Manohra cantonment Board	Mr. Shahid Ahmed Khan	Cantonment Executive Officer
31	Pakistan Army, Station Headquarter, Karachi	Lt col Asad Ali Wahidi	Representative
32	Pakistan Army, A.C.E. M.E.S, Karachi Cantt	Col Mehmood	Representative
33	Pakistan Navy, COM KAR	Mir Waqas Elahi	E.E COM KAR Head quarter
34	Pakistan Navy, COM PAK	Mr. Usman Nasim	Representative
35	PAF, Southern Command	Group Captain Ghulam Qadir Lodhi	Senior Staff Officer (Administration)

No.	Organisation	Name	Position / Designation
36	PAF, Faisal Base	Sq. Leader Mr. Asim	Representative
37	PAF, Masroor Base	Wing Commander Arshad Dar	Wing Commander (OC Admin Wing)
38	PAF, Masroor Base	Sq. Leader Mr Sajid	Representative
39	PAF, Korangi Creek	Air Commodore Khalid Farooq Chishti S.BT	Base Commander
40	PAF, Malir Base	M Parvez	Representative
41	Karachi Water & Sewerage Board (KW&SB)	Brig. Iftikhar Haider	MD, KW&SB
42	KW&SB	Mr. Shahid saleem	DMD (Planning)
43	KW&SB	Mr. Imran Asif	CE Zone-I
44	KW&SB	Mr. Najam-e-Alam Sid	CE Zone-II
45	KW&SB	Mr. Qutubuddin Shaikh	CE Zone-III
46	KW&SB	Mr. Gulzar Ahmad Memon	CE (E&M)
47	KW&SB	Mr. Mashkoor-ul-Hasnain	CE (Project)
48	KW&SB	Mr. Adnan Danishmandi	Additional with CE
49	KW&SB	Mr. Ali Mohammed Palijo	CE (Bulk)
50	KW&SB	Mr. Wajid Iqbal	SE (Landhi Town)
51	KW&SB	Mr. Jamil Akhtar	SE (Korangi Town)
52	KW&SB	Mr. Rahim Khatti	SE (Malir Town)
53	KW&SB	Mr. Aziz Siddiqui	SE (Bin Qasim Town)
54	KW&SB	Mr. Asadullah Khan	SE (Shah Faisal Town)
55	KW&SB	Mr. Shakeel Qureshi	SE (Liaquatabab Town)
56	KW&SB	Mr. Saifuddin	SE (Keamari Town)
57	KW&SB	Mr. Ovais Malik	SE (Orangi Town)
58	KW&SB	Mr. Saleem Ahmed	SE (Baldia Town)
59	KW&SB	Mr. Aziz Channa	SE (Gadap Town)
60	KW&SB	Mr. Saleem Siddiqui	SE (North Karachi Town)
61	KW&SB	Mr. Tauqir Ali Khan	SE (North Nazimabad Town)
62	KW&SB	Mr. Iftikkhar Ahmed Khan	SE (BWS) / Project Coordinator JICA
63	KW&SB	Mr. Qazi Niaz Ahmed	SE (COD FP / NEK FP & PS)
64	KW&SB	Mr. Noor Mohammed Chohan	SE (E&M-I / Dhabeji & Garo FP & PS)
65	KW&SB	Mr. Azam Khan	SE (S&C)
66	KW&SB	Mr. Shadab Mussarat	SE (SPC)
67	KW&SB	Mr. Parial Shah Rahidi	SE (Design), Design Dept.
68	KW&SB	Ms. Farida Salam	Deputy Project Coordinator (JICA)
69	KW&SB	Mr. Tehseen Manzar	Deputy Project Coordinator (JICA)
70	KW&SB	Mr. Misbahuddin Fareed	Project Manager K-III / TKP, Project Wing
71	KW&SB	Mr. Asif	EE (K-III) with PM (K-III)
72	KW&SB	Mr. Zafar	EE (K-III) with PM (K-III)
73	KW&SB	Mr. Muhammad Ayoob Shaikh	Dy Project Manager TKP, PW
74	KW&SB	Mr. Mehmood Qadir	Chief Revenue Officer (CRO), Rrevenew Dept.
75	KW&SB	Mrs. Farhal Naveed	Chief Chemist, Lab Unit (Water & Sewerage, Bulk Dept.)
76	KW&SB	Mr. Parvaiz Hyder	Representative, PR
77	KW&SB	Mr. Qadir Khan	Director, RP

No.	Organisation	Name	Position / Designation
78	Pakistan Television (Media)		
79	GEO (Media)		
80	Jang (Media)		
81	Express (Media)		
82	The Nation (Media)		
83	Labbaik Television (Media)		
84	Dhoom Television (Media)		
85	JICA Study Team	Mr. Sadanobu Sawara	Team Leader
86	JICA Study Team	Mr. Takehiko Oga	Deputy Team Leader
87	JICA Study Team	Mr. Koichi Okazaki	Water Supply Facility Planning
88	JICA Study Team	Mr. Taketoshi Ishihara	Water Quality
89	JICA Study Team	Mr. Jack Bannister	NRW Reduction
90	JICA Study Team	Mr. Masakazu Nakao	Sewrage Planning
91	JICA Study Team	Mr. Shozo Mori	Water Use Sutdy / Social Analysis / GIS Database
92	JICA Study Team	Ms. Shoko Yamida	Environmental & Social Considerations
93	JICA Study Team	Mr. M. Salim Amin	Project administration Manager
94	JICA Study Team	Ms. Ayesha Malik	Office Secretary

6. No. F.2/3/2004-Com issued by Cabinet Secretariat, Government of Pakistan

Dy No. ...

GOVERNMENT OF PAKISTAN
CABINET SECRETARIAT
(CABINET DIVISION)

No.F.2/3/2004-Com

Islamabad, the 31st July, 2004.

Minutes and decisions of the Meeting of the **Executive Committee of the National Economic Council (ECNEC)**, held on **Tuesday the 27th July, 2004** in the Auditorium of the Planning Commission 'P' Block, Pak. Secretariat, Islamabad are hereby circulated **for perusal and return.**

(ZAFAR-IQBAL)
Joint Secretary (Cabinet Committees)
Ph:9203014

FEDERATION:

Minister for Finance and Revenue.
Minister for Commerce
Minister for Communications
Minister for Education.
Minister for Food, Agriculture and Livestock.
Minister for Housing & Works.
Minister for Industries and Production.
Minister for Information Technology and Telecommunications
Minister for Local Government and Rural Development.
Minister for Petroleum and Natural Resources.
Minister for Privatization.
Minister for Railways
Minister for Water & Power
Minister of State (Incharge) for Environment
Deputy Chairman, Planning Commission.

PROVINCES:

PUNJAB
Minister for Finance.
Minister for Planning.

SINDH
Minister for Finance.
Minister for Planning.

NWFP
Minister for Finance.
Minister for Planning.

BALOCHISTAN
Minister for Finance.
Minister for Planning.

Copy alongwith copy of minutes and decisions is forwarded for similar action to:-

1. COS to the President.
2. Principal Secretary to the Prime Minister.
3. Cabinet Secretary
4. Additional Secretary (E) Prime Minister's Secretariat.

Copy alongwith a copy of minutes and decisions is also forwarded for perusal and necessary action, in terms of rule 24 of the Rules of Business,1973 and Para VII of the Pamphlet 'Procedure in regard to ECNEC' to:-

a) Chairman, Planning & Development Board, Punjab.
b) Additional Chief Secretary (P&D), Sindh.
c) Additional Chief Secretary (P&D), NWFP.
d) Additional Chief Secretary (P&D), Balochistan.

3.

Case No. ECNEC-82/3/2004 **General**
Dated: 27-07-2004

DECISION

The Executive Committee of the National Economic Council (ECNEC) took the following general decisions:

i In future the Planning Commission should, while submitting a Summary for ECNEC, attached a time schedule for various activities of a development Project alongwith the agency responsible for each activity.

ii. In case of development projects having environmental implications, an Environmental Impact Assessment (EIA) report should invariably be submitted alongwith the project document at the time of getting approval.

iii. The notice for ECNEC meetings should be issued by the Cabinet Division at least one week before the meeting and no Summary be included in the agenda subsequently, unless specific approval of the Chairman ECNEC is obtained in writing.

iv. With a view to effecting economy, bulky documents should not be annexed to the Summaries. One or two copies of such documents could however be brought to the meeting by the sponsoring Ministries/ Division for consultation in case of need.

APPENDIX – A112.1

Socio-Economic Data

A112.1 Socio-Economic Data

Table A112.1.1 Gross Domestic Product at Current Prices: 1999/00-2005/06

(Unit: Rs. billion)

Sector	1999/00	2000/01	2001/02	2002/03	2003/04*1	2004/05*1	2005/06*2
1. Agriculture	923.6	945.3	968.0	1,059.3	1,164.8	1,377.1	1,492.0
2. Mining & Quarrying	81.1	59.2	66.0	84.2	208.3	177.7	211.9
3. Manufacturing	522.8	608.1	642.9	725.4	902.5	1,107.1	1,338.4
4. Construction	87.4	94.7	95.2	100.9	115.5	153.3	178.8
5. Electricity, Gas & Water	139.6	133.1	134.4	120.6	190.7	205.8	215.7
6. Transport & Communication	401.0	513.0	542.8	609.9	675.6	793.7	982.4
7. Trade, Hotels & Restaurant	621.8	691.9	720.8	785.8	896.4	1,098.8	1,358.3
8. Finance & Insurance	132.5	117.0	142.4	145.0	165.2	234.2	311.7
9. Dwellings	110.4	124.4	126.5	135.1	146.3	165.4	185.4
10. Public Services	220.3	235.0	260.0	285.9	312.1	343.3	389.5
11. Social & Public Services	321.6	354.4	396.0	429.3	473.2	547.4	631.2
GDP at Factor Cost	**3,562.0**	**3,876.0**	**4,095.0**	**4,481.4**	**5,250.5**	**6,203.9**	**7,295.2**
12. Indirect Taxes	295.8	320.7	339.3	403.2	455.5	468.6	544.1
13. Subsidies	31.7	34.0	32.8	61.8	65.5	91.4	126.3
GDP at Market Prices	**3,826.1**	**4,162.7**	**4,401.4**	**4,822.8**	**5,640.6**	**6,581.1**	**7,713.1**

Source: Pakistan, Economic Survey 2005-06, Government of Pakistan
Note: *1 Preliminary
*2 Estimated

Table A112.1.2 Share of Gross Value Added to GDP: 1999/00-2005/06

(Unit: %)

Sector	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
1. Agriculture	24.1	22.7	22.0	22.0	20.6	20.9	19.3
2. Mining & Quarrying	2.1	1.4	1.5	1.7	3.7	2.7	2.7
3. Manufacturing	13.7	14.6	14.6	15.0	16.0	16.8	17.4
4. Construction	2.3	2.3	2.2	2.1	2.0	2.3	2.3
5. Electricity, Gas & Water	3.6	3.2	3.1	2.5	3.4	3.1	2.8
6. Transport & Communication	10.5	12.3	12.3	12.6	12.0	12.1	12.7
7. Trade, Hotels & Restaurant	16.3	16.6	16.4	16.3	15.9	16.7	17.6
8. Finance & Insurance	3.5	2.8	3.2	3.0	2.9	3.6	4.0
9. Dwellings	2.9	3.0	2.9	2.8	2.6	2.5	2.4
10. Public Services	5.8	5.6	5.9	5.9	5.5	5.2	5.1
11. Social & Public Services	8.4	8.5	9.0	8.9	8.4	8.3	8.2
GDP at Factor Cost	**93.1**	**93.1**	**93.0**	**92.9**	**93.1**	**94.3**	**94.6**
12. Imputed Interest	7.7	7.7	7.7	8.4	8.1	7.1	7.1
13. Import Duties	0.8	0.8	0.7	1.3	1.2	1.4	1.6
GDP at Market Prices	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table A112.1.3 GDP per Capita: 1999/00-2005/06

Item	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Population (Mid-year, Million)	137	140	143	146	149	150	154
In Local Monetary Unit (Rs. at Current Prices)	27,991	29,784	30,809	33,042	37,849	43,737	50,098
Exchange Rate (Rs./US$)*1	52.56	58.02	61.41	58.47	57.57	59.18	59.89
In US Dollars Equivalent (US$)	533	513	502	565	657	739	837

Note: *1 Annual average rate (refer to Table A81.1.14)

Table A112.1.4 Gross Domestic Product at 1999/00 Constant Prices: 1999/00-2005/06

(Unit: Rs. billion)

Sector	1999/00	2000/01	2001/02	2002/03	2003/04*1	2004/05*1	2005/06*2
1. Agriculture	923.6	903.5	904.4	943.2	964.8	1,029.8	1,055.2
2. Mining & Quarrying	81.1	85.5	90.4	96.4	111.5	122.2	126.8
3. Manufacturing	522.8	571.4	596.8	638.0	727.4	818.8	889.0
4. Construction	87.4	87.8	89.2	92.8	82.8	98.2	107.2
5. Electricity, Gas & Water	139.6	120.5	112.0	98.9	155.1	160.5	147.0
6. Transport & Communication	401.0	422.2	427.3	445.6	461.3	477.7	512.2
7. Trade, Hotels & Restaurant	621.8	649.6	667.6	707.1	766.7	851.7	936.1
8. Finance & Insurance	132.5	112.5	131.8	130.1	141.8	183.9	226.1
9. Dwellings	110.4	114.6	118.6	122.5	126.8	131.2	135.8
10. Public Services	220.3	225.2	240.6	259.1	267.3	268.8	281.5
11. Social & Private Services	321.6	339.4	366.3	388.5	410.1	434.2	462.5
GDP at Factor Cost	**3,562.0**	**3,632.1**	**3,745.1**	**3,922.3**	**4,215.6**	**4,577.1**	**4,879.5**
12. Indirect Taxes	295.8	301.9	312.9	355.3	372.0	383.8	383.8
13. Subsidies	31.7	32.1	30.2	54.5	53.5	64.0	64.0
GDP at Market Prices	**3,826.1**	**3,902.0**	**4,027.8**	**4,223.2**	**4,534.1**	**4,896.9**	**5,199.4**

Source: (1) Basic Statistics of the Lao PDR 1975-2000, State Planning Committee National Statistical Centre
Note: *1 Preliminary
*2 Estimated

Table A112.1.5 Real Growth Rate of Gross Value Added: 1999/00-2005/06

(Unit: %)

Sector	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
1. Agriculture	-	-2.2	0.1	4.3	2.3	6.7	2.5
2. Mining & Quarrying	-	5.5	5.7	6.6	15.6	9.6	3.8
3. Manufacturing	-	9.3	4.5	6.9	14.0	12.6	8.6
4. Construction	-	0.5	1.6	4.0	-10.7	18.6	9.2
5. Electricity, Gas & Water	-	-13.7	-7.0	-11.7	56.8	3.5	-8.4
6. Transport & Communication	-	5.3	1.2	4.3	3.5	3.6	7.2
7. Trade, Hotels & Restaurant	-	4.5	2.8	5.9	8.4	11.1	9.9
8. Finance & Insurance	-	-15.1	17.2	-1.3	9.0	29.7	23.0
9. Dwellings	-	3.8	3.5	3.3	3.5	3.5	3.5
10. Public Services	-	2.2	6.9	7.7	3.2	0.6	4.7
11. Social & Private Services	-	5.6	7.9	6.1	5.6	5.9	6.5
GDP at Factor Cost	-	**2.0**	**3.1**	**4.7**	**7.5**	**8.6**	**6.6**
12. Imputed Interest	-	2.1	3.6	13.6	4.7	3.2	0.0
13. Import Duties	-	1.0	-5.7	80.1	-1.8	19.6	0.0
GDP at Market Prices	-	**2.0**	**3.2**	**4.9**	**7.4**	**8.0**	**6.2**

Table A112.1.6 Real Growth Rate of GDP per Capita: 1999/00-2005/06

Item	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Population (Mid-year, Million)	137	140	143	146	149	150	154
GDP per Capita (Rs. at 1999/00 Constant Prices)	27,991	27,919	28,194	28,934	30,424	32,544	33,771
	2000/01	1998/99	1999/2000	2000/01	2001/02	2002/03	2000/2006
Real Growth Rate (% per annum)	-0.3	1.0	2.6	5.2	7.0	3.8	3.9

Table A112.1.7 Balance of Payments: 1999/00- 2004/06

(Unit: US$ Million)

Item	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06*1
I. Current Account	-1,143	-513	1,338	3,165	1,314	-1,753	-4,696
1. Goods, Services and Income (net)	-4,206	-4,411	-2,911	-2,572	-4,802	-10,193	-11,497
(1) Trade Balance	-1,412	-1,269	-294	-444	-1,208	-4,352	-6,104
Export (FOB)	8,190	8,933	9,140	10,889	12,396	14,401	11,854
Import (CIF)	-9,602	-10,202	-9,434	-11,333	-13,604	-18,753	-17,958
(2) Services (net)	-2,794	-3,142	-2,617	-2,128	-3,594	-5,841	-5,393
Receipts	1,501	1,464	2,027	2,967	2,894	3,837	3,383
Payments	-4,295	-4,606	-4,644	-5,095	-6,488	-9,678	-8,776
2. Transfers (net)	3,063	3,898	4,249	5,737	6,116	8,440	6,801
II. Capital & Financial Account	1,213	1,514	1,454	2,044	-488	2,125	4,820
1. Capital Account (net)	-1,757	484	2,241	1,944	-338	1,698	4,313
(1) Private Capital (net)	277	-68	-177	225	691	1,221	2,945
(2) Official Capital (net)	248	239	1,457	810	-892	1,331	960
(3) Errors & Omissions (net)	-2,282	313	961	909	-137	-854	408
2. Financial Account (net)	2,970	1,030	-787	100	-150	427	507
(1) Mid. & Short-term Capital	-221	431	-334	-180	-317	147	-180
(2) Other Short-term Liabilities	-775	-93	-591	-340	222	335	742
(3) Exceptional Financing	3,966	692	138	620	-55	-55	-55
III. Overall Balance	70	1,001	2,792	5,209	826	372	124

Source Pakistan, Economic Survey 2005-06, Government of Pakistan (Originally Quoted from "State Bank of Pakis
Note: *1 Provisional (July-March)

Table A112.1.8 Foreign Trade: 1999/00-2005/06

(Unit: US$ million)

Item	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06*1
Export	8,569	9,202	9,135	11,160	12,313	14,391	12,073
1. Primary Commodities	1,040	1,157	983	1,218	1,228	1,550	1,398
2. Semi-Manufactures	1,317	1,388	1,310	1,220	1,448	1,457	1,292
3. Manufactured Goods	6,212	6,657	6,842	8,722	9,637	11,383	9,383
Import	10,309	10,729	10,340	12,220	15,592	20,598	20,693
1. Capital Goods	2,705	2,688	2,879	3,779	5,489	7,436	7,409
2. Industrial Raw Material for	6,151	6,505	6,288	7,206	8,664	11,097	10,836
(1) Capital Goods	593	588	636	705	995	1,713	1,598
(2) Comnumer Goods	5,558	5,917	5,651	6,501	7,669	9,384	9,238
3. Consumer Goods	1,453	1,536	1,174	1,235	1,439	2,065	2,448

Source: Pakistan, Economic Survey 2005-06, Government of Pakistan (Originally Quoted from "Federal bureau
Note: *1 Provisional (July-March)

Table A112.1.9 Fiscal Operation of Government: 1999/00-2005/06

(Unit: Rs. Billion)

Item	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05*1	2005/06*2
Total Revenue	**512.5**	**553.0**	**625.3**	**720.8**	**791.1**	**900.0**	**1,095.6**
Federal	477.6	514.0	584.9	673.6	740.9	843.0	1,010.0
Provincial	34.9	39.0	40.4	47.2	50.2	57.0	85.6
1. Tax Revenues	405.6	444.3	479.3	554.0	609.9	654.3	795.5
Federal	386.8	422.5	460.2	534.0	580.3	624.8	762.8
Provincial	18.8	19.1	19.1	21.8	28.1	34.6	42.8
(1) Direct Taxes	115.7	128.6	147.4	157.9	169.9	186.5	226.9
(2) Indirect Taxes	289.9	315.7	331.9	396.1	440.0	467.8	568.6
1) Excise Duty	56.9	50.3	48.6	45.4	46.2	60.8	61.8
2) Sales Tax	116.8	153.5	166.6	195.1	219.1	235.5	296.7
3) Taxes on International Trade	*61.6*	*65.0*	*47.8*	*68.8*	*89.9*	*117.2*	*137.0*
4) Surcharge Taxes	38.9	30.2	54.9	68.2	61.4	27.1	32.6
5) Other Taxes	15.7	16.7	14.1	18.5	23.4	27.1	40.6
2. Non-tax Revenues	106.9	111.4	146.0	165.0	182.7	240.7	290.0
Federal	90.8	91.5	124.7	139.6	160.6	218.3	247.2
Provincial	16.1	19.9	21.3	25.4	22.1	22.4	42.8
Total Expenditure	**709.1**	**717.9**	**826.3**	**898.2**	**940.4**	**1,195.5**	**1,423.0**
1. Current Expenditures	626.4	645.7	700.2	791.7	763.1	943.1	1,097.9
Federal	477.9	479.0	524.6	599.8	582.4	688.6	782.1
Provincial	148.5	166.7	175.6	191.9	180.7	254.5	315.8
(1) Defence	150.4	131.2	149.3	159.7	184.9	211.7	241.1
(2) Interest	262.2	249.3	273.9	235.3	226.3	255.0	273.1
(3) Current Subsidies	23.2	29.0	29.2	57.1	67.9	66.7	92.7
1) Federal	*14.7*	*19.9*	*25.5*	*50.0*	*62.5*	*57.8*	*86.3*
2) Provincial	8.5	9.1	3.7	7.1	5.4	8.9	6.4
(4) General Administration	92.1	101.0	91.0	100.2	120.0	130.5	157.4
(5) All Others	98.4	135.2	156.8	239.4	164.0	279.1	333.7
2. Development Expenditures	95.6	89.8	126.3	129.2	161.0	227.7	326.7
3. Net Lending to PSEs	-12.9	-17.6	-0.2	-22.7	16.3	24.8	-1.6
Statistical Discrepancy	9.7	14.8	-11.7	3.2	-14.7	-78.5	0.0
Overall Deficit	**-206.3**	**-179.7**	**-189.2**	**-180.6**	**-134.5**	**-217.0**	**-327.4**

Source: Pakistan, Economic Survey 2005-06, Government of Pakistan
Note: *1 Revised Estimates
*2 Modified Budget Estimate

Table A112.1.10 Derivation of Standard Conversion Factor

(Unit: Rs. Million)

Description	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05*1	2005/06*2
1. Imports	533,792	627,000	634,630	714,372	897,825	1,223,079	1,237,243
2. Exports	443,678	539,070	560,947	652,294	709,036	854,088	721,799
3. Taxes on Imports	77,347	78,091	70,924	82,494	100,333	125,527	151,165
4. Sales Tax on Imports	80,069	94,050	95,195	107,156	134,674	183,462	185,586
5. Taxes on Exports	12	15	14	3	0	314	318
6. Subsidies on Imports*1	8,820	11,940	15,293	28,575	35,913	34,680	49,490
8. Total of (1) & (2)	977,470	1,166,070	1,195,577	1,366,666	1,606,861	2,077,167	1,959,042
9. (1)+(2)+(3)+(4)-(5)-(6)	1,126,053	1,326,256	1,346,389	1,527,738	1,805,955	2,351,162	2,245,986
10. Standard Conversion Factor (SCF)	0.87	0.88	0.89	0.89	0.89	0.88	0.87
							0.88

Source: Pakistan, Economic Survey 2005-06, June 2006, Finance Division GOP
Monthly Statistical Bulletine, October 2006 and January 2005, Federal Bureau of Statistics GOP
Remark: *1 Subsidies were assumed as less than 4% of imports refering from the past records between 1986/87 and 1990/91and less than 60% of the total subsidies in the respective years.

Table A112.1.11 Official Development Assistance: 1999-2005

(Unit: US$ Million)

Item	2000	2001	2002	2003	2004	2005	Total
Bilateral (DAC Countrie	**-43.3**	**1,058.4**	**623.8**	**134.8**	**251.4**	**1,498.1**	**3,523.2**
1. United States	77.5	881.1	383.8	312.0	294.2	611.1	2,559.7
2. United Kingdom	-208.3	152.6	183.5	184.6	105.7	105.6	523.7
3. Switzerland	34.6	33.5	20.0	27.5	189.0	182.3	486.9
4. Netherlands	45.5	17.7	0.2	22.5	52.6	165.1	303.6
5. Sweden	-45.6	268.1	1.3	3.1	4.8	8.4	240.1
6. Canada	11.7	29.5	52.8	10.6	11.9	48.6	165.1
7. Norway	11.0	-1.7	-0.3	1.3	8.1	82.7	101.1
8. Australia	3.0	2.6	2.2	3.3	6.2	30.3	47.6
9. Austria	1.1	1.2	0.7	20.9	1.8	6.9	32.6
10. Spain	0.8	3.6	0.7	0.9	0.1	4.6	10.7
11. Germany	-18.8	-120.2	258.5	-211.0	19.6	66.1	-5.8
12. Italy	-66.7	-37.1	-3.0	8.9	58.7	25.5	-13.7
13. Finland	-1.6	-12.9	-2.2	-6.0	-14.3	4.8	-32.2
14. France	-72.8	40.8	-412.3	-144.6	49.2	14.7	-525.0
15. Japan	32.2	-117.6	144.0	-92.6	-551.4	43.3	-542.1
16. Others	153.1	-82.8	-6.1	-6.6	15.2	98.1	57.6
Multilateral	**215.3**	**692.7**	**1,196.9**	**400.9**	**-79.1**	**765.1**	**3,191.8**
1. IDA	76.8	530.6	851.3	29.4	677.3	516.0	2,681.4
2. IMF	-82.1	38.6	282.3	377.6	137.3	-78.4	675.3
3. ADB	260.6	255.6	240.9	166.5	-710.7	324.8	537.7
4. EC	33.1	50.0	48.1	33.7	96.4	42.1	303.4
5. UNHCR	12.4	14.8	20.7	20.6	23.0	17.3	108.8
6. UNICEF	11.6	12.4	11.0	12.7	12.6	14.0	74.3
7. UNDP	4.0	5.9	6.4	7.4	7.1	11.6	42.4
8. WFP	2.7	1.8	4.4	11.3	8.6	10.7	39.5
9. UNTA	3.8	3.8	3.7	4.5	4.0	5.2	25.0
10. IFAD	-1.2	-2.7	-1.0	-1.7	1.5	1.3	-3.8
11. IFC	-47.8	-57.3	-64.7	-22.4	-39.8	-24.3	-256.3
12. IBRD	-67.2	-161.4	-208.5	-240.9	-303.1	-94.4	-1,075.5
13. Other Multilateral	13.2	3.8	6.3	5.3	5.4	11.2	45.2
14. Arab Agncies	-4.5	-3.1	-3.8	-4.7	-3.5	4.6	-15.0
Other Donor Countries	**-5.4**	**14.6**	**44.7**	**-1.5**	**1.7**	**163.5**	**217.6**
Total	**166.6**	**1,765.7**	**1,865.4**	**534.2**	**174.0**	**2,426.7**	**6,715.0**

Source: Geographical Distribution of Financial Flows to Aid Recipients, Disbursements Commitments Country Indicators 1999-2003, 2005, OECD Development Assistance Committee

Note: *1 Official development assistance is defined as grants and loans, with at least a 25% grant element, administered with the aim of promoting economic of social development. Figures indicate amounts.

Table A112.1.12 External Debt: 1990-2005

(Unit: US$ Million)

Item	1990	1995	2000	2001	2002	2003	2004	2005
Total Debt Stocks	20,663	30,229	32,781	31,665	33,586	35,741	35,547	33,675
1. Long Term Debt	16,643	25,381	29,733	28,544	30,014	32,388	32,426	30,953
2. Use of IMF Credit	835	1,613	1,529	1,807	2,032	2,108	1,876	1,492
3. Short Term Debt	3,185	3,235	1,519	1,314	1,540	1,245	1,245	1,230
Debt Outstanding of Long Term Debt	16,643	25,381	29,734	28,534	30,013	32,387	32,426	30,953
1. Public and Publicly Guaranteed	16,505	23,788	27,174	26,436	28,015	30,768	30,889	29,490
a. Official Creditors	15,791	22,691	25,123	25,174	27,226	30,218	30,069	28,188
- Multilateral	6,894	12,179	13,480	13,073	14,855	16,148	16,277	15,880
- Bilateral	8,897	10,512	11,643	12,101	12,371	14,070	13,792	12,308
b. Private Creditors	714	1,097	2,051	1,262	789	550	820	1,302
- Bonds	0	150	623	623	445	325	608	1,100
- Commercial Banks & Others	401	371	1,099	551	270	91	56	45
- Others	313	576	329	88	74	134	156	157
2. Private Non-guaranteed	138	1,593	2,560	2,098	1,998	1,619	1,537	1,463
Total Debt Service	1,902	3,215	2,854	2,995	2,888	3,077	4,260	2,442
1. Principal Repayment	1,071	2,013	1,869	2,131	2,050	2,229	3,513	1,690
a. Public and Publicly Guaranteed	866	1,497	1,142	1,451	1,482	1,254	2,481	1,127
- Official Creditors	725	1,267	1,104	922	903	931	2,206	987
- Private Creditors	141	230	37	529	579	323	275	139
b. Private Non-guaranteed	39	340	445	506	301	379	462	327
c. IMF Reperchases	166	176	282	174	268	595	570	237
2. Interest Payments	831	1,202	985	864	838	848	747	752
a. Public and Publicly Guaranteed	504	825	641	578	638	698	619	582
- Official Creditors	450	759	527	468	555	650	587	532
- Private Creditors	54	66	114	110	83	48	32	50
b. Private Non-guaranteed	11	130	217	177	105	90	75	101
c. IMF Charges	52	45	49	52	40	25	21	13
d. Short-term Debt	264	202	78	57	55	35	32	56
Ratios (%)								
1. Total Debt Stocks/GNP	49.5	49.5	45.9	45.7	48.6	44.6	37.9	31.1
2. Debt Service Ratio *1	21.3	26.5	25.2	24.6	18.1	16.2	21.1	10.2

Source: Global Development Finance, Country Tables 2007, II Summary and Country Tables,, 2007, World Bank
Note: Long term debt is defined as having original maturity of more than one year.
*1 Debt service as a percentage of earnings from exports of goods and service

Table A112.1.13 Consumer Price Index and Wholesale Price Index: 1994/95-2005/06

(Base 2000/01=100)

Year	General Index	Food, Beverages &	Clothes & Footware	House Rent	Energy	Furniture, & Equipment	Transport & Communi-	Recreation & Entertainment	Education	Cleaning, & Laundry	Medicare
1994/95	65.5	67.2	67.6	66.2	49.2	59.2	59.2	61.4	-	65.5	69.1
1995/96	72.6	74.1	75.6	72.4	57.0	64.7	64.7	71.0	-	75.0	76.3
1996/97	81.1	82.9	82.8	79.7	64.1	73.4	73.4	80.5	-	85.4	86.1
1997/98	87.5	89.2	86.5	87.4	71.2	76.9	76.9	88.1	-	87.7	90.6
1998/99	92.5	94.5	92.3	93.2	81.0	77.0	77.0	92.2	-	92.8	92.0
1999/00	95.8	96.6	97.3	97.2	90.4	81.1	81.1	96.5	-	97.8	93.1
2000/01	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2001/02	103.5	102.5	103.2	102.8	107.8	103.8	103.8	106.3	105.0	102.5	102.4
2002/03	106.8	105.4	106.8	103.8	118.4	105.3	105.3	107.2	109.7	103.4	105.6
2003/04	111.6	111.7	109.7	108.2	120.3	115.7	115.7	106.1	114.2	111.3	106.9
2004/05	122.0	125.7	113.0	120.4	128.5	120.2	120.2	105.9	117.6	115.9	107.9
2005/06	131.6	134.4	117.6	132.4	137.1	123.4	145.9	105.7	125.0	119.5	110.7
2006/07	141.9										

Wholesale Price Index (WPI) (Base 2000/01=100)

Year	General Index	Food	Raw Meterials	Fuel, Lighting, & Lubricant	Manufactures	Building Materials
1994/95	65.0	67.5	72.2	44.9	73.4	81.0
1995/96	72.2	75.4	76.0	53.0	79.9	87.3
1996/97	81.6	84.4	87.0	62.2	89.4	98.6
1997/98	87.0	90.5	93.8	69.7	91.6	98.6
1998/99	92.5	96.6	103.2	75.8	94.5	99.6
1999/00	94.2	97.1	92.4	83.2	98.8	97.2
2000/01	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2001/02	102.0	102.0	100.3	103.1	101.9	101.1
2002/03	107.8	105.6	115.5	116.0	104.0	102.9
2003/04	116.3	113.0	135.1	119.2	111.8	126.5
2004/05	124.1	125.0	110.4	138.0	113.1	143.8
2005/06	136.7	133.8	121.9	174.6	116.4	144.2
2006/07	146.2					

Source: Pakistan Statistical Yearbook 2007, 2007, GOP

Table A112.1.14 Foreign Exchange Rates at the End of Period: 1996-2007

Month	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Rs. per US Dollar												
January	34.33	40.12	44.05	46.00	51.79	59.32	60.23	58.20	57.41	59.12	59.84	60.77
February	34.40	40.12	44.05	46.00	51.88	60.27	60.19	58.09	57.34	59.12	59.94	60.81
March	34.52	40.12	44.05	46.00	51.79	60.93	60.12	57.78	57.51	59.12	59.98	60.71
April	34.75	40.24	44.05	46.00	51.79	61.24	60.05	57.77	57.47	59.12	60.05	60.73
May	34.83	40.39	44.05	51.69	51.79	62.52	60.17	57.63	57.72	59.56	60.19	60.76
June	35.10	40.46	46.00	51.39	51.79	64.11	60.06	57.81	58.13	59.72	60.26	60.52
July	35.32	40.52	46.00	51.16	51.79	64.01	59.54	57.71	58.30	59.64	60.36	60.40
August	35.62	40.52	46.00	61.62	51.79	64.07	59.36	57.74	58.81	59.68	60.35	60.66
September	36.97	40.52	46.00	51.75	51.79	64.20	59.19	57.91	59.21	59.72	60.56	-
October	40.12	44.05	46.00	51.77	56.97	62.15	59.19	57.41	59.21	59.72	60.74	-
November	40.12	44.05	46.00	51.79	57.49	60.86	58.53	57.22	59.67	59.78	60.71	-
December	40.12	44.05	46.00	51.79	58.03	60.86	58.53	57.22	59.12	59.83	60.92	-
Average	**35.91**	**40.92**	**44.94**	**49.12**	**52.81**	**61.93**	**59.72**	**57.75**	**58.26**	**59.51**	**60.32**	-
Japanese Yen per Rupee												
January	3.12	3.04	2.88	2.53	2.06	1.96	2.21	2.04	1.85	1.76	1.97	2.00
February	3.04	3.01	2.89	2.60	2.12	1.93	2.22	2.03	1.90	1.82	1.94	1.95
March	3.08	3.09	3.00	2.62	2.04	2.05	2.22	2.08	1.81	1.82	1.96	1.94
April	3.02	3.15	3.00	2.59	2.06	2.02	2.13	2.07	1.92	1.79	1.90	1.97
May	3.11	2.88	3.16	2.35	2.06	1.91	2.07	2.05	1.91	1.81	1.86	2.00
June	3.12	2.83	3.06	2.36	2.04	1.93	1.99	2.07	1.86	1.85	1.91	2.04
July	3.06	2.92	3.12	2.25	2.11	1.95	2.01	2.08	1.92	1.88	1.90	1.97
August	3.04	2.95	3.08	1.80	2.05	1.86	1.99	2.03	1.86	1.86	1.94	1.92
September	3.00	2.99	2.94	2.06	2.08	1.86	2.05	1.93	1.87	1.89	1.95	-
October	2.84	2.72	2.53	2.03	1.91	1.96	2.07	1.89	1.79	1.94	1.94	-
November	2.84	2.90	2.69	1.98	1.93	2.04	2.09	1.91	1.73	2.00	1.92	-
December	2.89	2.95	2.51	1.97	1.98	2.17	2.05	1.87	1.76	1.97	1.95	-
Average	**3.03**	**2.96**	**2.91**	**2.32**	**2.04**	**1.96**	**2.10**	**2.01**	**1.86**	**1.85**	**1.93**	-

APPENDIX – A112.2

Economic Evaluation of Water Supply Project

A112.2 Economic Evaluation of Water Supply Project

Table A112.2.1 Water Production and Sewerage Treatment Costs: 2004-05

Item of Expenditure		1. Water Supply	2. Sewerage Service	3. Administ-ration	Total
Direct Expenditure (Rs.1000)					
1. Charges of Raw Water to Sindh Gov.		946	0	0	946
2. Compensation (Salaries and Benefits)		485,015	207,332	181,509	873,857
3. Chemicals		29,222	0	0	29,222
4. P.O.L. for Pumping Stations		39,146	5,647	0	44,793
5. Electricity Charges		1,553,665	86,953	82,031	1,640,618
6. Arrears of Electricity Charges					0
7. Gas Charges		23,337			23,337
8. Repair and Maintenance /Improvement		90,841	54,412	15,533	160,786
9. Water Supply through Tankers					0
10. Vehicles Running Expenses		19,299	5,977	12,568	37,844
11. Printing and Stationary		710	119	4,492	5,321
12. Medical		0	0	60,902	60,902
13. Utilities		2,744	724	1,108	4,577
14. Miscellaneous		1,178	770	13,729	15,677
Sub-total		2,246,104	361,935	371,873	2,897,881
Indirect Expenditure (Rs.1000)					
15. Auditor' Remuneration					
16. Bad Debts Expenses		113,445	19,186	0	132,630
17. Depreciation		709,430	155,550	206	865,186
Sub-total		822,874	174,736	206	997,817
Ordinal Expenditures		3,068,978	536,671	372,080	3,895,698
Ratio of Sector		79%	14%	10%	100%
Financial Charges (Rs.1000)					
18. Non-operating Revenue		53,409	9,340	6,475	67,796
19. Non-operating Expenditure		932,282	163,028	113,029	1,183,420
20. Accrued Financial Charges (Long-term)		133,961	23,426	16,241	170,048
21. Accrued Financial Charges (Short-term)		837,278	146,414	101,511	1,062,823
Sub-total of Financial Expenditures		1,850,113	323,528	224,306	2,348,495
Grand Total (Rs.1000)					
Ordinal Expenditures		3,068,978	536,671	372,080	3,977,729
Ordinal & Current Financial Expenditures		3,947,852	690,359	478,633	5,116,844
Entire Total Expenditure		4,919,091	860,199	596,385	6,375,675
Adjusted Cost (Rs.1000)					
(a) Ordinal Expenditures with Overhead Expenditure		3,385,677	592,052		17.5%
(b) Ordinal & Current Financial Expenditures		4,355,245	761,600		17.5%
(c) Entire Total Expenditure		5,426,709	948,966		17.5%
(d) Entire Total Expenditure (w/o Depreciation & Financia		2,676,078	436,464		16.3%
Supplied Water in 2004-05					
Water Source	mgd	540			
Loss (35%)	mgd	189			
Water Consumption	mgd	351			
Water Consumption	mgy	128,115			
Water Production Cost					
(a) Ordinal Expenditures	Rs./1000 gallon	26.4			
(b) Ordinal & Current Financial Expenditures		34.0			
(c) Entire Total Expenditure	Rs./1000 gallon	**42.4**			
(d) Entire Total Expenditure (w/o Depreciation & Fin		**20.9**			
Sewer Treatment Cost	mgy		89,681		
(a) Ordinal Expenditures	Rs./1000 gallon		6.6		25.0%
(b) Ordinal & Current Financial Expenditures			8.5		25.0%
(c) Entire Total Expenditure	Rs./1000 gallon		**10.6**		25.0%
(d) Entire Total Expenditure (w/o Depreciation & Financial Charges			**4.9**		
Actual Revenue of KW&SB Services: 2004-05					
Total of Revenue (w/o Bad De	Rs. Million	2,232	420		
Unit Price	Rs./1000 gallon	**17.4**	**4.7**		26.9%

Remark: *1 Electric expenditure was segregated into the following ratio: 94.7% for water, 5.3% for sewerage and 5.0% for administration.

*2 Sewage volume was set as 70% of Water Consumption.

Table A112.2.2 Construction Cost of Individual Water Supply System

1. Type 2 (Low and Lower Middle Income Group)

Description	Unit*1	Rate*1 (Rs./Unit)	Type 2 Receiving Tanks Quantity	Type 2 Receiving Tanks Total (Rs.)	Additional Well System Quantity	Additional Well System Total (Rs.)
(1) Boring for tube well	R. Feet	91.50	-	0	75	6,863
(2) Laying PVC pipes of class "B"	R. Feet	1.88	150	282	50	94
(3) Pump with 0.5 Hp	Nos.	5,000	1	5,000	1	5,000
(4) Water tanks (6'×6'×6')	Nos.	40,000	1	40,000	0	0
(5) Water tanks (4.5'×4.5'×4.5')	Nos.	30,000	1	30,000	0	0
Total				75,282		11,957
Price adjustment*2				20%		20%
Total Cost Adjusted				90,274		14,338

2. Type 3 (Upper Middle Income Group)

Description	Unit	Rate*1 (Rs./Unit)	Type 3 Receiving Tanks Quantity	Type 3 Receiving Tanks Total (Rs.)	Additional Well System Quantity	Additional Well System Total (Rs.)
(1) Boring for tube well	R. Feet	91.50	-	0	75	6,863
(2) Laying PVC pipes of class "B"	R. Feet	1.88	200	376	75	141
(3) Pump with 0.5 Hp	Nos.	5,000	1	5,000	1	5,000
(4) Water tanks (6'×6'×6')	Nos.	40,000	2	80,000	0	0
(5) Water tanks (4.5'×4.5'×4.5')	Nos.	30,000	-	0	-	0
Total				85,376		12,004
Price adjustment*2				20%		20%
Total Cost Adjusted				102,378		14,394

3. Type 4 (High Income Group)

Description	Unit	Rate*1 (Rs./Unit)	Type 4 Receiving Tanks Quantity	Type 4 Receiving Tanks Total (Rs.)	Additional Well System Quantity	Additional Well System Total (Rs.)
(1) Boring for tube well	R. Feet	91.50	-	0	100	9,150
(2) Laying PVC pipes of class "B"	R. Feet	1.88	300	564	100	188
(3) Pump with 0.5 Hp	Nos.	5,000	2	10,000	1	5,000
(4) Water tanks (6'×6'×6')	Nos.	40,000	3	120,000	1	40,000
(5) Water tanks (4.5'×4.5'×4.5')	Nos.	30,000	-	0	-	0
Total				130,564		54,338
Price adjustment*2				20%		20%
Total Cost Adjusted				156,565		65,159

Remark: *1 Unit rates KW&SB in 2004 were applied for estimate..

*2 Including fixing works

*3 Price index (WPI) was 121.82 in Dec. 2004 and 146.08 in Dec. 2006.

Table A112.2.3 Annual O&M Cost of Individual Water Supply System and Well Installation

1. Type 2 (Middle Income Group)

Item	Tank System	Add. Well System
1. Installation Cost of Well System with Pump (Rs.)	90,274	14,338
2. Annual Costs for Water of Domestic Use (Rs./year)		
1) Annualized Equipment Costs (Invisible Costs) *1		
a. Facilities except Pump	11,283	1,116
b. Pump	1,062	1,062
2) O&M cost		
a. Electricity (Visible Costs)*2	938	0
b. Maintenance (Invisible Costs)*3	903	143
Total	14,185	2,322

2. Type 3 (Upper Middle Income Group)

Item	Tank System	Add. Well System
1. Installation Cost of Well System with Pump (Rs.)	102,378	14,394
2. Annual Costs for Water of Domestic Use (Rs./year)		
1) Annualized Equipment Costs (Invisible Costs) *1		
a. Facilities except Pump	12,903	1,124
b. Pump	1,062	1,062
2) O&M cost		
a. Electricity (Visible Costs)*5	1,059	0
b. Maintenance (Invisible Costs)*3	1,024	144
Total	16,048	2,330

3. Type 4 (High Income Group)

Item	Tank System	Add. Well System
1. Installation Cost of Well System with Pump (Rs.)	156,565	65,159
2. Annual Costs for Water of Domestic Use (Rs./year)		
1) Annualized Equipment Costs (Invisible Costs) *1		
a. Facilities except Pump	19,354	7,920
b. Pump	2,124	1,062
2) O&M cost		
a. Electricity (Visible Costs)*6	1,165	0
b. Maintenance (Invisible Costs)*3	1,566	652
Total	24,209	9,634

Remark *1 In order to calculate annualized costs, Capital Recovery Factor (CRF) is applied on condition that an economic life (n) is 10 years for pump and 20 years for other equipment, and an interest rate (r) is 12%. Applying the formula of CRF = r/(1-1/(1+r)^n), the CRFs were calculated at 0.277 and 0.177, respectively.

*2 (89-2) lit/capita/day × 9.4 persons/family / 1,000 lit/h × (0.5Hp*0.746)/ 60% × 365 days/year × Rs.5/kWh (Volume of well water (lit/HH/month))/ 1,000 lit/h × (0.5Hp*0.746)/60% × 12 months × Rs.5/kWh

*3 Assumed at the 1% of equipment costs in a year

*4 Percentage of well system owner: 28% of lower; 13% of Upper Middle and 5% of High groups

*5 (104-2) lit/capita/day × 9.0 persons/family / 1,000 lit/h × (0.5Hp*0.746)/ 60% × 365 days/year × Rs.5/kWh (Volume of well water (lit/HH/month)) / 1,000 lit/h × (0.5Hp*0.746)/60% × 12 months × Rs.5/kWh

*6 (133-2) lit/capita/day × 7.7 persons/family / 1,000 lit/h × (0.5Hp*0.746)/ 60% × 365 days/year × Rs.5/kWh (Volume of well water (lit/HH/month))/ 1,000 lit/h × (0.5Hp*0.746)/60% × 12 months × Rs.5/kWh

Table A112.2.4 Domestic Water Consumption by Water Source and by Income Level

Item	Type 1 Low Income	Type 2 Middle Income	Type 3 Upper Middle Income	Type 4 High Income
I. Percentage Distribution of Water Consumption by Water Source*1				
1. Drinking Water				
(1) Bottled Water	2	9	12	26
(2) Piped Water	60	67	80	69
(3) Piped Water (Shared)	6	3	2	2
(4) Water Tanker	18	4	1	3
(5) Water Carried by Seller	2	3	1	0
(6) Public Water Storage	3	1	2	0
(7) Well/Bore	7	11	1	0
(8) Others	2	2	1	0
Total	100	100	100	100
2. Other Usages				
(1) Bottled Water	0	0	0	0
(2) Piped Water	59	62	83	91
(3) Piped Water (Shared)	5	4	2	0
(4) Water Tanker	19	6	4	5
(5) Water Carried by Seller	3	1	1	0
(6) Public Water Storage	3	1	0	0
(7) Well/Bore	11	26	10	4
(8) Others	0	0	0	0
Total	100	100	100	100
II. Monthly Water Consumption in Master Plan				
1. Average Number of Person per Household	9.4	9.3	9.0	7.7
2. Per Capita Consumption (lit/capita/day) *2	55	89	104	133
3. Monthly Consumption (lit/Household/month)	15,586	24,803	28,004	30,806
III. Monthly Water Consumption by Water Source				
1. All Usage (lit/HH/month)				
(1) Bottled Water	11	50	65	120
(2) Piped Water	9,201	15,406	23,227	27,932
(3) Piped Water (Shared)	785	987	559	9
(4) Water Tanker	2,956	1,477	1,104	1,531
(5) Water Carried by Seller	462	259	282	0
(6) Public Water Storage	468	248	10	0
(7) Well/Bore	1,692	6,365	2,752	1,214
(8) Others	11	11	7	0
Total	15,586	24,803	28,006	30,806
	15,600	**24,800**	**28,000**	**30,800**
(9) Water Boiled for Drinking	553	508	475	342

Remark: *1 Refer to "Water Awareness Survey", by JICA Study Team in 2006
*2 Unit Water Consumption Rate in 2005
*3 In terms of water consumption of income level, the survey results of "Water Awareness Survey" was assumed to correspond to the respective household types above as follows.

Income Level	Type 1 Low Income	Type 2 Middle Income	Type 3 Upper Middle Income	Type 4 High Income
Water Awareness Survey	Katchi Abadis	Low &Lower Middle Income Group	Upper Middle Income Group	High Income Group

Table A112.2.5 Water Procurement Cost by Water Source and by Income Level

Item	Type 1 Low Income	Type 2 Middle Income	Type 3 Upper Middle Income	Type 4 High Income
I. Monthly Water Consumption by Water Source				
1. All Usage (lit/HH/month)				
(1) Bottled Water	11	50	65	120
(2) Piped Water	9,201	15,406	23,227	27,932
(3) Piped Water (Shared)	785	987	559	9
(4) Water Tanker	2,956	1,477	1,104	1,531
(5) Water Carried by Seller	462	259	282	0
(6) Public Water Storage	468	248	10	0
(7) Well/Bore	1,692	6,365	2,752	1,214
(8) Others	11	11	7	0
Total	**15,586**	**24,803**	**28,006**	**30,806**
(9) Water Boiled for Drinking	553	508	475	342
II. Monthly Water Cost for Water Sources Procurement (Rs./Month)				
1. Water Purchasing Cost	475	688	820	1,389
(1) Bottled Water*1	180	494	637	1,181
(2) Piped Water*2	38	63	91	107
(3) Spot Market Water*3	256	131	92	101
2. Water Boiling for Drinking Purpose*4	31	28	27	19
4. Water Fetching Cost*5	23	23	23	0
Total	529	739	870	1,408
III. Annual Water Cost for Water Procurement including Receiving Tank Water System (Rs./Year)				
1. Water source costs	6,343	8,862	10,435	16,901
2. Annualised Instalment and O&M Costs of Domestic Tank System				
(1) Water domestic plumbing system*	4,929	11,135	14,603	23,361
Annual Cost	7,093	14,185	16,048	24,209
Installation Rate	70%	79%	91%	97%
(2) Well system	163	650	303	482
Annual Cost	1,161	2,322	2,330	9,634
Installation Rate	14%	28%	13%	5%
Total	11,435	20,648	25,341	40,744
IV. Unit Water Procurement Cost on Average (Rs./CM)				
1. Annual consumption (m^3/Household/Y	187	298	336	370
2. Annual procurement cost (Rs/year)	11,435	20,648	25,341	40,744
3. Unit procurement cost (Rs./m^3)	61	69	75	110
4. **Unit Procurement Cost in Economic Value**				
(Rs./m^3 in Economic Value)	**54**	**61**	**66**	**97**
(Rs./1000 gallon in Eco. Value)	**245**	**278**	**302**	**441**

Note:
*1 Costs of bottled water: Rs.75/4.5 gallons for container type and Rs.24/1.5 litre for pet bottle type
*2 Unit Price of Piped water in 2004-05: Rs.17.4/1000 gallon
*3 Water costs though water tanker: Rs.300/1000 gallon
*4 Energy consumption for boiling of one litre water: 1 litre * (100℃ - 25℃) = 75 kcal/litre
Gas consumption cost for boiling:
75 kcal/lit / 8,300kcal/CM / 50%(efficiency of boiling kettle) * Rs.3.10.CM = Rs.0.056/liter
*5 Water fetching cost is considered as family labour has to procure water source from source places.
Minimum wage 250 Rs./day / 8 hrs/day = 32 Rs./hr
Assumed as a half of the above rate for economically inactive persons: 15 Rs./hr
*6 Cost of Type 1 was assumed as 50% less of that of Type 2.
*7 SCF to economic value is calculated at 90% of market prices.

Table A112.2.6 Gas Tariff for Domestic Use: 2007

No.	Tier	Cubic Meters per Month	Rs. Per MMBTU	Rs./m^3
1.	First Slab	Up to 50 m^3	85.03	2.80
2.	Second Slab	Over 50, up to 100 m^3	89.03	2.93
3.	Third Slab	Over 100, up to 200 m^3	162.07	5.33
4.	Fourth Slab	Over 200, up to 300 m^3	259.29	8.53
5.	Fifth Slab	All Over 300 m^3	337.3	11.10

Note: Minimum charges Rs114.69 per month (around 41m^3/month)

Remark. Calorie content of city gas (Sui Southern Gas Company Ltd) is 931.91 BTU/cf (8,300kcal/m^3).

Figure A112.2.1 Gas Tariff for Domestic Use: 2007

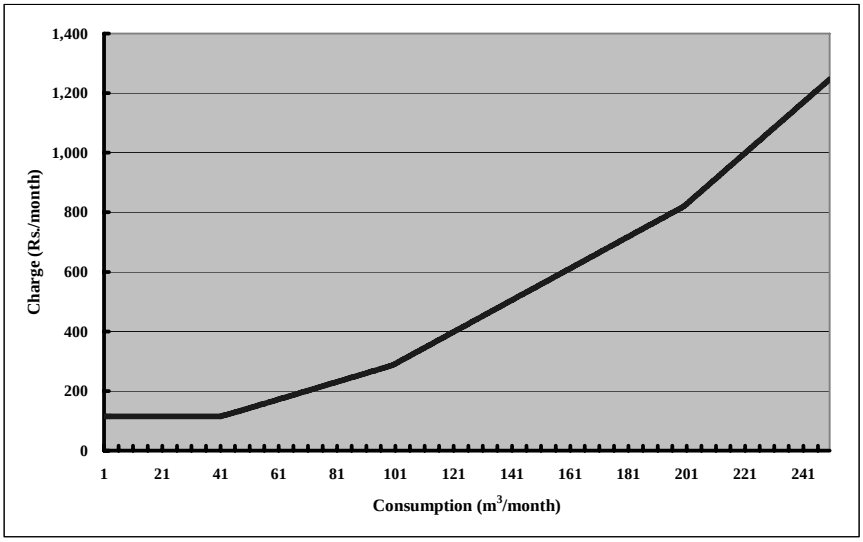


Table A112.2.7 (1) Statistic Data of Industrial Types in Sindh Province: 2000-01

No.	Industry Code	Industrial Type	Number of Reporting Establishments (Nos)	Value of Fixed Assets at End of Year (Rs.Million/Year)	Average daily Employees (Nos)	Employment Cost (Rs.Million/Year)	Industrial Cost (Rs.Million/Year)	Value of Production (Rs.Million/Year)	Value Added (VA) (Rs.Million/Year)
1.	311&312	Food Manufacturing	424	20,287	31,270	3,012	43,084	62,600	19,516
2.	313&314	Beverage Industries & Tobacco Manufacturing	15	1,071	2,751	260	3,342	10,960	7,618
3.	320&321	Manufacturing of Textiles	417	36,078	92,219	6,963	71,799	102,907	31,108
4.	322	Wearing Apparel	156	5,446	27,686	2,611	17,632	24,621	6,989
5.	323	Leather & Leather Products	33	1,141	5,596	641	7,140	10,698	3,558
6.	324	Foot-wear Except Rubber or Plastic	4	98	461	53	1,176	1,628	452
7.	325	Ginning &Baling of Fibres (Cotton)	113	1,103	8,186	280	17,278	26,110	8,832
8.	331&332	Wood, Wood Products & Furniture not Metal	19	368	888	86	2,221	2,740	519
9.	341	Paper & Paper Products	29	315	866	99	946	1,595	649
10.	342	Printing &Publishing	42	880	2,499	358	1,421	2,365	945
11.	350	Drugs & Pharmaceutical Products	71	4,395	14,216	4,078	18,141	34,964	16,823
12.	351	Industrial Chemicals	37	35,191	4,375	1,590	20,397	34,402	14,005
13.	352	Other Chemical Products	55	1,116	4,199	861	6,621	10,299	3,678
14.	353&354	Petroleum Refining & Products of Petroleum & Coal	8	3,374	2,406	869	76,043	93,701	17,657
15.	355	Rubber Products	15	328	2,529	263	1,577	2,952	1,375
16.	356	Plastic Products	41	3,642	2,385	315	4,952	6,131	1,179
17.	362	Glass & Glass Products	10	341	1,360	141	581	1,106	526
18.	369	Other Non-metallic Mineral Products	29	4,602	4,500	656	4,529	7,977	3,449
19.	371	Iron & Steel	36	33,371	19,232	3,851	10,634	26,602	15,967
20.	372	Non-ferrous Metal Basic Industries	4	61	430	15	99	295	196
21.	380&381	Fabricated Metal Products	60	2,679	4,101	485	3,656	6,042	2,386
22.	382	Non-electrical Machinery	31	2,664	4,928	662	1,538	2,629	1,092
23.	383	Electrical Machinery & Supplies	36	2,181	5,986	1,391	11,394	19,513	8,118
24.	384	Transport Equipment	49	7,612	14,090	2,650	29,177	39,862	10,685
25.	385&386	Scientific, Measuring Instruments, Photographic & Optical Goods	6	129	405	162	621	1,142	521
26.	391, 393&394	Handicrafts & Other Manufacturing	28	343	1,703	176	974	1,545	571
		Total	1,768	168,816	259,267	32,526	356,972	535,387	178,415

Source: Summary of Manufacturing Industry 2000-2001, Federal Bureau of Statistics, Statistics Division, GOP

Table A112.2.7 (2) Estimated Water Demand by Manufacturing Industry: 2007

No.	Industry Code	Industrial Type	Value Added (VA) (Rs.Million/Year)	VA in 2007*1 (Rs.Million/Year)	mount of Make-up Fresh Water per V (m3/day per Y100 Million*2)	(m3/day per Rs.100 Million)	Water Demand by Industry (m^3/day)	Water Demand by Industry (1000 gallon/day)
1.	311&312	Food Manufacturing	19,516	28,239	36.8	73.5	20,762	4,567
2.	313&314	Beverage Industries & Tobacco Manufacturing	7,618	11,023	29.1	58.1	6,407	1,409
3.	320&321	Manufacturing of Textiles	31,108	45,014	170.8	341.6	153,777	33,827
4.	322	Wearing Apparel	6,989	10,113	11.5	23.1	2,332	513
5.	323	Leather & Leather Products	3,558	5,148	65.2	130.5	6,716	1,477
6.	324	Foot-wear Except Rubber or Plastic	452	654	7.0	14.0	92	20
7.	325	Ginning &Baling of Fibres (Cotton)	8,832	12,780	383.1	766.2	97,922	21,540
8.	331&332	Wood, Wood Products & Furniture not Metal	519	752	11.0	22.0	166	36
9.	341	Paper & Paper Products	649	938	367.1	734.1	6,889	1,515
10.	342	Printing &Publishing	945	1,367	3.6	7.2	99	22
11.	350	Drugs & Pharmaceutical Products	16,823	24,343	14.1	28.1	6,840	1,505
12.	351	Industrial Chemicals	14,005	20,265	71.5	143.1	28,996	6,378
13.	352	Other Chemical Products	3,678	5,322	57.4	114.7	6,106	1,343
14.	353&354	Petroleum Refining & Products of Petroleum & Coal	17,657	25,550	170.7	341.4	87,219	19,186
15.	355	Rubber Products	1,375	1,990	18.2	36.3	722	159
16.	356	Plastic Products	1,179	1,706	28.1	56.1	958	211
17.	362	Glass & Glass Products	526	761	25.3	50.6	385	85
18.	369	Other Non-metallic Mineral Products	3,449	4,990	34.7	69.5	3,467	763
19.	371	Iron & Steel	15,967	23,104	94.5	189.0	43,658	9,604
20.	372	Non-ferrous Metal Basic Industries	196	283	49.7	99.4	282	62
21.	380&381	Fabricated Metal Products	2,386	3,453	13.1	26.3	907	200
22.	382	Non-electrical Machinery	1,092	1,580	5.4	10.8	171	38
23.	383	Electrical Machinery & Supplies	8,118	11,747	6.7	13.4	1,569	345
24.	384	Transport Equipment	10,685	15,461	5.5	11.0	1,707	375
25.	385&386	Scientific, Measuring Instruments, Photographic &	521	754	7.2	14.5	109	24
26.	391, 393&394	Handicrafts & Other Manufacturing	571	826	4.9	9.9	81	18
		Total	178,415	258,167			478,339	105,222
		Simple Average (per establishment)	101	146			271	60

Note: *1 Applied WPI between 144.7 in 2007 and 100.0 in 2000-01.
*2 Unit Requirement for Location of Manufacturing Industry, Classified by Industrial Type, March 2006, Japan Industrial Location Centre
(Establishments Employing the Number of 30 or More Workers as of 1986)

Table A112.2.8 Water Procurement Cost through Well System in Manufacturing Industry

Description	Unit*1	Quantity	Total Cost
I. Installation Investment Cost (Rs.1000)			
1. Boring for tube well (250mm × 100m)			1,560
2. Pump with 11kW			440
with electricity system			
3. Water tanks (135m^3)			490
Total			2,490
II. Annual O&M Costs for Water (Rs./year)			
1. O&M cost			
(1) Electricity			24,090
(2) Repair & Maintenance			24,900
(3) Compensation			53,400
(4) Miscellaneous			10,239
Sub-total			112,629
2. Annualized Equipment Costs			
(1) Well System			193,664
(2) Pump System			64,603
(3) Water Tanks			60,830
Sub-total			319,097
Total			**431,726**
			431,700
III. Water Consumption through Well System		Sindh Province	Karachi City
1. Number of Reporting Establishment	Nos.	1,768	1,218
2. Value Added during Year*1	Rs. Million	174,693	124,935
3. Daily Water Consumption*2	m^3/day	478,339	342,093
4. Daily Water Consumption per Establishment	m^3/day	271	281
5. Daily Water Consumption from Well System	m^3/day	13.5	14.0
IV. Unit Cost of Well Water System in Karachi City			
(1) Annual Water Consumption from Well System	m^3/year		5,126
(2) Annualised Investment & O&M Costs of Well S	Rs.1000/year		431,700
(3) Unit Procurement Cost	Rs./m^3		84.2
V. Water Procurement Cost of Well System in Karachi City			
(1) Annual Water Consumption			
1) Piped Water	m^3/year		97,390
2) Well Water	m^3/year		5,126
Total	m^3/year		102,515
(2) Water Procurement Cost			
1) Piped Water	Rs./m^3		373,238
2) Well Water	Rs./m^3		431,700
Total	Rs./m^3		804,938
IV. Unit Water Procurement Cost on Average (Rs./CM)			
1. Annual consumption (m^3/Establishment/Yr)			102,515
2. Annual procurement cost (Rs/year)			804,938
3. Unit procurement cost (Rs./m^3)			7.9
4. **Unit procurement cost**			
(Rs./m^3 in Economic Value)			**6.9**
(Rs./1000 gallon in Economic Value)			**31.4**

Note: *1 Data from "Development Statistics of Sindh 2004" Sep. 2004, Bureau of Statistics GOS, which were different from the national statistical data

*2 Water consumption was calculated applying the ratio of the city's VA over the national VA.

Table A112.2.9 Negative Benefits of Domestic Water Supply System by Residential Type

Item	Type 1 Low Income	Type 2 Middle Income	Type 3 Upper Middle Income	Type 4 High Income
I. Investment Cost				
1. Investment Cost of Domestic Water System (Rs./Household)				
(1) Water system	32,183	72,700	95,343	196,594
Initial investment cost	46,306	92,612	104,772	203,725
Installation rate	70%	79%	91%	97%
(2) Well system*1	840	3,360	1,560	900
Initial investment cost	6,000	12,000	12,000	18,000
Installation rate	14%	28%	13%	5%
Total	33,023	76,060	96,903	197,494
II. Negative Benefit (Rs./Household) *2				
1. Negative Benefit in Market Price	16,511	38,030	48,451	98,747
2. **Unit Negative Benefit (In Economic Value)**	**14,500**	**33,500**	**42,600**	**86,900**

Note: *1 Since the economic life of pump system was five years, the annualised value was assumed to be a half of the original in order to coordinate with water system of 10 years' economic life.
*2 Negative benefit is assumed to be a half of the investment cost.

Table A112.2.10 Negative Benefit of Non-Domestic Water Supply System in Manufacturing Factory

Item	Type 1 Low Income	Type 2 Middle Income	Type 3 Upper Middle Income	Type 4 High Income
I. Monthly Water Consumption by Water Source	Cost	Economic Life	Life Time Cost	
1. Investment Cost of Non-domestic Water System (Rs.1000/Establishment for 30 years life)				
(1) Boring for tube well (250mm × 100m)	1,560	30	1,560	
(2) Pump with 11kW	440	15	880	
(3) Water tanks (135m^3)	490	30	490	
Total	2,490		**2,930**	
II. Negative Benefit				
1. Negative Benefit in Market Price (Rs. 1000/Establishment)*1			1,465	
2. Annual consumption (m^3/Establishment/Year)			102,515	
3. Negative Benefit per Water Consumed in the Year Water Served (Rs./m^3)			14.3	
4. **Negative Benefit in Economic Value**				
Rs./m^3 in Economic Value			**13.0**	
Rs./1000 gallon in Economic Value			**59.0**	

Note: *1 Negative benefit is assumed to be a half of the investment cost.

Table A112.2.11 Number of Outpatients and Inpatients in Karachi City: 2005

S/No.	Item	Male	Female	Total
	Number of Patients Treated*1			
	Number of Indoor Patients	106,003	132,319	238,322
	Number of Outdoor Patients			
	New Cases	2,581,712	2,851,314	5,433,026
	Old Cases	198,342	258,652	456,994
	Total	2,780,054	3,109,966	5,890,020
	Population			15,119,835
	Morbidity Rate			
	Inpatient (times/100,000 population)			1,576
	Outpatient (Visits/1,000 population)			390
	Morbidity Rate of Water Borne Diseases			
	Inpatient (times/100,000 population)			173
	Outpatient (Visits/1,000 population)			43

Source: Health Department, GOS, February 2007

Note: *1 The number of patients covers only the cases by the public medical institutions.

Table A112.2.12 Number of Hospitals and their Beds in Karachi City

	Serial #	Name of Hospital	Class	Bed Strength
Public & Semi-public Hospitals				
1.	169	Sindh Govt. Hospital Korangi	I	100
2.	171	Sindh Govt. Behbehani Hospital	I	100
3.	172	Sindh Govt. hospital Ibrahim Hydri	I	86
4.	173	Shaikh Khalifa Bin Hamad Al-Thani	I	260
5.	174	Civil Hospital Karachi	I	1,703
6.	175	Institute of Urology & Kidney	I	146
7.	176	Sindh Govt. Lyari Gen: Hospital Karachi	I	350
8.	178	Sindh Govt. Hospital Liaquatabad Karachi	I	100
9.	179	Sindh Govt. Hospital New Karachi	I	50
10.	180	P.I.A. Hospital K.D.A. Scheme No.1 Karachi	II	75
11.	184	Services Hospital Karachi	II	100
12.	185	Police Hospital Karachi	II	50
13.	186	Port Trust Hospital Karachi	II	196
14.	187	Pak: Railway Hospital Karachi	II	175
15.	188	Central Prison Hospital Karachi	II	56
16.	191	Lyari Hospital Karachi	III	35
17.	192	Cantonment Hospital Jet Line Karachi	III	10
18.	193	K.M.C. Abbasi Shaheed Hospital Karachi	III	570
19.	195	K.M.C. Homeopathic Hospital	III	15
20.	211	Landhi Korangi Hospital K-Area Korangi Kyc.	V	15
21.	218	Muhammad Qasim Hospital Port Qaxim	V	200
		Sub-Total		4,392
Private Hospital				
1.	170	Ojha Institute of Chest Diseases Karachi	I	350
2.	177	Skin and Social Hygiene Centre Karachi	I	50
3.	181	SESSI Hospital Landhi	II	182
4.	182	Juvenile Hail Hospital Landhi Karachi	II	16
5.	183	SESSI K.V. Hospital Site Area Karachi	II	335
6.	189	Leprosy Hospital Manghopir Karachi	III	225
7.	190	Spencer Eye Hospital Karachi	III	156
8.	194	S.R.S. Hospital Karachi	III	98
9.	196	Medicare Clinic	V	128
10.	197	Shan Hospital	V	100
11.	213	Taj Medical Complex	V	150
12.	214	Sea Breas Hospital	V	150
13.	216	Cardiac Hospital	V	186
14.	217	Liaquat National Hospital	V	560
15.	219	Agha Khan Hospital and Medical College	V	302
16.	259	Murshid Hospital Karachi	V	110
17.	261	Lady Different Hospital	V	175
18.	262	Charania Hospital	V	177
19.	263	Holy Family Hospital	V	225
20.	264	Karachi Adventist Hospital	V	153
21.	265	Gul Bano & Dr. Furhor Ahkai Saria Nursing Home	V	148
22.	266	Mid East Med: Centre Khayaban-e-Iqbal	V	105
23.	267	Masoomeen Hospital	V	101
24.	268	Volunteer Free Hospital & Maternity Home	V	100
25.	269	Sindh Medical Centre Hilal Ahmer House	V	100
26.	297	Baqai Hospital	V	309
27.	298	Imam Zainul Abddin Hospital	V	140
28.	299	Asghar General Hospital	V	100
		Other 112 Hospitals in Karachi	V	3,362
		Sub-Total		8,293
		Total of Beds		**12,685**
		Total of Hospitals		**161**
		Average Number of Beds per Hospital		**79**
		Population in Karachi in 2005		**15,119,835**
		Population per Hospital Bed		**1,192**
		Population per Hospital		**93,912**
		Ratio of Private Hospital Beds to Public Beds		**1.9**

Source: Health Department, GOS, February 2007

Table A112.2.13 Yearly Morbidity and Mortality Statistics from Hospitals, Dispensaries/Outpatient Department in Civil Hospital Karachi: 2005

S/No	Name of Disease and Injuries	No. of New Cases
1	**Intestinal Infectious Diseases**	37,121
2	Tuberculosis	12,896
3	**Other Bacterial Diseases**	24,124
4	**Viral Diseases**	13,621
5	Rickettsiosis and Other Arthropoborne Diseases	0
6	**Venereal Diseases**	735
7	Other Infectious and Parasitic and Late Effects of Infectious a	0
8	Malignant Neoplasm of Lip, Oral Cavity and Pharynx	57,016
9	Malignant Neoplasm of Digestive Organs and Peritoneum	1,103
10	Malignant Neoplasm of Respiratory and Intrathoracic Organs	861
11	Malignant Neoplasm of Bone, Connective tissue, Skin and Br	503
12	Malignant Neoplasm of Genitourinary or Organs	498
13	Malignant Neoplasm of Other and Unspecified Sites	701
14	Malignant Neoplasm of Lymphatic and Haemopoietic Tissue	362
15	Benign Neoplasm	329
16	Carcinoma in Situ	0
17	Other and Unspecified Neoplasm	0
18	Endocrine and Metabolic Diseases Immunity Disorders	72,101
19	Nutritional Deficiencies	520
20	Diseases of Blood and Blood forming Organs	9,201
21	Mental Disorders	7,019
22	Diseases of the Nervous System	30,968
23	Disorders of the Eye and Adnexa	28,109
24	Diseases of the Ear and Mastoid Process	1,203
25	Rheumatic Fever and Rheumatic Hear Diseases	15,301
26	Hypertensive Diseases	20,561
27	Ischemic Heart Diseases	19,703
28	Diseases of Pulmonar Circulation & Other Forms of Heart Di	19,098
29	Cerebrovascular Diseases	2,206
30	Other Diseases of Circulatory System	2,164
31	Diseases of the Upper respiratory Tract	46,846
32	Other Diseases of the Respiratory System	60,388
33	Diseases of Oral Cavity, Salivary Glands and Jaws	4,341
34	Diseases of Other Parts of the Digestive System	26,491
35	Diseases of Urinary System	21,712
36	Diseases of Male Genital Organs	2,908
37	Diseases of Female Genital Organs	2,981
38	Abortion	1,710
39	Direct Obstetric Causes	823
40	Indirect Obstetric Causes	1,232
41	Normal Delivery	4,692
42	Diseases of Skin and Subcutaneious Tissue	48,232
43	Diseases of Musculskeletal System and Perinatal Period	19,540
44	Congenital Anomalies	716
45	Certain Conditions Originating in the Perinatal Period	648
46	Signs, Symptoms & III-defined Conditions (Undiagnosed)	47,101
47	Fractures	2,901
48	Dislocations, Sprains and Strains (of Joints and Muscles)	2,604
49	Intracranial and Internal Injuries Including Nerves	2,207
50	Open Wounds and Injury to Blood Vessels	947
51	Effects of Foreign Body Entering through Orifice	9,409
52	Bums	698
53	Poisonings and Toxic Effects	1,029
54	Complications Medical and Surgical Care	691
55	Other Injuries, Early Complication of Trauma	597
56	Late Effects of Injuries, of Poisonings, Effects and Other exte	0
	Total	689,468
	Total of Water Borne Diseases	75,601
	Rate of Water Borne Diseases to All Diseases	**11%**
	Incomplete Entries	250,798
	Total of New Cases	800,163
	Total of Old Cases	140,103
	Grand Total (New and Old Cases)	940,266

Source: Yearly Morbidity and Mortality Statistics from Hospitals, Dispensary/Out Patient Department, February 2007, Health Department, Gov. of Sindh

Table A112.2.14 Statement Depicting Patients Position for the Year 2006

No.	Name of Ward, Operation Theatre (OT) and Outpatient Department (OPD)	Number of Patients Operated	Number of Operation	Authorised Beds	New Admissions	Inpatients Treated	Patients Stay in Days
1.	Burns Centre	3,755		60	491	11,121	23
2.	Plastic Surgery	3,089	596	25	247	6,295	25
3.	Chest Clinic	23,910		-	-	-	-
4.	Cancer OPD	3,238		-	24	315	13
5.	Casualty	251,813		60	-	-	-
6.	Cardiology & CCU	19,576		63	987	9,876	10
7.	Cardiac Surgery	-	256	13	94	3,764	40
8.	Dental Surgery (OMFS)	31,552	271	11	215	3,231	15
9.	E.N.T.-1	28,044	1,570	40	1,167	16,890	14
10.	E.N.T.-2	28,720	1,417	40			
11.	Emergency Operation Theatre		2,335		-	-	-
12.	Eye-1	16,244	569	25	271	2,276	8
13.	Eye-2	16,729	576	25	249	2,947	12
14.	Gynace Emergency OT	-	2,839		-	-	-
15.	Gynace-1	19,724	676	50	2,812	11,080	4
16.	Gynace-2	17,121	780	50	3,877	11,166	3
17.	Gynace-3	19,903	660	50	1,565	11,996	8
18.	Isolation	-	-	25	221	1,306	6
19.	Medical-1	31,938		50	887	11,052	12
20.	Medical-2	28,220		50	1,282	11,339	9
21.	Medical-3	25,757		50	1,197	10,878	9
22.	Medical-4	25,345		50	880	11,310	13
23.	Medical-5	19,504		50	1,254	11,673	9
24.	Neurology	9,687		40	383	7,245	19
25.	Neuro CCU			-	180	2,076	12
26.	Neuro Surgery	7,389	456	40	700	10,324	15
27.	Ortho-1	25,223	1,078	50	693	18,051	26
28.	Ortho-2	24,820	1,272	62	951	18,088	19
29.	Ortho Gen.	9,728		-	-	-	-
30.	Paeds Surgery	3,460	569	30	321	3,335	10
31.	Paeds-1	28,010		50	670	9,514	14
32.	Paeds-2	21,786		50	638	5,203	8
33.	Paeds-3	28,215		50	1,050	12,467	12
34.	Paeds Nursery	-		20	1,075	4,754	4
35.	Physiotherapy	19,473		-	-	-	-
36.	Psychiatry	7,834		50	255	5,266	21
37.	Skin Ward	83,586		36	169	4,250	25
38.	Surgical-1	8,878	711	50	1,002	9,893	10
39.	Surgical-2	7,245	900	50	1,075	9,581	9
40.	Surgical-3	6,655	742	50	618	7,214	12
41.	Surgical-4	5,863	886	50	527	9,739	18
42.	Surgical-5	4,200	769	50	710	8,029	11
43.	Surgical-6	7,788	648	50	512	9,199	18
44.	Surgical ICU	-		13	420	1,483	4
45.	Vascular Surgery	-	225	30	100	4,178	42
46.	Diabetic	14,594	-	-	-	-	-
47.	Beds Reserved			150			
	Total	938,616	20,801	1,758	29,769	308,404	10

Source: Civil Hospital Karachi, GOS, February 2007

Table A112.2.15 Expenditure for General Hospital Services of Civil Hospital Karachi: 2005-06 and 2006-07

(Unit: Rs.1000)

Code	Description	No. of Posts 2005-06	2005-2006 Revised Estimates	2006-2007 Budget
A01	**Employees Related Expenses**		**516,117**	**553,525**
A011	Pay	2,673	271,636	282,836
A011-1	Pay of Officer	889	153,578	158,597
A011-2	Pay of Other Staff	1,784	118,058	124,239
A012	Allowances		244,482	270,689
A012-1	regular Allowances		242,182	268,189
A012-2	Other Allowances (excl. TA)		2,300	2,500
A03	**Operating Expenses**		**223,526**	**369,707**
A032	Communications		1,310	1,311
A033	Utilities		57,500	52,000
A034	Occupancy Costs		2,770	2,783
A038	Travel & Transportation		1,404	1,794
A039	General		160,543	311,820
A09	**Physical Assets**		**50,263**	**35,000**
A092	Computer Equipment		550	-
A094	Other Stores and Stocks (Medicines*1, etc.)		30,000	-
A095	Purchase of Transport		2,713	-
A096	Purchase of Plant & Machinery		15,000	33,000
A097	Purchase of Furniture & Fixture		2,000	2,000
A13	**Repairs and Maintenance**		**6,207**	**6,828**
A130	Transport		400	440
A131	Machinery and Equipment		5,507	6,058
A132	Furniture & Fixture		300	330
	Total		**796,113**	**965,060**

Source: Budget 2006-2007, Vol.III, Financial Department Government of Sindh

Remark: *1 According to the reply of the questionnaire, the hospital required Rs.271 million for medicine against Rs.30 million of revised estimate. Therefore, patients have to buy over-the-counter drugs outside of the hospital.

Table A112.2.16 Average Charges of Medical and Surgical Treatment for Outpatients and Inpatients in Public Hospital: 2005

1. Payment of Outpatient and Inpatient*1
   - (1) Outpatient — **Rs.500/visit** including consultation and medicines for one week. Medical care is free in principle in public hospital, but patients have to buy medicines at outside pharmacy because the public hospitals prepare the medicines of about one-ninth of necessary stock.
   - (2) Inpatient — **Rs.1,500/day** including subsidiary price of surgical operation (Rs.1,000 to 2,000 per operation) and staying expense (Rs.20 to 30 per day).

2. Budget of Civil Hospital Karachi (Provincial Hospital, Refer to Table A81-1-2-10)
   - (1) Total Budget for Hospital Services in 2005/06 — Rs. 796 Million
   - (2) Number of Patients Treated Annually
     - 1) Outpatient — 938,616
     - 2) Inpatient — No. of Patients Treated Annually — 308,404

3. Average Expenses of Medical Examination
   - (1) Supposition — The ratio of expenses of both outpatient and inpatient was set as 1:3 considering the ratio of payment mentioned in Item 1.
   - (2) Average Expenses
     - 1) Outpatient — Rs. 427 per patient
       - **Rs. 430 per patient**
     - 2) Inpatient — Rs. 1,281 per day
       - **Rs. 1,300 per day**

4. Unit Benefit from Saving of Medical Expenses
   - (1) Supposition — The hospitalisation period of water borne diseases was assumed as 4 days on average. According to doctors of Health Department in GOS, the length is between 2 and 5 days, so 3.5 days on average.
   - (2) Unit Benefit from Saving of Medical Expenses in Public Hospital
     - 1) Outpatient — **Rs. 430 per patient**
     - 2) Inpatient (Average period of hospitalisation: 4 da — **Rs. 5,200 per time**

Source: Health Department, GOS, February 2007
Remark: *1 Advice from a doctor in Sindh Government.

Table A112.2.17 Beneficiary and Water Demand: 2012 to 2025

Year	Total Figures in Proj. Area	Existing Residents					Incremental Residents					Total Beneficiaries in Proj. Area
		Type 1	Type 2	Type 3	Type 4	Total	Type 1	Type 2	Type 3	Type 4	Total	
Beneficiary (Population Base, Unit:1000)												
2012	20,155	1,861	516	116	100	2,593	365	101	23	20	509	3,102
2013	20,968	2,842	789	178	152	3,961	741	206	46	40	1,033	4,994
2014	21,781	3,862	1,072	242	207	5,382	1,270	353	79	68	1,770	7,152
2015	22,594	5,048	1,401	316	270	7,034	1,859	516	116	99	2,590	9,624
2016	23,585	6,306	1,750	395	337	8,788	2,369	657	148	127	3,301	12,089
2017	24,576	7,111	1,973	445	381	9,910	2,987	829	187	160	4,162	14,072
2018	25,568	8,894	2,468	557	476	12,394	3,630	1,007	227	194	5,059	17,453
2019	26,559	10,145	2,815	635	543	14,139	4,341	1,205	272	232	6,050	20,189
2020	27,550	10,790	2,994	675	577	15,036	5,058	1,404	316	271	7,048	22,085
2021	28,541	11,445	3,176	716	612	15,949	5,776	1,603	361	309	8,049	23,998
2022	29,533	11,799	3,274	738	631	16,443	6,533	1,813	409	350	9,104	25,548
2023	30,524	12,601	3,497	789	674	17,561	7,336	2,036	459	393	10,224	27,785
2024	31,515	13,463	3,736	842	720	18,762	8,139	2,259	509	436	11,343	30,104
2025	32,506	14,383	3,991	900	770	20,044	8,942	2,482	560	479	12,462	32,506
Beneficiary (Household Base, Unit:1000)												
2012	2,879	266	74	17	14	370	52	14	3	3	73	443
2013	2,995	406	113	25	22	566	106	29	7	6	148	713
2014	3,112	552	153	35	30	769	181	50	11	10	253	1,022
2015	3,228	721	200	45	39	1,005	266	74	17	14	370	1,375
2016	3,369	901	250	56	48	1,255	338	94	21	18	472	1,727
2017	3,511	1,016	282	64	54	1,416	427	118	27	23	595	2,010
2018	3,653	1,271	353	80	68	1,771	519	144	32	28	723	2,493
2019	3,794	1,449	402	91	78	2,020	620	172	39	33	864	2,884
2020	3,936	1,541	428	96	82	2,148	723	201	45	39	1,007	3,155
2021	4,077	1,635	454	102	87	2,278	825	229	52	44	1,150	3,428
2022	4,219	1,686	468	105	90	2,349	933	259	58	50	1,301	3,650
2023	4,361	1,800	500	113	96	2,509	1,048	291	66	56	1,461	3,969
2024	4,502	1,923	534	120	103	2,680	1,163	323	73	62	1,620	4,301
2025	4,644	2,055	570	129	110	2,863	1,277	355	80	68	1,780	4,644
Domestic Water Consumption of Beneficiaries (Unit: Million m^3/Year)												
2012	506	41	17	4	5	67	8	3	1	1	13	81
2013	537	63	26	7	8	104	16	7	2	2	27	131
2014	569	86	36	10	10	142	28	12	3	3	47	189
2015	601	114	47	13	14	188	42	17	5	5	69	257
2016	640	144	60	16	18	239	54	23	6	7	90	329
2017	684	167	70	19	21	276	70	29	8	9	116	392
2018	729	214	89	25	27	354	87	36	10	11	145	499
2019	776	249	104	29	32	414	107	45	12	14	177	591
2020	825	271	113	32	35	451	127	53	15	16	211	662
2021	876	294	123	35	38	490	148	62	18	19	247	737
2022	926	309	129	37	40	516	171	72	21	22	286	802
2023	978	337	141	41	44	563	196	82	24	26	328	891
2024	1,032	367	154	45	49	614	222	93	27	29	371	986
2025	1,087	400	168	49	53	670	249	104	31	33	417	1,087
Non-domestic Water Consumption of Beneficiaries (Unit: Million m^3/Year)												
2012	327											50
2013	342											82
2014	358											118
2015	374											159
2016	392											201
2017	414											237
2018	436											297
2019	458											348
2020	480											385
2021	502											422
2022	522											451
2023	541											493
2024	561											536
2025	580											580

Table A112.2.18 Book Value of Fixed Assets and Depreciation Charges at the End of Fiscal Year 2005/06 (1/2)

(Unit: Rs.Million)

Name of Assets	Opening Balance (01-07-06)			Additions/Transfers during the Year			Total Value			Rate of Depre-ciation	Depreciation during the Year			Written Down Value Balance		
	Total	Water	Sewe-rage	Total	Water	Sewe-rage	Total	Water	Sewe-rage		Total	Water	Sewe-rage	Total	Water	Sewe-rage
I. Own Generated Assets (W&S)																
Category A																
1. Vehicles	9.8	6.5	3.3				9.8	6.5	3.3	10%	1.0	0.7	0.3	8.8	5.9	2.9
2. Office Equipment & Furniture	8.5	5.7	2.9	1.6	1.1	0.5	10.1	6.8	3.4	10%	1.0	0.7	0.3	9.1	6.1	3.0
3. Office Building	0.5	0.3	0.2				0.5	0.3	0.2	5%	0.0	0.0	0.0	0.4	0.3	0.1
4. Plants & Machines	11.2	7.5	3.7				11.2	7.5	3.7	10%	1.1	0.7	0.4	10.1	6.7	3.4
Total A	30.0	20.0	10.0	1.6	1.1	0.5	31.6	21.1	10.5		3.1	2.1	1.0	28.5	19.0	9.5
Category B																
1. KCH Water Supply Project IDA 1374-Pak	535.2	535.2	0.0				535.2	535.2	0.0	5%	26.8	26.8	0.0	508.4	508.4	0.0
2. KCH Water Supply Project IDA 1652	675.4	675.4	0.0				675.4	675.4	0.0	5%	33.8	33.8	0.0	641.6	641.6	0.0
3. KCH Water Supply Project ADB793(SF)-Pak	868.3	0.0	868.3				868.3	0.0	868.3	5%	43.4	0.0	43.4	824.9	0.0	824.9
4. K.S.D.P.-II ADB Credit 1001-1002 Pak	2,547.3	0.0	2,547.3				2,547.3	0.0	2,547.3	5%	127.4	0.0	127.4	2,419.9	0.0	2,419.9
5. KCH Water Supply Project IDA 1987-Pak	10,568.8	10,568.8	0.0				10,568.8	10,568.8	0.0	5%	528.4	528.4	0.0	10,040.4	10,040.4	0.0
6. Government Aided Projects	290.2	290.2	0.0				290.2	290.2	0.0	5%	14.5	14.5	0.0	275.7	275.7	0.0
7. Work Executed by Self Faineance (KW&SB)	4.3	4.3	0.0				4.3	4.3	0.0	5%	0.2	0.2	0.0	4.1	4.1	0.0
Total B	15,489.4	12,073.8	3,415.6	0.0	0.0	0.0	15,489.4	12,073.8	3,415.6		774.5	603.7	170.8	14,715.0	11,470.1	3,244.8
Category C																
1. Sewerage Cleaning Machine	13.2	0.0	13.2				13.2	0.0	13.2	10%	1.3	0.0	1.3	11.9	0.0	11.9
Total C	13.2	0.0	13.2	0.0	0.0	0.0	13.2	0.0	13.2		1.3	0.0	1.3	11.9	0.0	11.9
II. Assets Transferred from KMC																
1. Lands	2,137.4	0.0	2,137.4				2,137.4	0.0	2,137.4	-	-	-	-	2,137.4	-	2,137.4
2. Buildings	115.3	0.0	115.3				115.3	0.0	115.3	5%	5.8	0.0	5.8	109.6	0.0	109.6
3. Plants & Machineries	17.2	0.0	17.2				17.2	0.0	17.2	10%	1.7	0.0	1.7	15.5	0.0	15.5
4. Sewerage Pipe Lines	229.7	0.0	229.7				229.7	0.0	229.7	5%	11.5	0.0	11.5	218.2	0.0	218.2
Total D	2,499.7	0.0	2,499.7	0.0	0.0	0.0	2,499.7	0.0	2,499.7		19.0	0.0	19.0	2,480.7	0.0	2,480.7
III Assets Transferred from KDA and KWMB																
1. Capital Work KWSB	1.6	1.6	0.0				1.6	1.6	0.0	5%	0.1	0.1	0.0	1.5	1.5	0.0
2. Capital Work from KDA	346.7	346.7	0.0				346.7	346.7	0.0	5%	17.3	17.3	0.0	329.3	329.3	0.0
3. Spares and Stores	6.6	6.6	0.0				6.6	6.6	0.0	10%	0.7	0.7	0.0	5.9	5.9	0.0
4. Machineries and Equipments	2.4	2.4	0.0				2.4	2.4	0.0	10%	0.2	0.2	0.0	2.2	2.2	0.0
5. Laboratory Inventory	0.4	0.4	0.0				0.4	0.4	0.0	10%	0.0	0.0	0.0	0.4	0.4	0.0
6. Other Minor Fixed Assets	0.0	0.0	0.0				0.0	0.0	0.0	10%	0.0	0.0	0.0	0.0	0.0	0.0
Total E	357.7	357.7	0.0	0.0	0.0	0.0	357.7	357.7	0.0		18.4	18.4	0.0	339.3	339.3	0.0

(To be continued)

Table A112.2.18 Book Value of Fixed Assets and Depreciation Charges at the End of Fiscal Year 2005/06 (2/2)

(Continuation) (Unit: Rs.Million)

Name of Assets	Opening Balance (01-07-06)			Additions/Transfers during the Year			Total Value			Rate of Depre-ciation	Depreciation during the Year			Written Down Value Balance		
	Total	Water	Sewe-rage	Total	Water	Sewe-rage	Total	Water	Sewe-rage		Total	Water	Sewe-rage	Total	Water	Sewe-rage
IV Capital Scheme (Sewerage)																
1. Renovation Scheme of Sewerage in PECHS & KCHS	22.8	0.0	22.8				22.8	0.0	22.8	5%	1.1	0.0	1.1	21.7	0.0	21.7
2. Lyan Sewerage Scheme	57.5	0.0	57.5				57.5	0.0	57.5	5%	2.9	0.0	2.9	54.6	0.0	54.6
3. Ren & Rpl of Water Supply in N.N. & F.B.Area	28.4	0.0	28.4				28.4	0.0	28.4	5%	1.4	0.0	1.4	27.0	0.0	27.0
Total F	108.7	0.0	108.7	0.0	0.0	0.0	108.7	0.0	108.7		5.4	0.0	5.4	103.2	0.0	103.2
V. Work-in-Progress (Water)																
Category A																
1. KCH Water Supply Sanitation Project L2747-Project L2747-01	3,019.8	3,019.8	0.0	204.9	204.9	0.0	3,224.6	3,224.6	0.0					3,224.6	3,224.6	0.0
2. Pumping Conveyance System	639.3	639.3	0.0	0.0	0.0	0.0	639.3	639.3	0.0					639.3	639.3	0.0
3. Improvement Project PK-P40 Japan	3,018.9	3,018.9	0.0	771.0	771.0	0.0	3,789.9	3,789.9	0.0					3,789.9	3,789.9	0.0
4. GKBWS Scheme K-III	2,932.8	2,932.8	0.0	2,900.9	2,900.9	0.0	5,833.7	5,833.7	0.0					5,833.7	5,833.7	0.0
5. Tameer-e-Karachi Prog	0.0	0.0	0.0	49.9	49.9	0.0	49.9	49.9	0.0					49.9	49.9	0.0
6. Bank Balance with FAP	8.1	8.1	0.0	0.0	0.0	0.0	8.1	8.1	0.0					8.1	8.1	0.0
7. Bank Balance with FAP	1.1	1.1	0.0	0.2	0.2	0.0	1.3	1.3	0.0					1.3	1.3	0.0
Total G	9,619.9	9,619.9	0.0	3,926.9	3,926.9	0.0	13,546.8	13,546.8	0.0					13,546.8	13,546.8	0.0
Category B																
1. Misc. C-W.I.P.	270.2	270.2	0.0	0.0			270.2	270.2	0.0					270.2	270.2	0.0
Total H	270.2	270.2	0.0	0.0	0.0	0.0	270.2	270.2	0.0					270.2	270.2	0.0
Grand Total (A..H)	28,388.8	22,341.6	6,047.2	3,928.5	3,928.0	0.5	32,317.3	26,269.6	6,047.7		821.7	624.1	197.6	31,495.6	25,645.4	5,850.2

Source: Financial Accounts 2004-05 (Draft), March 2006, KWSB

Table A112.2.19 O&M Costs of Proposed Water Supply Project in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Elec-tricity	Chemi-cal	Mainte-nance	Other Costs	Price Contin-gency	Total
2012	0.31	0.01	0.01	0.20	0.12	0.64
2013	0.50	0.02	0.02	0.24	0.20	0.96
2014	0.69	0.02	0.02	0.27	0.30	1.31
2015	0.90	0.03	0.03	0.31	0.44	1.72
2016	1.10	0.04	0.03	0.35	0.59	2.11
2017	1.61	0.06	0.06	0.47	0.96	3.16
2018	2.02	0.07	0.07	0.54	1.32	4.02
2019	2.36	0.08	0.08	0.59	1.69	4.80
2020	2.61	0.08	0.08	0.63	2.05	5.45
2021	2.77	0.08	0.09	0.65	2.39	5.98
2022	3.19	0.11	0.13	0.77	3.07	7.27
2023	3.51	0.12	0.13	0.81	3.65	8.22
2024	3.84	0.12	0.14	0.86	4.31	9.27
2025	4.18	0.13	0.14	0.90	5.05	10.41
2026	4.18	0.13	0.14	0.90	5.49	10.85
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2055	4.18	0.13	0.14	0.90	37.18	42.54

Economic Value (Unit: Rs. Billion)

Year	Elec-tricity	Chemi-cal	Mainte-nance	Other Costs	Price Contin-gency	Total
2012	0.30	0.01	0.01	0.17	0.00	0.49
2013	0.48	0.02	0.01	0.21	0.00	0.72
2014	0.67	0.02	0.02	0.24	0.00	0.95
2015	0.87	0.03	0.03	0.28	0.00	1.21
2016	1.06	0.04	0.03	0.31	0.00	1.44
2017	1.56	0.06	0.06	0.41	0.00	2.08
2018	1.95	0.07	0.07	0.47	0.00	2.56
2019	2.28	0.08	0.08	0.52	0.00	2.95
2020	2.51	0.08	0.08	0.55	0.00	3.23
2021	2.67	0.08	0.08	0.57	0.00	3.42
2022	3.08	0.11	0.12	0.68	0.00	3.99
2023	3.38	0.12	0.13	0.72	0.00	4.34
2024	3.70	0.12	0.13	0.76	0.00	4.71
2025	4.03	0.13	0.14	0.80	0.00	5.09
2026	4.03	0.13	0.14	0.80	0.00	5.09
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2055	4.03	0.13	0.14	0.80	0.00	5.09

Table A112.2.20 Replacement Costs of Proposed Water Supply Project in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Direct Cost	Other Costs	Price Contin-gency	Total
2023	0.00	0.00	0.00	0.00
2024	4.87	0.73	1.58	7.19
2025	4.87	0.73	1.69	7.30
2026	7.79	1.18	2.88	11.85
2027	2.92	0.44	1.14	4.50
2028	3.12	0.47	1.29	4.89
2029	6.70	1.02	2.93	10.65
2030	6.61	1.01	3.04	10.66
2031	6.63	1.01	3.21	10.85
2032	2.93	0.45	1.49	4.87
2033	3.10	0.48	1.66	5.23
2034	6.56	1.01	3.66	11.24
2035	6.59	1.02	3.84	11.45
2036	6.34	0.98	3.86	11.18
2037	2.92	0.45	1.85	5.22
2038	3.12	0.49	2.07	5.68
2039	12.78	1.97	7.03	21.77
2040	12.69	1.96	7.29	21.93
2041	7.84	1.23	5.83	14.89
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2051	6.38	1.03	6.66	14.07
2052	2.93	0.47	3.16	6.56
2053	3.10	0.50	3.45	7.05
2054	8.02	1.30	9.16	18.48
2055	8.04	1.30	9.46	18.80

Economic Value (Unit: Rs. Billion)

Year	Direct Cost	Other Costs	Price Contin-gency	Total
2023	0.00	0.00	0.00	0.00
2024	4.87	0.69	0.00	5.56
2025	4.87	0.69	0.00	5.56
2026	7.70	1.09	0.00	8.79
2027	2.83	0.40	0.00	3.23
2028	3.03	0.43	0.00	3.47
2029	6.61	0.94	0.00	7.54
2030	6.52	0.92	0.00	7.44
2031	6.54	0.93	0.00	7.46
2032	2.84	0.41	0.00	3.25
2033	3.01	0.43	0.00	3.44
2034	6.47	0.92	0.00	7.39
2035	6.50	0.92	0.00	7.42
2036	6.25	0.89	0.00	7.13
2037	2.83	0.40	0.00	3.23
2038	3.03	0.43	0.00	3.47
2039	12.69	1.79	0.00	14.48
2040	12.60	1.78	0.00	14.38
2041	7.75	1.10	0.00	8.84
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2051	6.29	0.89	0.00	7.18
2052	2.84	0.41	0.00	3.25
2053	3.01	0.43	0.00	3.44
2054	7.93	1.12	0.00	9.04
2055	7.95	1.11	0.00	9.06

APPENDIX – A112.3

Economic Evaluation of Sewerage Project

A112.3 Economic Evaluation of Sewerage Project

Table A112.3.1 Average Household Income by Income Class (1/2)

I. Average Income in Water Awareness Survey*2

Income Class	Katchi Abadis	Low & Lower Middle	Upper Middle	High
Income Range (Rs./month)	10,252	10,181	22,174	63,636

II. Income Distribution Based on Karachi Master Plan 2020*1

Household Income Distribution

Income Class	Low	Middle	Upper Middle	Upper	Average
Income Range (Rs./month)	Lower than 12,000	12,001 to 21,000	21,001 to 30,000	30,001 and above	
Average Income (Rs./month)	6,000	16,500	25,000	45,800	10,500
Component Ratio (%)	72.00	20.00	4.00	4.00	100.00

III. Income Distribution in January 2007 reevaluated applying II. table above and CPI *3

Income Class	Low	Middle	Upper Middle	High	Average
Income Range (Rs./month)	Lower than 14,400	14,401 to 25,200	25,001 to 36,000	36,001 and above	
Average Income (Rs./month)	**7,200**	**19,800**	**30,600**	**55,000**	**12,700**
Component Ratio (%)	72.00	20.00	4.00	4.00	100.00

IV. Average Income of 18 Towns in January 2007

Income Class	Unit	Keamari	SITE	Baldia	Orangi	Lyari
(1) Low	%	58.49	46.34	40.31	60.51	44.02
(2) Middle	%	25.17	32.40	34.05	24.18	32.08
(3) Upper Middle	%	11.27	13.77	11.96	10.87	15.24
(4) High	%	5.07	7.50	13.68	4.44	8.65
Average Income	Rs./month	**10,100**	**11,500**	**12,600**	**9,900**	**11,900**

Income Class	Unit	Saddar	Jamshed	Gulshan-e-Iqbal	Shah Faisal	Landhi
(1) Low	%	38.83	40.46	16.35	25.53	59.60
(2) Middle	%	31.13	27.55	30.39	38.80	29.46
(3) Upper Middle	%	14.23	14.87	13.82	24.48	7.71
(4) High	%	15.82	17.13	39.44	11.19	3.22
Average Income	Rs./month	**13,000**	**12,800**	**20,100**	**15,400**	**9,900**

Income Class	Unit	Korangi	North Nazimabad	New Karachi	Gulberg	Liaquatabad
(1) Low	%	59.37	21.98	51.89	22.25	36.82
(2) Middle	%	31.40	32.94	30.82	37.89	29.43
(3) Upper Middle	%	7.30	15.52	7.30	15.69	18.03
(4) High	%	1.93	29.56	9.99	24.17	15.72
Average Income	Rs./month	**9,900**	**17,400**	**10,900**	**16,800**	**13,400**

Income Class	Unit	Malir	Bin Qasim	Gadap		Karachi
(1) Low	%	60.21	44.60	49.01		40.27
(2) Middle	%	34.66	37.22	27.64		31.34
(3) Upper Middle	%	2.56	18.18	14.35		13.47
(4) High	%	2.56	0.00	9.00		14.92
Average Income	Rs./month	**9,800**	**11,500**	**11,300**		**12,700**

Remark:

*1 Socio Economic Survey Report-2005 V1.0 (Table 11), Karachi Master Plan 2020, CDGK
A household size was calculated as 7 members on average, in Karachi Profile.

*2 Water Awareness Survey, August 2007, JICA Study Team

*3 The price increase wwas calculated at around 20% up applying the following CPIs: 117.55 in July 2004 and 141.01 in January 2007

Table A112.3.1 Average Household Income by Income Class (2/2)

IV. Total Income by Income Level of 18 Towns in January 2007

Income Class	Unit	Keamari	SITE	Baldia	Orangi	Lyari
(1) Low	%	58.49	46.34	40.31	60.51	44.02
(2) Middle	%	25.17	32.40	34.05	24.18	32.08
(3) Upper Middle	%	11.27	13.77	11.96	10.87	15.24
(4) High	%	5.07	7.50	13.68	4.44	8.65
Average Income	Rs./month	**10,100**	**11,500**	**12,600**	**9,900**	**11,900**

Income Class	Unit	Saddar	Jamshed	Gulshan-e-Iqbal	Shah Faisal	Landhi
(1) Low	%	38.83	40.46	16.35	25.53	59.60
(2) Middle	%	31.13	27.55	30.39	38.80	29.46
(3) Upper Middle	%	14.23	14.87	13.82	24.48	7.71
(4) High	%	15.82	17.13	39.44	11.19	3.22
Average Income	Rs./month	**13,000**	**12,800**	**20,100**	**15,400**	**9,900**

Income Class	Unit	Korangi	North Nazimabad	New Karachi	Gulberg	Liaquatabad
(1) Low	%	59.37	21.98	51.89	22.25	36.82
(2) Middle	%	31.40	32.94	30.82	37.89	29.43
(3) Upper Middle	%	7.30	15.52	7.30	15.69	18.03
(4) High	%	1.93	29.56	9.99	24.17	15.72
Average Income	Rs./month	**9,900**	**17,400**	**10,900**	**16,800**	**13,400**

Income Class	Unit	Malir	Bin Qasim	Gadap		Karachi
(1) Low	%	60.21	44.60	49.01		40.27
(2) Middle	%	34.66	37.22	27.64		31.34
(3) Upper Middle	%	2.56	18.18	14.35		13.47
(4) High	%	2.56	0.00	9.00		14.92
Average Income	Rs./month	**9,800**	**11,500**	**11,300**		**12,700**

Table A112.3.2 Willingness-to-Pay by Income Level

Item	Type 1 Low Income	Type 2 Middle Income	Type 3 Upper Middle Income	Type 4 High Income
I. Average Household Income				
1. Monthly Income (Rs./HH/month)	7,200	19,800	30,600	55,000
Annual Income (Rs./HH/Year)	86,400	237,600	367,200	660,000
2. Composition of Type by Income Level	72%	20%	4%	4%
II. Sewage Volume				
1. Annual Sewage Voluem (m^3/HH/Year)	131	208	235	259
(1000 gallon/HH/Yea	28.8	45.8	51.7	56.9
III. Wilingness-to-Pay (WtP) for Sewerage				
1. 1% of Income of WtP for Sewerage Service				
1) Willingness-to-Pay (Rs./HH/Year)	864	2,376	3,672	6,600
2) Willingness-to-Pay (Rs./m^3)	6.6	11.4	15.6	25.5
(Rs./1000gallon)	30	52	71	116
Overall Average of WtP			8.7	Rs./m^3
			39.4	Rs./1000 gallon
Ref. Present Payment to KW&SB	106	177	267	321
Payment of Unit Sewage (Rs./m^3/Y	0.8	0.9	1.1	1.2
2. WtP in Economic Value				
1) Willingness-to-Pay (Rs./HH/Year)	760	2,091	3,231	5,808
2) Willingness-to-Pay (Rs./m^3)	5.8	10.0	13.7	22.4
(Rs./1000gal	26.4	45.6	62.4	102.0
Overall Average of WtP			**7.6**	**Rs./m^3**
			34.7	**Rs./1000 gallon**

Table A112.3.3 Construction and O&M Costs of Septic Tank System

Item	Specification	Cost
1. Inicial Investment		
(1) Estimate of Septic Tank		
Specification		
2) Water used per person = 70 gallon/capita/day		
3) Sewerage (70% of water) = 49 gallon/capita/day		
4) 5 to 6 persons in a house		
5) Total capacity = 6 persons × 49 gallon/capita/day = 294 gallon/day = 46 cuft (ft^3)		
6) Inside size of septic tank = 4' × 3.3' × 3.5'depth		
18" (1.5')	Free Board	
6" thick	Walls	
6" thick	1:3:6 Base Concrete	
4" thick	Pre-cast RCC slab	
Buffle wall	2.5' × 3.3' × 4" thick	
Quantity and Price		
2) Excavation:	126 cuft × @Rs.10/cuft	1,260
3) Plaster: 40□ + 33□ + 7.5□	80 sqft × @Rs.10/sqft	800
4) 1:3:6 Base Concrete	10.75 cuft × @Rs.130/cuft	1,397
5) 6" Walls (both sides)	93 sqft × @46.5/sqft	6,980
6) Pre-cast RCC Slab 4" thick	21.5sqft × @56/sqft	1,200
7) Buffle wall	8.25 sqft × @110/sqft	900
8) M.S. Iron Step	4 × @80	320
9) 100" RCC Pipe	(10' + 10') × @60	1,200
10) Tee		100
11) Contingency (5%) + Overhead (10%)		2,043
Total		**16,200**
(2) Estimate of Soak Pit		
Specification: Size 25-30 feet × 4'Φ		
Quantity and Price		
1) Excavation:	78.6 cuft × @Rs.23/cuft	2,000
2) Dry stone 15 kg size	1.8 ton × @2,000/ton	3,600
3) Pre-cast RCC slab 4'Φ × 4" thick		1,200
4) 100" RCC Sewer Pipe	10' × @60	180
5) Bend		80
6) Contingency (5%) + Overhead (10%)		1,040
Total		**8,100**
Grand Total		**24,300**
2. Operation and Maintenance Cost		
(1) Recurrent Cost (for 1.5~2.0 years)		
1) Cleaning Labour Cost (every 1.5~2.0 years)		1,000
2) Acid		500
Total		**1,500**
3. Annual Cost of Individual Septic Tank		
(1) Annual Costs for Septick Tank (Rs./year/HH)		
1) Annualized Equipment Costs (Invisible Costs) *1		3,253
2) O&M cost		1,500
Total in Market Prices		4,753
Total in Economic Value (Rs./Year/HH)		**4,180**

Source: Estimate by Eng. A. Ghaffar, Staff of JICA Study Team

Remark: *1 In order to calculate annualized costs, Capital Recovery Factor (CRF) is applied on condition that an economic life (n) is 20 years for septic tank, and an interest rate (r) is 12%.
Applying the formula of CRF = r/(1-1/(1+r)^n), the CRFs were calculated at 0.134.

Table A112.3.4 Beneficiary and Sewage Discharge Volume: 2008 to 2025

Year	Total Figures in Proj. Area	Beneficiaries by TP and 3Towns					Beneficiaries by Type (Income Level)				
		TP-1 & TP-3	TP-2	TP-4	3 Towns	Total	Type 1	Type 2	Type 3	Type 4	Total
Beneficiary (Population Base, Unit:1000)											
2008	17,218	645	0	0	0	645	463	128	29	25	645
2009	17,926	645	0	0	0	645	463	128	29	25	645
2010	18,634	645	0	0	0	645	463	128	29	25	645
2011	19,342	645	0	1,543	0	2,188	1,570	436	98	84	2,188
2012	20,190	637	0	1,713	0	2,350	1,686	468	106	90	2,350
2013	21,039	630	0	1,882	0	2,512	1,803	500	113	96	2,512
2014	21,888	2,276	0	2,051	0	4,327	3,105	862	194	166	4,327
2015	22,736	4,014	0	2,220	0	6,234	4,473	1,241	280	239	6,234
2016	23,585	4,226	0	2,388	0	6,614	4,746	1,317	297	254	6,614
2017	24,576	6,573	0	3,466	635	10,674	7,659	2,126	479	410	10,674
2018	25,568	6,749	0	4,515	1,255	12,519	8,983	2,493	562	481	12,519
2019	26,559	6,928	0	5,541	1,874	14,343	10,292	2,856	644	551	14,343
2020	27,550	7,112	2,817	6,551	2,493	18,973	13,614	3,778	852	729	18,973
2021	28,541	7,298	3,258	7,547	3,112	21,215	15,223	4,225	953	815	21,215
2022	29,533	7,688	3,545	8,710	4,065	24,008	17,227	4,781	1,078	922	24,008
2023	30,524	7,829	3,907	9,890	5,019	26,645	19,120	5,306	1,196	1,023	26,645
2024	31,515	8,463	4,100	11,040	5,971	29,574	21,221	5,889	1,328	1,136	29,574
2025	32,506	8,848	5,013	11,720	6,924	32,505	23,325	6,473	1,460	1,248	32,505
Beneficiary (Household Base, Unit:1000)											
2008	2,460	92	0	0	0	92	66	18	4	4	92
2009	2,561	92	0	0	0	92	66	18	4	4	92
2010	2,662	92	0	0	0	92	66	18	4	4	92
2011	2,763	92	0	220	0	313	224	62	14	12	313
2012	2,884	91	0	245	0	336	241	67	15	13	336
2013	3,006	90	0	269	0	359	258	71	16	14	359
2014	3,127	325	0	293	0	618	444	123	28	24	618
2015	3,248	573	0	317	0	891	639	177	40	34	891
2016	3,369	604	0	341	0	945	678	188	42	36	945
2017	3,511	939	0	495	91	1,525	1,094	304	68	59	1,525
2018	3,653	964	0	645	179	1,788	1,283	356	80	69	1,788
2019	3,794	990	0	792	268	2,049	1,470	408	92	79	2,049
2020	3,936	1,016	402	936	356	2,710	1,945	540	122	104	2,710
2021	4,077	1,043	465	1,078	445	3,031	2,175	604	136	116	3,031
2022	4,219	1,098	506	1,244	581	3,430	2,461	683	154	132	3,430
2023	4,361	1,118	558	1,413	717	3,806	2,731	758	171	146	3,806
2024	4,502	1,209	586	1,577	853	4,225	3,032	841	190	162	4,225
2025	4,644	1,264	716	1,674	989	4,644	3,332	925	209	178	4,644

Sewage Discharge Volume by TPs & 3 Towns (Unit: 10^6 m^3/Year)							**Sewage Treated Volume by Generator**				
Year	Ttl. Disch.	TPs-1&3	TP-2	TP-4	3 Towns	Total	Type 1	Type 2	Type 3	Type 4	Non-
2008	501	16	0	0	0	16	16	7	2	2	4
2009	522	16	0	0	0	16	18	7	2	2	4
2010	543	16	0	0	0	16	20	8	2	2	4
2011	564	16	0	50	0	67	38	16	4	5	29
2012	596	16	0	56	0	73	40	17	4	5	37
2013	628	16	0	62	0	79	43	18	5	5	45
2014	659	60	0	69	0	128	88	37	10	11	53
2015	691	107	0	75	0	181	100	42	11	12	61
2016	722	113	0	81	0	194	111	46	13	14	69
2017	771	179	0	120	21	320	154	64	18	19	105
2018	819	186	0	159	42	387	172	72	20	22	142
2019	867	194	0	198	63	455	217	91	25	28	179
2020	916	201	102	237	85	625	246	103	29	31	216
2021	964	209	119	276	106	709	274	115	33	35	253
2022	1,015	224	132	324	142	822	316	132	38	41	295
2023	1,066	232	147	373	179	931	356	149	43	47	337
2024	1,116	254	157	422	215	1,048	400	167	49	53	379
2025	1,167	269	176	470	252	1,167	445	186	55	59	421

Table A112.3.5 O&M Costs of Proposed Sewerage Project in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Elec-tricity	Sludge Dispo-sal	Mainte-nance	Person-nel	Other Costs	Price Contin-gency	Total
2008	0.01	0.00	0.01	0.00	0.01	0.00	0.03
2009	0.01	0.00	0.01	0.00	0.01	0.00	0.03
2010	0.01	0.00	0.01	0.00	0.01	0.00	0.03
2011	0.01	0.00	0.03	0.00	0.01	0.01	0.05
2012	0.03	0.01	0.04	0.01	0.02	0.02	0.14
2013	0.03	0.01	0.05	0.02	0.02	0.03	0.16
2014	0.05	0.02	0.08	0.02	0.02	0.05	0.25
2015	0.07	0.02	0.12	0.04	0.03	0.09	0.36
2016	0.08	0.02	0.13	0.04	0.03	0.11	0.40
2017	0.14	0.05	0.26	0.06	0.05	0.22	0.78
2018	0.17	0.07	0.33	0.08	0.06	0.32	1.02
2019	0.20	0.09	0.40	0.10	0.07	0.44	1.30
2020	0.31	0.16	0.53	0.14	0.11	0.70	1.95
2021	0.35	0.19	0.61	0.17	0.12	0.91	2.35
2022	0.41	0.22	0.70	0.20	0.14	1.16	2.83
2023	0.47	0.26	0.80	0.23	0.15	1.45	3.36
2024	0.53	0.29	0.90	0.27	0.17	1.81	3.96
2025	0.59	0.32	0.99	0.29	0.18	2.18	4.55
2026	0.59	0.32	0.99	0.29	0.18	2.37	4.74
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2055	0.59	0.32	0.99	0.29	0.18	15.90	18.28

Economic Value (Unit: Rs. Billion)

Year	Elec-tricity	Sludge Dispo-sal	Mainte-nance	Person-nel	Other Costs	Price Contin-gency	Total
2008	0.01	0.00	0.01	0.00	0.01	0.00	0.02
2009	0.01	0.00	0.01	0.00	0.01	0.00	0.02
2010	0.01	0.00	0.01	0.00	0.01	0.00	0.02
2011	0.01	0.00	0.03	0.00	0.01	0.00	0.04
2012	0.03	0.00	0.04	0.01	0.03	0.00	0.11
2013	0.03	0.00	0.05	0.01	0.03	0.00	0.13
2014	0.05	0.00	0.08	0.02	0.04	0.00	0.19
2015	0.07	0.00	0.11	0.03	0.05	0.00	0.26
2016	0.07	0.00	0.12	0.03	0.05	0.00	0.28
2017	0.13	0.00	0.25	0.06	0.09	0.00	0.53
2018	0.16	0.01	0.32	0.07	0.12	0.00	0.67
2019	0.20	0.01	0.39	0.09	0.14	0.00	0.82
2020	0.30	0.02	0.51	0.12	0.24	0.00	1.19
2021	0.34	0.02	0.59	0.15	0.28	0.00	1.38
2022	0.40	0.03	0.68	0.17	0.32	0.00	1.59
2023	0.45	0.03	0.77	0.20	0.36	0.00	1.82
2024	0.51	0.04	0.86	0.24	0.40	0.00	2.05
2025	0.57	0.04	0.95	0.26	0.44	0.00	2.27
2026	0.57	0.04	0.95	0.26	0.44	0.00	2.27
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2055	0.57	0.04	0.95	0.26	0.44	0.00	2.27

Table A112.3.6 Replacement Costs of Proposed Sewerage Project in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Direct Cost	Engi-neering Cost	Physical Contin-gency	Admin-istration	Price Contin-gency	Total
2023	0.87	0.07	0.05	0.01	0.02	1.01
2024	0.87	0.07	0.05	0.02	0.03	1.03
2025	0.87	0.07	0.05	0.02	0.05	1.05
2026	0.68	0.05	0.04	0.01	0.05	0.83
2027	0.22	0.02	0.01	0.00	0.02	0.27
2028	0.22	0.02	0.01	0.00	0.02	0.27
2029	0.13	0.01	0.01	0.00	0.02	0.16
2030	4.15	0.31	0.22	0.08	0.64	5.40
2031	4.15	0.31	0.22	0.08	0.72	5.49
2032	4.89	0.37	0.26	0.10	0.96	6.57
2033	5.70	0.43	0.31	0.12	1.24	7.79
2034	5.50	0.41	0.30	0.11	1.32	7.64
2035	5.02	0.38	0.27	0.10	1.32	7.09
2036	5.02	0.38	0.27	0.11	1.44	7.21
2037	3.57	0.27	0.19	0.08	1.11	5.21
2038	4.44	0.33	0.24	0.10	1.48	6.59
2039	3.44	0.26	0.18	0.08	1.23	5.19
2040	2.53	0.19	0.14	0.06	0.97	3.89
2041	0.68	0.05	0.04	0.02	0.60	1.38
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2053	4.49	0.34	0.24	0.17	6.32	11.57
2054	3.49	0.26	0.19	0.14	5.10	9.18
2055	2.53	0.19	0.14	0.10	3.84	6.81

Economic Value (Unit: Rs. Billion)

Year	Direct Cost	Engi-neering Cost	Physical Contin-gency	Admin-istration	Price Contin-gency	Total
2023	0.87	0.06	0.05	0.01	0.00	1.00
2024	0.87	0.06	0.05	0.01	0.00	1.00
2025	0.87	0.06	0.05	0.01	0.00	1.00
2026	0.68	0.05	0.04	0.01	0.00	0.78
2027	0.22	0.02	0.01	0.00	0.00	0.25
2028	0.22	0.02	0.01	0.00	0.00	0.25
2029	0.13	0.01	0.01	0.00	0.00	0.15
2030	4.15	0.30	0.22	0.07	0.00	4.74
2031	4.15	0.30	0.22	0.07	0.00	4.74
2032	4.89	0.35	0.26	0.08	0.00	5.58
2033	5.70	0.41	0.31	0.10	0.00	6.51
2034	5.50	0.40	0.29	0.09	0.00	6.28
2035	5.02	0.36	0.27	0.08	0.00	5.74
2036	5.02	0.36	0.27	0.08	0.00	5.74
2037	3.57	0.26	0.19	0.06	0.00	4.08
2038	4.44	0.32	0.24	0.08	0.00	5.08
2039	3.44	0.25	0.18	0.06	0.00	3.93
2040	2.53	0.18	0.14	0.04	0.00	2.90
2041	0.68	0.05	0.04	0.01	0.00	0.78
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2053	4.49	0.32	0.24	0.08	0.00	5.13
2054	3.49	0.25	0.19	0.06	0.00	3.99
2055	2.53	0.18	0.14	0.04	0.00	2.90

Table A112.3.7 Beneficiary and Sewage Discharge Volume (Case 2): 2008 to 2025

Year	Total Figures in Proj. Area	Beneficiaries by TP and 3Towns					Beneficiaries by Type (Income Level)				
		TP-1 & TP-3	TP-2	TP-4	3 Towns	Total	Type 1	Type 2	Type 3	Type 4	Total
Beneficiary (Population Base, Unit:1000)											
2008	17,218	645	0	0	0	645	463	128	29	25	645
2009	17,926	645	0	0	0	645	463	128	29	25	645
2010	18,634	645	0	0	0	645	463	128	29	25	645
2011	19,342	645	0	1,543	0	2,188	1,570	436	98	84	2,188
2012	20,190	637	0	1,713	0	2,350	1,686	468	106	90	2,350
2013	21,039	630	0	1,882	0	2,512	1,803	500	113	96	2,512
2014	21,888	2,276	0	2,051	0	4,327	3,105	862	194	166	4,327
2015	22,736	4,014	0	2,220	0	6,234	4,473	1,241	280	239	6,234
2016	23,585	4,226	0	2,388	0	6,614	4,746	1,317	297	254	6,614
2017	24,576	6,573	0	3,466	0	10,039	7,204	1,999	451	385	10,039
2018	25,568	6,749	0	4,515	0	11,264	8,083	2,243	506	433	11,264
2019	26,559	6,928	0	5,541	0	12,469	8,947	2,483	560	479	12,469
2020	27,550	7,112	2,817	6,551	0	16,480	11,826	3,282	740	633	16,480
2021	28,541	7,298	3,258	7,547	0	18,103	12,990	3,605	813	695	18,103
2022	29,533	7,688	3,545	8,710	0	19,943	14,310	3,971	895	766	19,943
2023	30,524	7,829	3,907	9,890	0	21,626	15,518	4,306	971	830	21,626
2024	31,515	8,463	4,100	11,040	0	23,603	16,937	4,700	1,060	906	23,603
2025	32,506	8,848	5,013	11,720	0	25,581	18,356	5,094	1,149	982	25,581
Beneficiary (Household Base, Unit:1000)											
2008	2,460	92	0	0	0	92	66	18	4	4	92
2009	2,561	92	0	0	0	92	66	18	4	4	92
2010	2,662	92	0	0	0	92	66	18	4	4	92
2011	2,763	92	0	220	0	313	224	62	14	12	313
2012	2,884	91	0	245	0	336	241	67	15	13	336
2013	3,006	90	0	269	0	359	258	71	16	14	359
2014	3,127	325	0	293	0	618	444	123	28	24	618
2015	3,248	573	0	317	0	891	639	177	40	34	891
2016	3,369	604	0	341	0	945	678	188	42	36	945
2017	3,511	939	0	495	0	1,434	1,029	286	64	55	1,434
2018	3,653	964	0	645	0	1,609	1,155	320	72	62	1,609
2019	3,794	990	0	792	0	1,781	1,278	355	80	68	1,781
2020	3,936	1,016	402	936	0	2,354	1,689	469	106	90	2,354
2021	4,077	1,043	465	1,078	0	2,586	1,856	515	116	99	2,586
2022	4,219	1,098	506	1,244	0	2,849	2,044	567	128	109	2,849
2023	4,361	1,118	558	1,413	0	3,089	2,217	615	139	119	3,089
2024	4,502	1,209	586	1,577	0	3,372	2,420	671	151	129	3,372
2025	4,644	1,264	716	1,674	0	3,654	2,622	728	164	140	3,654

Sewage Discharge Volume by TP & 3 Towns (Unit: 10^6 m^3/Year)							**Sewage Treated Volume by Generator**				
Year	Ttl. Disch.	TPs-1&3	TP-2	TP-4	3 Towns	Total	Type 1	Type 2	Type 3	Type 4	Non-
2008	471	16	0	0	0	16	16	7	2	2	4
2009	485	16	0	0	0	16	18	7	2	2	4
2010	499	16	0	0	0	16	20	8	2	2	4
2011	513	16	0	50	0	67	38	16	4	5	29
2012	535	16	0	56	0	73	40	17	4	5	37
2013	557	16	0	62	0	79	43	18	5	5	45
2014	579	60	0	69	0	128	88	37	10	11	53
2015	601	107	0	75	0	181	100	42	11	12	61
2016	623	113	0	81	0	194	111	46	13	14	69
2017	653	179	0	120	0	299	152	64	17	19	96
2018	684	186	0	159	0	345	174	73	20	22	124
2019	714	194	0	198	0	392	195	82	23	25	152
2020	745	201	102	237	0	540	217	91	25	28	180
2021	776	209	119	276	0	604	238	99	28	31	207
2022	810	224	132	324	0	680	267	112	32	35	235
2023	845	232	147	373	0	752	293	123	35	38	262
2024	880	254	157	422	0	832	325	136	40	43	289
2025	915	269	176	470	0	915	357	150	44	48	317

Table A112.3.8 Economic Benefit of Proposed Sewerage Project (Case 2) in Master Plan

(Unit: Rs. Billion)

Year	Domestic Benefit of Improved Environment					Non-domestic Benefit of Imp. Environment	Medical Benefit						
							Family Expense				Medical Treatment	Absence from Work	Sub-total
	Type 1	Type 2	Type 3	Type 4	Sub-total		Type 1	Type 2	Type 3	Type 4			
2008	0.08	0.06	0.02	0.04	0.19	0.06	0.08	0.02	0.01	0.01	0.03	0.00	0.14
2009	0.09	0.06	0.02	0.04	0.21	0.07	0.09	0.02	0.01	0.01	0.03	0.00	0.15
2010	0.10	0.07	0.02	0.04	0.23	0.08	0.09	0.02	0.01	0.01	0.03	0.00	0.17
2011	0.20	0.14	0.05	0.09	0.48	0.27	0.20	0.05	0.01	0.02	0.07	0.00	0.36
2012	0.20	0.15	0.05	0.10	0.50	0.35	0.23	0.05	0.01	0.03	0.08	0.01	0.41
2013	0.21	0.15	0.06	0.10	0.52	0.42	0.25	0.06	0.02	0.03	0.09	0.01	0.46
2014	0.47	0.34	0.12	0.22	1.15	0.50	0.45	0.10	0.03	0.05	0.16	0.01	0.81
2015	0.53	0.38	0.14	0.25	1.30	0.57	0.51	0.12	0.03	0.06	0.18	0.01	0.91
2016	0.59	0.42	0.16	0.28	1.45	0.65	0.57	0.13	0.04	0.07	0.20	0.01	1.02
2017	0.84	0.61	0.23	0.40	2.08	0.84	0.74	0.17	0.05	0.09	0.27	0.02	1.33
2018	0.98	0.70	0.27	0.47	2.42	1.02	0.85	0.20	0.05	0.10	0.31	0.02	1.53
2019	1.11	0.80	0.31	0.54	2.76	1.21	0.96	0.22	0.06	0.11	0.35	0.02	1.72
2020	1.25	0.90	0.35	0.62	3.11	1.40	1.06	0.25	0.07	0.12	0.38	0.02	1.91
2021	1.38	1.00	0.39	0.69	3.46	1.58	1.17	0.27	0.08	0.13	0.42	0.03	2.10
2022	1.55	1.12	0.44	0.78	3.89	1.79	1.29	0.30	0.08	0.15	0.46	0.03	2.31
2023	1.70	1.23	0.49	0.86	4.29	2.00	1.40	0.32	0.09	0.16	0.50	0.03	2.50
2024	1.88	1.36	0.54	0.96	4.76	2.21	1.52	0.35	0.10	0.18	0.55	0.04	2.73
2025	2.07	1.50	0.60	1.07	5.25	2.42	1.65	0.38	0.11	0.19	0.59	0.04	2.96

Year	Saving Benefit of O&M Expenses of Septic Tank			Reduction of O&M Expenses	Positive Benefit Total	Negative Benefit Elimination of Septic Tanks			Grand Total
	Type 1	Type 2	Total			Type 1	Type 2	Total	
2008	0.02	0.01	0.03	0.00	0.43	0.05	0.03	0.07	0.35
2009	0.02	0.01	0.03	0.00	0.47	0.01	0.00	0.01	0.46
2010	0.02	0.01	0.03	0.00	0.52	0.01	0.00	0.01	0.51
2011	0.05	0.03	0.07	0.02	1.20	0.07	0.04	0.10	1.10
2012	0.05	0.03	0.08	0.02	1.36	0.02	0.01	0.02	1.34
2013	0.06	0.03	0.09	0.03	1.52	0.02	0.01	0.02	1.50
2014	0.11	0.06	0.17	0.08	2.70	0.12	0.07	0.19	2.52
2015	0.12	0.07	0.19	0.09	3.07	0.04	0.02	0.05	3.01
2016	0.14	0.07	0.21	0.11	3.43	0.04	0.02	0.05	3.37
2017	0.18	0.10	0.27	0.19	4.70	0.11	0.06	0.16	4.54
2018	0.20	0.11	0.31	0.24	5.53	0.07	0.04	0.10	5.42
2019	0.23	0.12	0.35	0.30	6.35	0.07	0.04	0.10	6.25
2020	0.25	0.14	0.39	0.36	7.17	0.06	0.04	0.10	7.07
2021	0.28	0.15	0.43	0.43	8.00	0.06	0.03	0.10	7.90
2022	0.31	0.17	0.47	0.53	8.99	0.07	0.04	0.11	8.88
2023	0.33	0.18	0.51	0.63	9.94	0.07	0.04	0.10	9.84
2024	0.36	0.20	0.56	0.75	11.01	0.08	0.04	0.12	10.89
2025	0.39	0.21	0.61	0.86	12.10	0.08	0.04	0.12	11.98

Table A112.3.9 Economic Investment Costs of Proposed Sewerage Project (Case 2) in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Direct Cost			Engineering			Physical Contingency			Price Contingency			Administration	Total		
	Foreign	Local	Sub-Total	Foreign	Local	Sub-Total	Foreign	Local	Sub-Total	Foreign	Local	Sub-Total	Local	Foreign	Local	Total
2008	1.04	1.30	2.34	0.12	0.05	0.18	0.06	0.07	0.13	0.02	0.09	0.10	0.04	1.24	1.55	2.79
2009	1.04	1.30	2.34	0.12	0.05	0.18	0.06	0.07	0.13	0.04	0.18	0.21	0.04	1.26	1.64	2.90
2010	1.04	1.30	2.34	0.12	0.05	0.18	0.06	0.07	0.13	0.06	0.27	0.33	0.04	1.28	1.74	3.02
2011	0.85	1.25	2.10	0.11	0.05	0.16	0.05	0.07	0.11	0.06	0.36	0.42	0.04	1.07	1.77	2.84
2012	0.73	1.68	2.40	0.13	0.05	0.18	0.04	0.09	0.13	0.07	0.61	0.68	0.05	0.97	2.48	3.45
2013	0.73	1.68	2.40	0.13	0.05	0.18	0.04	0.09	0.13	0.08	0.76	0.84	0.05	0.98	2.63	3.61
2014	0.64	1.67	2.30	0.12	0.05	0.17	0.04	0.09	0.12	0.09	0.91	1.00	0.05	0.88	2.76	3.65
2015	4.86	5.40	10.26	0.54	0.23	0.77	0.27	0.28	0.55	0.72	3.51	4.23	0.24	6.38	9.66	16.04
2016	4.86	5.40	10.26	0.54	0.23	0.77	0.27	0.28	0.55	0.81	4.08	4.90	0.25	6.48	10.24	16.72
2017	4.44	5.62	10.06	0.53	0.23	0.75	0.25	0.29	0.54	0.84	4.85	5.69	0.26	6.06	11.24	17.30
2018	5.39	6.11	11.50	0.60	0.26	0.86	0.30	0.32	0.62	1.12	6.01	7.13	0.30	7.41	13.00	20.41
2019	5.04	5.86	10.89	0.57	0.25	0.82	0.28	0.31	0.59	1.15	6.48	7.64	0.30	7.04	13.19	20.23
2020	4.11	4.84	8.95	0.47	0.20	0.67	0.23	0.25	0.48	1.03	6.00	7.03	0.26	5.84	11.55	17.39
2021	4.11	4.84	8.95	0.47	0.20	0.67	0.23	0.25	0.48	1.11	6.69	7.80	0.27	5.92	12.25	18.18
2022	2.52	3.38	5.90	0.31	0.13	0.44	0.14	0.18	0.32	0.74	5.15	5.89	0.19	3.72	9.02	12.74
2023	2.52	3.38	5.90	0.31	0.13	0.44	0.14	0.18	0.32	0.80	5.68	6.48	0.20	3.77	9.56	13.33
2024	1.52	2.66	4.18	0.22	0.09	0.31	0.09	0.14	0.22	0.52	4.90	5.42	0.15	2.35	7.94	10.29
2025	0.55	1.66	2.21	0.12	0.05	0.17	0.03	0.09	0.12	0.21	3.32	3.53	0.09	0.91	5.20	6.11
Total	45.98	59.31	105.28	5.53	2.37	7.90	2.58	3.08	5.66	9.48	59.84	69.31	2.82	63.56	127.42	190.98

Economic Value (Unit: Rs. Billion)

Year	Direct Cost			Engineering			Physical Contingency			Price Contingency			Administration	Grand Total		
	Foreign	Local	Sub-Total	Foreign	Local	Sub-Total	Foreign	Local	Sub-Total	Foreign	Local	Sub-Total	Local	Foreign	Local	Total
2008	1.04	1.14	2.19	0.12	0.05	0.17	0.06	0.06	0.12	0.00	0.00	0.00	0.04	1.22	1.29	2.51
2009	1.04	1.14	2.19	0.12	0.05	0.17	0.06	0.06	0.12	0.00	0.00	0.00	0.04	1.22	1.29	2.51
2010	1.04	1.14	2.19	0.12	0.05	0.17	0.06	0.06	0.12	0.00	0.00	0.00	0.04	1.22	1.29	2.51
2011	0.85	1.10	1.95	0.11	0.04	0.15	0.05	0.06	0.11	0.00	0.00	0.00	0.03	1.01	1.24	2.24
2012	0.73	1.47	2.20	0.13	0.05	0.17	0.04	0.08	0.12	0.00	0.00	0.00	0.04	0.90	1.64	2.53
2013	0.73	1.47	2.20	0.13	0.05	0.17	0.04	0.08	0.12	0.00	0.00	0.00	0.04	0.90	1.64	2.53
2014	0.64	1.47	2.10	0.12	0.05	0.17	0.04	0.08	0.11	0.00	0.00	0.00	0.04	0.80	1.62	2.42
2015	4.86	4.75	9.61	0.54	0.20	0.74	0.27	0.25	0.52	0.00	0.00	0.00	0.16	5.67	5.36	11.03
2016	4.86	4.75	9.61	0.54	0.20	0.74	0.27	0.25	0.52	0.00	0.00	0.00	0.16	5.67	5.36	11.03
2017	4.44	4.94	9.38	0.53	0.20	0.73	0.25	0.26	0.51	0.00	0.00	0.00	0.16	5.22	5.56	10.78
2018	5.39	5.38	10.77	0.60	0.23	0.83	0.30	0.28	0.58	0.00	0.00	0.00	0.18	6.29	6.07	12.36
2019	5.04	5.15	10.19	0.57	0.22	0.79	0.28	0.27	0.55	0.00	0.00	0.00	0.17	5.89	5.81	11.70
2020	4.11	4.26	8.37	0.47	0.18	0.65	0.23	0.22	0.45	0.00	0.00	0.00	0.14	4.81	4.80	9.61
2021	4.11	4.26	8.37	0.47	0.18	0.65	0.23	0.22	0.45	0.00	0.00	0.00	0.14	4.81	4.80	9.61
2022	2.52	2.97	5.49	0.31	0.12	0.43	0.14	0.15	0.30	0.00	0.00	0.00	0.09	2.97	3.34	6.31
2023	2.52	2.97	5.49	0.31	0.12	0.43	0.14	0.15	0.30	0.00	0.00	0.00	0.09	2.97	3.34	6.31
2024	1.52	2.34	3.86	0.22	0.08	0.30	0.09	0.12	0.21	0.00	0.00	0.00	0.07	1.82	2.61	4.43
2025	0.55	1.46	2.01	0.12	0.04	0.16	0.03	0.08	0.11	0.00	0.00	0.00	0.03	0.70	1.61	2.31
Total	45.98	52.19	98.17	5.53	2.08	7.61	2.58	2.71	5.29	0.00	0.00	0.00	1.67	54.08	58.65	112.74

Table A112.3.10 Economic O&M Costs of Proposed Sewerage Project (Case 2) in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Elec-tricity	Sludge Dispo-sal	Mainte-nance	Person-nel	Other Costs	Price Contin-gency	Total
2008	0.01	0.00	0.01	0.00	0.01	0.00	0.03
2009	0.01	0.00	0.01	0.00	0.01	0.00	0.03
2010	0.01	0.00	0.01	0.00	0.01	0.00	0.03
2011	0.01	0.00	0.03	0.00	0.01	0.01	0.05
2012	0.03	0.01	0.04	0.01	0.02	0.02	0.14
2013	0.03	0.01	0.05	0.02	0.02	0.03	0.16
2014	0.05	0.02	0.08	0.02	0.02	0.05	0.25
2015	0.07	0.02	0.12	0.04	0.03	0.09	0.36
2016	0.08	0.02	0.12	0.04	0.03	0.10	0.39
2017	0.13	0.05	0.19	0.05	0.05	0.18	0.64
2018	0.15	0.07	0.22	0.05	0.05	0.24	0.77
2019	0.18	0.09	0.24	0.05	0.06	0.30	0.93
2020	0.28	0.15	0.31	0.08	0.10	0.51	1.44
2021	0.32	0.18	0.35	0.09	0.11	0.63	1.68
2022	0.37	0.21	0.39	0.09	0.12	0.78	1.95
2023	0.41	0.24	0.43	0.10	0.14	0.95	2.27
2024	0.46	0.27	0.48	0.10	0.15	1.15	2.62
2025	0.51	0.30	0.52	0.11	0.16	1.37	2.96
2026	0.51	0.30	0.52	0.11	0.16	1.48	3.08
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2055	0.51	0.30	0.52	0.11	0.16	5.94	7.54

Economic Value (Unit: Rs. Billion)

Year	Elec-tricity	Sludge Dispo-sal	Mainte-nance	Person-nel	Other Costs	Price Contin-gency	Total
2008	0.01	0.00	0.01	0.00	0.01	0.00	0.02
2009	0.01	0.00	0.01	0.00	0.00	0.00	0.02
2010	0.01	0.00	0.01	0.00	0.00	0.00	0.02
2011	0.01	0.00	0.03	0.00	0.00	0.00	0.04
2012	0.03	0.00	0.04	0.01	0.02	0.00	0.10
2013	0.03	0.00	0.05	0.01	0.02	0.00	0.11
2014	0.05	0.00	0.08	0.02	0.02	0.00	0.17
2015	0.07	0.00	0.11	0.03	0.03	0.00	0.24
2016	0.07	0.00	0.12	0.03	0.03	0.00	0.25
2017	0.12	0.00	0.19	0.04	0.06	0.00	0.41
2018	0.15	0.01	0.21	0.04	0.08	0.00	0.48
2019	0.18	0.01	0.23	0.05	0.10	0.00	0.56
2020	0.27	0.02	0.30	0.07	0.17	0.00	0.84
2021	0.31	0.02	0.34	0.08	0.20	0.00	0.95
2022	0.35	0.03	0.37	0.08	0.23	0.00	1.07
2023	0.40	0.03	0.42	0.08	0.27	0.00	1.20
2024	0.45	0.04	0.46	0.09	0.30	0.00	1.34
2025	0.49	0.04	0.50	0.10	0.33	0.00	1.47
2026	0.49	0.04	0.50	0.10	0.33	0.00	1.47
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2055	0.49	0.04	0.50	0.10	0.33	0.00	1.47

Table A112.3.11 Economic Replacement Costs of Proposed Sewerage Project (Case 2) in Master Plan

Financial Value (Unit: Rs. Billion)

Year	Direct Cost	Engi-neering Cost	Physical Contin-gency	Admin-istration	Price Contin-gency	Total
2023	0.87	0.07	0.05	0.01	0.02	1.01
2024	0.87	0.07	0.05	0.02	0.03	1.03
2025	0.87	0.07	0.05	0.02	0.05	1.05
2026	0.68	0.05	0.04	0.01	0.05	0.83
2027	0.22	0.02	0.01	0.00	0.02	0.27
2028	0.22	0.02	0.01	0.00	0.02	0.27
2029	0.13	0.01	0.01	0.00	0.02	0.16
2030	4.15	0.31	0.22	0.08	0.64	5.40
2031	4.15	0.31	0.22	0.08	0.72	5.49
2032	3.37	0.25	0.18	0.07	0.66	4.53
2033	4.18	0.31	0.22	0.08	0.91	5.71
2034	3.98	0.30	0.21	0.08	0.96	5.53
2035	3.50	0.26	0.19	0.07	0.92	4.95
2036	3.50	0.26	0.19	0.07	1.00	5.03
2037	2.05	0.15	0.11	0.04	0.64	3.00
2038	2.92	0.22	0.16	0.06	0.98	4.34
2039	1.92	0.14	0.10	0.04	0.69	2.90
2040	1.02	0.08	0.05	0.02	0.39	1.56
2041	0.68	0.05	0.04	0.02	0.60	1.38
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2053	2.97	0.22	0.16	0.11	4.19	7.66
2054	1.97	0.15	0.11	0.08	2.88	5.19
2055	1.02	0.08	0.05	0.04	1.54	2.73

Economic Value (Unit: Rs. Billion)

Year	Direct Cost	Engi-neering Cost	Physical Contin-gency	Admin-istration	Price Contin-gency	Total
2023	0.87	0.06	0.05	0.01	0.00	1.00
2024	0.87	0.06	0.05	0.01	0.00	1.00
2025	0.87	0.06	0.05	0.01	0.00	1.00
2026	0.68	0.05	0.04	0.01	0.00	0.78
2027	0.22	0.02	0.01	0.00	0.00	0.25
2028	0.22	0.02	0.01	0.00	0.00	0.25
2029	0.13	0.01	0.01	0.00	0.00	0.15
2030	4.15	0.30	0.22	0.07	0.00	4.74
2031	4.15	0.30	0.22	0.07	0.00	4.74
2032	3.37	0.24	0.18	0.06	0.00	3.85
2033	4.18	0.30	0.22	0.07	0.00	4.78
2034	3.98	0.29	0.21	0.07	0.00	4.55
2035	3.50	0.25	0.19	0.06	0.00	4.00
2036	3.50	0.25	0.19	0.06	0.00	4.00
2037	2.05	0.15	0.11	0.03	0.00	2.35
2038	2.92	0.21	0.16	0.05	0.00	3.34
2039	1.92	0.14	0.10	0.03	0.00	2.20
2040	1.02	0.07	0.05	0.02	0.00	1.16
2041	0.68	0.05	0.04	0.01	0.00	0.78
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2053	2.97	0.21	0.16	0.05	0.00	3.40
2054	1.97	0.14	0.11	0.03	0.00	2.25
2055	1.02	0.07	0.05	0.02	0.00	1.16