CHAPTER 8

APPENDIX – A81.1

Town-wise Population, Sewage Generation and BOD Load Generation

A81.1 Town-wise Population, Sewage Generation and BOD Load Generation

Table A81.1.1 Town-wise Population

(Person)

No.	Town	Area	Total Population					Population in Sewer Covered Area				
		(km^2)	2006	2011	2016	2021	2025	2006	2011	2016	2021	2025
1	Keamari											
	Urbanized Area 1	2.5	82,095	86,720	92,264	98,740	103,920	20,524	38,796	59,486	83,149	103,920
	Urbanized Area 2	7.8	208,096	216,048	225,580	236,714	245,622	145,667	168,290	193,524	221,764	245,622
	Urbanized Area 3	3.9	137,127	140,866	145,349	150,585	154,773	95,989	109,727	124,694	141,074	154,773
	Other	415.6	229,831	595,219	1,033,202	1,544,752	1,953,993	4,597	11,904	20,664	865,061	1,953,993
	Total	429.8	657,149	1,038,853	1,496,395	2,030,791	2,458,308	266,777	328,717	398,368	1,311,048	2,458,308
2	SITE	25.4	720,068	772,637	835,651	909,249	968,127	180,017	345,653	538,775	765,683	968,127
3	Baldia	29.2	643,782	784,294	952,723	1,149,444	1,306,821	64,378	264,183	546,562	931,655	1,306,821
4	Orangi	23.5	1,116,962	1,210,963	1,323,641	1,455,246	1,560,530	111,696	407,903	759,352	1,179,515	1,560,530
5	Lyari	8.0	925,708	938,854	954,611	973,016	987,740	370,283	523,782	683,301	850,109	987,740
6	Saddar	24.1	945,829	999,117	1,062,994	1,137,600	1,197,285	662,080	778,260	911,937	1,065,752	1,197,285
7	Jamshed	23.4	1,138,680	1,265,611	1,417,763	1,595,471	1,737,637	797,076	985,844	1,216,291	1,494,704	1,737,637
8	Gulshan-e-Iqbal	53.7	1,027,454	1,433,010	1,919,145	2,486,936	2,941,169	154,118	535,493	1,146,437	2,041,905	2,941,169
9	Shah Faisal	11.7	515,508	544,553	579,368	620,031	652,561	103,102	223,553	359,818	515,605	652,561
10	Landhi	39.1	1,056,812	1,287,471	1,563,960	1,886,890	2,145,234	211,362	528,541	971,301	1,569,098	2,145,234
11	Korangi	41.5	884,428	1,168,020	1,507,959	1,904,997	2,222,627	442,214	737,697	1,150,811	1,704,471	2,222,627
12	North Nazimabad	16.7	765,820	830,191	907,352	997,474	1,069,572	689,238	769,019	907,352	997,474	1,069,572
13	New Karachi	20.5	1,050,261	1,109,433	1,180,363	1,263,207	1,329,482	525,131	700,695	900,803	1,130,238	1,329,482
14	Gulberg	13.8	699,910	758,741	829,261	911,627	977,520	629,919	702,834	829,261	911,627	977,520
15	Liaquatabad	10.9	988,284	1,002,318	1,019,141	1,038,790	1,054,509	889,456	928,463	1,019,141	1,038,790	1,054,509
16	Malir	17.8	621,348	707,465	810,692	931,258	1,027,711	217,472	368,627	561,084	803,823	1,027,711
17	Bin Qasim											
	Urbanized Area 1	21.1	449,683	593,860	766,690	968,574	1,130,053	89,937	243,795	476,155	805,446	1,130,053
	Other	537.2	122,913	455,113	853,309	1,318,367	1,690,442	2,458	9,102	17,066	738,286	1,690,442
	Total	558.3	572,596	1,048,973	1,619,999	2,286,941	2,820,495	92,395	252,897	493,221	1,543,732	2,820,495
18	Gadap											
	Urbanized Area 1	5.3	135,765	143,415	152,584	163,293	171,860	67,883	90,578	116,446	146,104	171,860
	Urbanized Area 2	20.9	178,458	226,217	300,850	429,286	677,714	17,846	76,199	172,593	347,948	677,714
	Other	1,413.7	270,139	966,033	1,782,807	2,695,508	3,279,991	5,403	19,321	35,656	1,509,484	3,279,991
	Total	1,439.9	584,362	1,335,665	2,236,241	3,288,087	4,129,565	91,132	186,098	324,695	2,003,536	4,129,565
	Sub-Total	2,787.3	14,914,961	18,236,169	22,217,259	26,867,055	30,586,893	6,497,846	9,568,259	13,718,510	21,858,765	30,586,893
19	Cantonment											
	Karachi Cantonment	5.7	22,067	28,025	35,166	43,507	50,180	19,860	25,223	31,649	39,156	50,180
	Clifton Cantonmment	3.4	13,240	16,815	21,100	26,104	30,108	11,916	15,134	18,990	23,494	30,108
	Faisal Cantonment	33.9	130,931	166,281	208,654	258,144	297,737	117,838	149,653	187,789	232,330	297,737
	Malir Cantonment	71.4	276,083	350,622	439,970	544,327	627,812	248,475	315,560	395,973	489,894	627,812
	Korangi Creek Cantonment	12.4	48,058	61,031	76,585	94,751	109,282	43,252	54,928	68,927	85,276	109,282
	Total	126.8	490,379	622,774	781,475	966,833	1,115,119	441,341	560,498	703,328	870,150	1,115,119
20	Defence	38.3	396,252	482,737	586,407	707,490	804,356	118,876	144,821	175,922	459,869	804,356
	Sub-Total	165.1	886,631	1,105,511	1,367,882	1,674,323	1,919,475	560,217	705,319	879,250	1,330,019	1,919,475
	Total	2,952.4	15,801,592	19,341,680	23,585,141	28,541,378	32,506,368	7,058,063	10,273,578	14,597,760	23,188,784	32,506,368

Table A81.1.2 Town-wise Sewage Generation (Total)

(m^3/d)

No.	Town	Domestic					Non-Domestic					Total				
		2006	2011	2016	2021	2025	2006	2011	2016	2021	2025	2006	2011	2016	2021	2025
1	Keamari															
	Urbanized Area 1	3,715	3,927	4,446	5,405	6,216	1,179	1,517	1,808	2,022	2,143	4,894	5,444	6,254	7,427	8,359
	Urbanized Area 2	9,416	9,783	10,871	12,958	14,691	3,277	4,136	4,836	5,281	5,536	12,693	13,919	15,707	18,239	20,227
	Urbanized Area 3	6,205	6,379	7,005	8,243	9,257	1,973	2,482	2,895	3,150	3,277	8,178	8,861	9,900	11,393	12,534
	Other	10,400	26,953	49,792	84,559	116,872	3,285	10,410	20,246	31,650	40,295	13,685	37,363	70,038	116,209	157,167
	Total	29,736	47,042	72,114	111,165	147,036	9,714	18,545	29,785	42,103	51,251	39,450	65,587	101,899	153,268	198,287
2	SITE	34,021	36,532	42,050	51,970	60,463	36,679	38,811	41,822	46,870	49,864	70,700	75,343	83,872	98,840	110,327
3	Baldia	27,171	33,127	42,826	58,689	72,908	7,439	11,679	16,294	20,509	23,469	34,610	44,806	59,120	79,198	96,377
4	Orangi	47,142	51,148	59,499	74,303	87,062	9,578	10,755	12,162	14,197	15,474	56,720	61,903	71,661	88,500	102,536
5	Lyari	39,070	39,655	42,911	49,681	55,106	9,718	9,951	10,290	11,075	11,392	48,788	49,606	53,201	60,756	66,498
6	Saddar	56,807	60,053	67,997	82,657	95,055	91,143	93,057	97,348	107,044	112,409	147,950	153,110	165,345	189,701	207,464
7	Jamshed	61,248	68,127	81,220	103,819	123,548	13,260	16,422	19,811	23,527	25,957	74,508	84,549	101,031	127,346	149,505
8	Gulshan-e-Iqbal	60,345	84,228	120,047	176,701	228,339	35,403	48,065	63,722	85,645	101,609	95,748	132,293	183,769	262,346	329,948
9	Shah Faisal	26,348	27,854	31,538	38,338	44,088	22,265	23,260	24,714	27,300	28,744	48,613	51,114	56,252	65,638	72,832
10	Landhi	44,604	54,380	70,302	96,342	119,683	24,641	28,807	34,332	43,016	49,097	69,245	83,187	104,634	139,358	168,780
11	Korangi	37,328	49,335	67,785	97,267	124,001	25,318	31,640	39,683	51,924	60,725	62,646	80,975	107,468	149,191	184,726
12	North Nazimabad	43,579	47,277	54,991	68,667	80,453	9,268	10,117	11,240	13,120	14,300	52,847	57,394	66,231	81,787	94,753
13	New Karachi	44,327	46,860	53,059	64,498	74,172	9,649	10,356	11,260	12,777	13,658	53,976	57,216	64,319	77,275	87,830
14	Gulberg	38,911	42,214	49,101	61,312	71,836	8,444	9,350	10,478	12,211	13,297	47,355	51,564	59,579	73,523	85,133
15	Liaquatabad	51,315	52,083	56,359	65,250	72,376	11,303	11,301	11,520	12,467	12,864	62,618	63,384	67,879	77,717	85,240
16	Malir	28,325	32,275	39,361	51,358	61,929	51,268	54,625	60,258	71,097	78,269	79,593	86,900	99,619	122,455	140,198
17	Bin Qasim															
	Urbanized Area 1	20,934	27,667	38,014	54,548	69,540	40,134	51,450	65,474	84,907	98,789	61,068	79,117	103,488	139,455	168,329
	Other	5,722	21,203	42,308	74,248	104,025	10,970	39,429	72,870	115,572	147,778	16,692	60,632	115,178	189,820	251,803
	Total	26,656	48,870	80,322	128,796	173,565	51,104	90,879	138,344	200,479	246,567	77,760	139,749	218,666	329,275	420,132
18	Gadap															
	Urbanized Area 1	5,730	6,058	6,859	8,338	9,588	9,546	16,918	23,006	7,117	5,110	15,276	22,976	29,865	15,455	14,698
	Urbanized Area 2	7,532	9,555	13,524	21,919	37,810	2,509	14,229	34,101	16,949	20,150	10,041	23,784	47,625	38,868	57,960
	Other	11,402	40,803	80,140	137,629	182,991	760	3,608	7,046	73,526	97,520	12,162	44,411	87,186	211,155	280,511
	Total	24,664	56,416	100,523	167,886	230,389	12,815	34,755	64,153	97,592	122,780	37,479	91,171	164,676	265,478	353,169
	Sub-Total	721,597	877,476	1,132,005	1,548,699	1,922,009	439,009	552,375	697,216	892,953	1,031,726	1,160,606	1,429,851	1,829,221	2,441,652	2,953,735
19	Cantonment															
	Karachi Cantonment	931	1,184	1,581	2,221	2,800	1,259	1,564	1,947	2,479	2,858	2,190	2,748	3,528	4,700	5,658
	Clifton Cantonnment	559	710	948	1,333	1,680	756	939	1,168	1,488	1,715	1,315	1,649	2,116	2,821	3,395
	Faisal Cantonment	5,526	7,023	9,379	13,180	16,611	7,471	9,284	11,548	14,713	16,953	12,997	16,307	20,927	27,893	33,564
	Malir Cantonment	11,652	14,810	19,777	27,793	35,026	15,756	19,578	24,350	31,024	35,747	27,408	34,388	44,127	58,817	70,773
	Korangi Creek Cantonment	2,028	2,578	3,443	4,838	6,097	2,742	3,408	4,238	5,400	6,223	4,770	5,986	7,681	10,238	12,320
	Total	20,696	26,305	35,128	49,365	62,214	27,984	34,773	43,251	55,104	63,496	48,680	61,078	78,379	104,469	125,710
20	Defence	37,629	45,877	59,309	81,278	100,969	8,313	9,713	11,585	14,552	16,635	45,942	55,590	70,894	95,830	117,604
	Sub-Total	58,325	72,182	94,437	130,643	163,183	36,297	44,486	54,836	69,656	80,131	94,622	116,668	149,273	200,299	243,314
	Total	779,922	949,658	1,226,442	1,679,342	2,085,192	475,306	596,861	752,052	962,609	1,111,857	1,255,228	1,546,519	1,978,494	2,641,951	3,197,049

Table A81.1.3 Town-wise Sewage Generation in Sewer Covered Area

(m^3/d)

No.	Town	Domestic					Non-Domestic					Total				
		2006	2011	2016	2021	2025	2006	2011	2016	2021	2025	2006	2011	2016	2021	2025
1	Keamari															
	Urbanized Area 1	929	1,757	2,867	4,552	6,216	295	679	1,166	1,703	2,143	1,224	2,436	4,033	6,255	8,359
	Urbanized Area 2	6,591	7,621	9,326	12,139	14,691	2,294	3,222	4,149	4,947	5,536	8,885	10,843	13,475	17,086	20,227
	Urbanized Area 3	4,343	4,969	6,009	7,722	9,257	1,381	1,933	2,484	2,951	3,277	5,724	6,902	8,493	10,673	12,534
	Other	208	539	996	47,353	116,872	66	208	405	17,724	40,295	274	747	1,401	65,077	157,167
	Total	12,071	14,886	19,198	71,766	147,036	4,036	6,042	8,204	27,325	51,251	16,107	20,928	27,402	99,091	198,287
2	SITE	8,505	16,343	27,111	43,764	60,463	9,170	17,363	26,964	39,469	49,864	17,675	33,706	54,075	83,233	110,327
3	Baldia	2,717	11,158	24,569	47,569	72,908	744	3,934	9,348	16,623	23,469	3,461	15,092	33,917	64,192	96,377
4	Orangi	4,714	17,229	34,134	60,224	87,062	958	3,623	6,977	11,507	15,474	5,672	20,852	41,111	71,731	102,536
5	Lyari	15,628	22,123	30,715	43,406	55,106	3,887	5,552	7,365	9,676	11,392	19,515	27,675	38,080	53,082	66,498
6	Saddar	39,765	46,778	58,334	77,436	95,055	63,800	72,487	83,514	100,283	112,409	103,565	119,265	141,848	177,719	207,464
7	Jamshed	42,874	53,068	69,678	97,262	123,548	9,282	12,792	16,996	22,041	25,957	52,156	65,860	86,674	119,303	149,505
8	Gulshan-e-Iqbal	9,052	31,474	71,713	145,080	228,339	5,310	17,961	38,066	70,319	101,609	14,362	49,435	109,779	215,399	329,948
9	Shah Faisal	5,270	11,435	19,587	31,881	44,088	4,453	9,549	15,349	22,702	28,744	9,723	20,984	34,936	54,583	72,832
10	Landhi	8,921	22,324	43,661	80,116	119,683	4,928	11,826	21,322	35,771	49,097	13,849	34,150	64,983	115,887	168,780
11	Korangi	18,664	31,159	51,730	87,028	124,001	12,659	19,983	30,284	46,458	60,725	31,323	51,142	82,014	133,486	184,726
12	North Nazimabad	39,221	43,794	54,991	68,667	80,453	8,341	9,372	11,240	13,120	14,300	47,562	53,166	66,231	81,787	94,753
13	New Karachi	22,164	29,596	40,492	57,708	74,172	4,825	6,541	8,593	11,432	13,658	26,989	36,137	49,085	69,140	87,830
14	Gulberg	35,020	39,104	49,101	61,312	71,836	7,600	8,661	10,478	12,211	13,297	42,620	47,765	59,579	73,523	85,133
15	Liaquatabad	46,183	48,245	56,359	65,250	72,376	10,173	10,468	11,520	12,467	12,864	56,356	58,713	67,879	77,717	85,240
16	Malir	9,914	16,817	27,242	44,330	61,929	17,944	28,463	41,705	61,368	78,269	27,858	45,280	68,947	105,698	140,198
17	Bin Qasim															
	Urbanized Area 1	4,187	11,358	23,609	45,361	69,540	8,027	21,122	40,663	70,607	98,789	12,214	32,480	64,272	115,968	168,329
	Other	114	424	846	41,579	104,025	219	789	1,457	64,720	147,778	333	1,213	2,303	106,299	251,803
	Total	4,301	11,782	24,455	86,940	173,565	8,246	21,911	42,120	135,327	246,567	12,547	33,693	66,575	222,267	420,132
18	Gadap															
	Urbanized Area 1	2,865	3,826	5,234	7,460	9,588	4,773	10,685	17,557	6,368	5,110	7,638	14,511	22,791	13,828	14,698
	Urbanized Area 2	753	3,218	7,758	17,766	37,810	251	4,793	19,563	13,738	20,150	1,004	8,011	27,321	31,504	57,960
	Other	228	816	1,603	77,072	182,991	15	72	141	41,175	97,520	243	888	1,744	118,247	280,511
	Total	3,846	7,860	14,595	102,298	230,389	5,039	15,550	37,261	61,281	122,780	8,885	23,410	51,856	163,579	353,169
	Sub-Total	328,830	475,175	717,665	1,272,037	1,922,009	181,395	282,078	427,306	709,380	1,031,726	510,225	757,253	1,144,971	1,981,417	2,953,735
19	Cantonment															
	Karachi Cantonment	838	1,065	1,423	1,999	2,800	1,133	1,408	1,752	2,231	2,858	1,971	2,473	3,175	4,230	5,658
	Clifton Cantonnment	503	639	854	1,200	1,680	680	845	1,051	1,339	1,715	1,183	1,484	1,905	2,539	3,395
	Faisal Cantonment	4,973	6,321	8,441	11,862	16,611	6,724	8,356	10,393	13,242	16,953	11,697	14,677	18,834	25,104	33,564
	Malir Cantonment	10,487	13,329	17,799	25,013	35,026	14,180	17,620	21,915	27,922	35,747	24,667	30,949	39,714	52,935	70,773
	Korangi Creek Cantonment	1,825	2,320	3,098	4,354	6,097	2,468	3,067	3,814	4,860	6,223	4,293	5,387	6,912	9,214	12,320
	Total	18,626	23,674	31,615	44,428	62,214	25,185	31,296	38,925	49,594	63,496	43,811	54,970	70,540	94,022	125,710
20	Defence	11,289	13,763	17,793	52,831	100,969	2,494	2,914	3,476	9,459	16,635	13,783	16,677	21,269	62,290	117,604
	Sub-Total	29,915	37,437	49,408	97,259	163,183	27,679	34,210	42,401	59,053	80,131	57,594	71,647	91,809	156,312	243,314
	Total	358,745	512,612	767,073	1,369,296	2,085,192	209,074	316,288	469,707	768,433	1,111,857	567,819	828,900	1,236,780	2,137,729	3,197,049

Table A81.1.4 Town-wise BOD Generation (Total)

(kg/d)

No.	Town	Domestic					Non-Domestic					Total					BOD (mg/l)
		2006	2011	2016	2021	2025	2006	2011	2016	2021	2025	2006	2011	2016	2021	2025	2025
1	Keamari																
	Urbanized Area 1	4,105	4,336	4,613	4,937	5,196	295	379	452	506	536	4,400	4,715	5,065	5,443	5,732	686
	Urbanized Area 2	10,405	10,802	11,279	11,836	12,281	819	1,034	1,209	1,320	1,384	11,224	11,836	12,488	13,156	13,665	676
	Urbanized Area 3	6,856	7,043	7,267	7,529	7,739	493	621	724	788	819	7,349	7,664	7,991	8,317	8,558	683
	Other	11,492	29,761	51,660	77,238	97,700	821	2,603	5,062	7,913	10,074	12,313	32,364	56,722	85,151	107,774	686
	Total	32,858	51,942	74,819	101,540	122,916	2,428	4,637	7,447	10,527	12,813	35,286	56,579	82,266	112,067	135,729	685
2	SITE	36,003	38,632	41,783	45,462	48,406	9,170	9,703	10,456	11,718	12,466	45,173	48,335	52,239	57,180	60,872	552
3	Baldia	32,189	39,215	47,636	57,472	65,341	1,860	2,920	4,074	5,127	5,867	34,049	42,135	51,710	62,599	71,208	739
4	Orangi	55,848	60,548	66,182	72,762	78,027	2,395	2,689	3,041	3,549	3,869	58,243	63,237	69,223	76,311	81,896	799
5	Lyari	46,285	46,943	47,731	48,651	49,387	2,430	2,488	2,573	2,769	2,848	48,715	49,431	50,304	51,420	52,235	786
6	Saddar	47,291	49,956	53,150	56,880	59,864	22,786	23,264	24,337	26,761	28,102	70,077	73,220	77,487	83,641	87,966	424
7	Jamshed	56,934	63,281	70,888	79,774	86,882	3,315	4,106	4,953	5,882	6,489	60,249	67,387	75,841	85,656	93,371	625
8	Gulshan-e-Iqbal	51,373	71,651	95,957	124,347	147,058	8,851	12,016	15,931	21,411	25,402	60,224	83,667	111,888	145,758	172,460	523
9	Shah Faisal	25,775	27,228	28,968	31,002	32,628	5,566	5,815	6,179	6,825	7,186	31,341	33,043	35,147	37,827	39,814	547
10	Landhi	52,841	64,374	78,198	94,345	107,262	6,160	7,202	8,583	10,754	12,274	59,001	71,576	86,781	105,099	119,536	708
11	Korangi	44,221	58,401	75,398	95,250	111,131	6,330	7,910	9,921	12,981	15,181	50,551	66,311	85,319	108,231	126,312	684
12	North Nazimabad	38,291	41,510	45,368	49,874	53,479	2,317	2,529	2,810	3,280	3,575	40,608	44,039	48,178	53,154	57,054	602
13	New Karachi	52,513	55,472	59,018	63,160	66,474	2,412	2,589	2,815	3,194	3,415	54,925	58,061	61,833	66,354	69,889	796
14	Gulberg	34,996	37,937	41,463	45,581	48,876	2,111	2,338	2,620	3,053	3,324	37,107	40,275	44,083	48,634	52,200	613
15	Liaquatabad	49,414	50,116	50,957	51,940	52,725	2,826	2,825	2,880	3,117	3,216	52,240	52,941	53,837	55,057	55,941	656
16	Malir	31,067	35,373	40,535	46,563	51,386	12,817	13,656	15,065	17,774	19,567	43,884	49,029	55,600	64,337	70,953	506
17	Bin Qasim																
	Urbanized Area 1	22,484	29,693	38,335	48,429	56,503	10,034	12,863	16,369	21,227	24,697	32,518	42,556	54,704	69,656	81,200	482
	Other	6,146	22,756	42,665	65,918	84,522	2,743	9,857	18,218	28,893	36,945	8,889	32,613	60,883	94,811	121,467	482
	Total	28,630	52,449	81,000	114,347	141,025	12,777	22,720	34,587	50,120	61,642	41,407	75,169	115,587	164,467	202,667	482
18	Gadap																
	Urbanized Area 1	6,788	7,171	7,629	8,165	8,593	2,387	4,230	5,752	1,779	1,278	9,175	11,401	13,381	9,944	9,871	672
	Urbanized Area 2	8,923	11,311	15,043	21,464	33,886	627	3,557	8,525	4,237	5,038	9,550	14,868	23,568	25,701	38,924	672
	Other	13,507	48,302	89,140	134,775	164,000	190	902	1,762	18,382	24,380	13,697	49,204	90,902	153,157	188,380	672
	Total	29,218	66,784	111,812	164,404	206,479	3,204	8,689	16,039	24,398	30,696	32,422	75,473	127,851	188,802	237,175	672
	Sub-Total	745,747	911,812	1,110,863	1,343,354	1,529,346	109,755	138,096	174,311	223,240	257,932	855,502	1,049,908	1,285,174	1,566,594	1,787,278	605
19	Cantonment																
	Karachi Cantonment	1,103	1,401	1,758	2,175	2,509	315	391	487	620	715	1,418	1,792	2,245	2,795	3,224	570
	Clifton Cantonnment	662	841	1,055	1,305	1,505	189	235	292	372	429	851	1,076	1,347	1,677	1,934	570
	Faisal Cantonment	6,547	8,314	10,433	12,907	14,887	1,868	2,321	2,887	3,678	4,238	8,415	10,635	13,320	16,585	19,125	570
	Malir Cantonment	13,804	17,531	21,999	27,216	31,391	3,939	4,895	6,088	7,756	8,937	17,743	22,426	28,087	34,972	40,328	570
	Korangi Creek Cantonment	2,403	3,052	3,829	4,738	5,464	686	852	1,060	1,350	1,556	3,089	3,904	4,889	6,088	7,020	570
	Total	24,519	31,139	39,074	48,341	55,756	6,997	8,694	10,814	13,776	15,875	31,516	39,833	49,888	62,117	71,631	570
20	Defence	19,813	24,137	29,320	35,375	40,218	2,078	2,428	2,896	3,638	4,159	21,891	26,565	32,216	39,013	44,377	377
	Sub-Total	44,332	55,276	68,394	83,716	95,974	9,075	11,122	13,710	17,414	20,034	53,407	66,398	82,104	101,130	116,008	477
	Total	790,079	967,088	1,179,257	1,427,070	1,625,320	118,830	149,218	188,021	240,654	277,966	908,909	1,116,306	1,367,278	1,667,724	1,903,286	595

Table A81.1.5 Town-wise BOD Generation in Sewer Covered Area

(kg/d)

No.	Town	Domestic					Non-Domestic					Total					BOD (mg/l)
		2006	2011	2016	2021	2025	2006	2011	2016	2021	2025	2006	2011	2016	2021	2025	2025
1	Keamari																
	Urbanized Area 1	1,026	1,940	2,974	4,157	5,196	74	170	292	426	536	1,100	2,110	3,266	4,583	5,732	686
	Urbanized Area 2	7,283	8,415	9,676	11,088	12,281	574	806	1,037	1,237	1,384	7,857	9,221	10,713	12,325	13,665	676
	Urbanized Area 3	4,799	5,486	6,235	7,054	7,739	345	483	621	738	819	5,144	5,969	6,856	7,792	8,558	683
	Other	230	595	1,033	43,253	97,700	17	52	101	4,431	10,074	247	647	1,134	47,684	107,774	686
	Total	13,338	16,436	19,918	65,552	122,916	1,010	1,511	2,051	6,832	12,813	14,348	17,947	21,969	72,384	135,729	685
2	SITE	9,001	17,283	26,939	38,284	48,406	2,293	4,341	6,741	9,867	12,466	11,294	21,624	33,680	48,151	60,872	552
3	Baldia	3,219	13,209	27,328	46,583	65,341	186	984	2,337	4,156	5,867	3,405	14,193	29,665	50,739	71,208	739
4	Orangi	5,585	20,395	37,968	58,976	78,027	240	906	1,744	2,877	3,869	5,825	21,301	39,712	61,853	81,896	799
5	Lyari	18,514	26,189	34,165	42,505	49,387	972	1,388	1,841	2,419	2,848	19,486	27,577	36,006	44,924	52,235	786
6	Saddar	33,104	38,913	45,597	53,288	59,864	15,950	18,122	20,879	25,071	28,102	49,054	57,035	66,476	78,359	87,966	424
7	Jamshed	39,854	49,292	60,815	74,735	86,882	2,321	3,198	4,249	5,510	6,489	42,175	52,490	65,064	80,245	93,371	625
8	Gulshan-e-Iqbal	7,706	26,775	57,322	102,095	147,058	1,328	4,490	9,517	17,580	25,402	9,034	31,265	66,839	119,675	172,460	523
9	Shah Faisal	5,155	11,178	17,991	25,780	32,628	1,113	2,387	3,837	5,676	7,186	6,268	13,565	21,828	31,456	39,814	547
10	Landhi	10,568	26,427	48,565	78,455	107,262	1,232	2,957	5,331	8,943	12,274	11,800	29,384	53,896	87,398	119,536	708
11	Korangi	22,111	36,885	57,541	85,224	111,131	3,165	4,996	7,571	11,615	15,181	25,276	41,881	65,112	96,839	126,312	684
12	North Nazimabad	34,462	38,451	45,368	49,874	53,479	2,085	2,343	2,810	3,280	3,575	36,547	40,794	48,178	53,154	57,054	602
13	New Karachi	26,257	35,035	45,040	56,512	66,474	1,206	1,635	2,148	2,858	3,415	27,463	36,670	47,188	59,370	69,889	796
14	Gulberg	31,496	35,142	41,463	45,581	48,876	1,900	2,165	2,620	3,053	3,324	33,396	37,307	44,083	48,634	52,200	613
15	Liaquatabad	44,473	46,423	50,957	51,940	52,725	2,543	2,617	2,880	3,117	3,216	47,016	49,040	53,837	55,057	55,941	656
16	Malir	10,874	18,431	28,054	40,191	51,386	4,486	7,116	10,426	15,342	19,567	15,360	25,547	38,480	55,533	70,953	506
17	Bin Qasim																
	Urbanized Area 1	4,497	12,190	23,808	40,272	56,503	2,007	5,281	10,166	17,652	24,697	6,504	17,471	33,974	57,924	81,200	482
	Other	123	455	853	36,914	84,522	55	197	364	16,180	36,945	178	652	1,217	53,094	121,467	482
	Total	4,620	12,645	24,661	77,186	141,025	2,062	5,478	10,530	33,832	61,642	6,682	18,123	35,191	111,018	202,667	482
18	Gadap																
	Urbanized Area 1	3,394	4,529	5,822	7,305	8,593	1,193	2,671	4,389	1,592	1,278	4,587	7,200	10,211	8,897	9,871	672
	Urbanized Area 2	892	3,810	8,630	17,397	33,886	63	1,198	4,891	3,435	5,038	955	5,008	13,521	20,832	38,924	672
	Other	270	966	1,783	75,474	164,000	4	18	35	10,294	24,380	274	984	1,818	85,768	188,380	672
	Total	4,556	9,305	16,235	100,176	206,479	1,260	3,887	9,315	15,321	30,696	5,816	13,192	25,550	115,497	237,175	672
	Sub-Total	324,893	478,414	685,927	1,092,937	1,529,346	45,352	70,521	106,827	177,349	257,932	370,245	548,935	792,754	1,270,286	1,787,278	605
19	Cantonment																
	Karachi Cantonment	993	1,261	1,582	1,958	2,509	283	352	438	558	715	1,276	1,613	2,020	2,516	3,224	570
	Clifton Cantonnment	596	757	950	1,175	1,505	170	211	263	335	429	766	968	1,213	1,510	1,934	570
	Faisal Cantonment	5,892	7,483	9,389	11,617	14,887	1,681	2,089	2,598	3,311	4,238	7,573	9,572	11,987	14,928	19,125	570
	Malir Cantonment	12,424	15,778	19,799	24,495	31,391	3,545	4,405	5,479	6,981	8,937	15,969	20,183	25,278	31,476	40,328	570
	Korangi Creek Cantonment	2,163	2,746	3,446	4,264	5,464	617	767	954	1,215	1,556	2,780	3,513	4,400	5,479	7,020	570
	Total	22,068	28,025	35,166	43,509	55,756	6,296	7,824	9,732	12,400	15,875	28,364	35,849	44,898	55,909	71,631	570
20	Defence	5,944	7,241	8,796	22,993	40,218	624	729	869	2,365	4,159	6,568	7,970	9,665	25,358	44,377	377
	Sub-Total	28,012	35,266	43,962	66,502	95,974	6,920	8,553	10,601	14,765	20,034	34,932	43,819	54,563	81,267	116,008	477
	Total	352,905	513,680	729,889	1,159,439	1,625,320	52,272	79,074	117,428	192,114	277,966	405,177	592,754	847,317	1,351,553	1,903,286	595

APPENDIX – A81.2

Evaluation of Trickling Filter Capacities at TP-1 and TP-2

A81.2 Evaluation of Trickling Filter Capacities at TP-1 and TP-2

Design parameters applied as high rate trickling filter are:

Table A81.2.1 Criteria for High Rate Trickling Filter

	Criteria
Hydraulic loading	Not greater than 15 $m^3/m^2/d$
BOD volumetric loading	Not greater than 1.2 $kg/m^3/d$

Since present influent BOD concentration is not foreseeable, influent BOD is set forth as follows.

Table A81.2.2 Influent and Effluent Qualities

	Influent BOD (mg/l)	Effluent BOD (mg/l)
UASB	600	300
PST	300	180
HRTF / FST	180	80

Where, UASB: Upflow anaerobic sludge blanket
PST: Primary settling tank
HRTF: High rate trickling filter
FST: Final settling tank

One unit of trickling filter has the diameter of 42 m and the water depth of 1.5 m.

Supposing flow rate is Q $m^3/m^2/d$ and the number of trickling filters is N,

Hydraulic loading: $Q/(N*D^2*0.785) \leq 15$

$$Q \leq 11.77*N*D^2$$

BOD volumetric loading: $(Q*0.180)/(N*D^2*0.785*1.5) \leq 1.2$

$$Q \leq 7.85*N*D^2$$

If Q is smaller than the one that satisfies BOD volumetric loading, it will be the maximum possible flow rate. Substituting 8 (units) and 42 (m) for the number of trickling filter and filter diameter respectively, the maximum possible flow rate of each of TP-1 and TP-2 is calculated below.

$Q \leq 7.85* 8*42^2 =$ **110,000** (m^3/d) (24.2 mgd)

APPENDIX – A81.3

Location of Sludge Use/Disposal Sites

A81.3 Location of Sludge Use/Disposal Sites

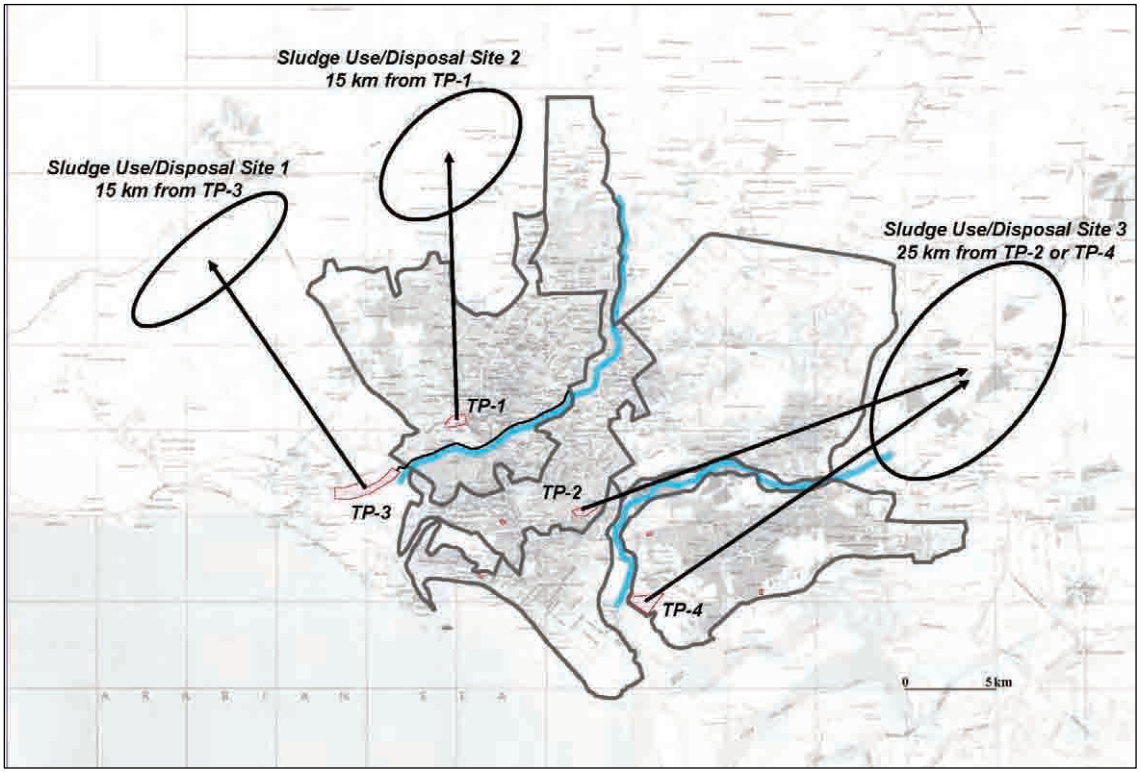

Figure A81.3.1 Location of Sludge Use/Disposal Sites

APPENDIX – A82.1

Alternative Study Details

A82.1 Alternative Study Details

Table A82.1.1 shows a summary sheet for calculation for the alternative study. Initial costs and operation and maintenance cost of each alternative are shown in **Table A82.1.2.**

Table A82.1.1 NPV Calculation Sheet for Alternative Study

(Million Rs.)

		Alternative 1					Alternative 2					Alternative 3				
		Initial	Replace	Land	O&M	Total	Initial	Replace	Land	O&M	Total	Initial	Replace	Land	O&M	Total
1	2008	26,312		0	161	26,474	29,602		0	191	29,793	26,001		900	161	27,062
2	2009				247	247				292	292				246	246
3	2010				332	332				393	393				331	331
4	2011				418	418				494	494				416	416
5	2012	26,312			503	26,815	29,602			595	30,197	26,001			501	26,502
6	2013				589	589				696	696				586	586
7	2014				674	674				797	797				671	671
8	2015				760	760				898	898				756	756
9	2016			12	845	857			12	999	1,011			12	841	853
10	2017	26,312			930	27,243	29,602			1,100	30,703	26,001			927	26,928
11	2018				1,016	1,016				1,201	1,201				1,012	1,012
12	2019				1,101	1,101				1,302	1,302				1,097	1,097
13	2020				1,187	1,187				1,403	1,403				1,182	1,182
14	2021			6	1,272	1,278			6	1,504	1,510			6	1,267	1,273
15	2022	26,312			1,358	27,670	29,602			1,606	31,208	26,001			1,352	27,353
16	2023		10,525		1,443	11,968		11,841		1,707	13,547		10,400		1,437	11,838
17	2024				1,529	1,529				1,808	1,808				1,522	1,522
18	2025				1,614	1,614				1,909	1,909				1,607	1,607
19	2026				1,614	1,614				1,909	1,909				1,607	1,607
20	2027		10,525		1,614	12,139		11,841		1,909	13,750		10,400		1,607	12,008
21	2028				1,614	1,614				1,909	1,909				1,607	1,607
22	2029				1,614	1,614				1,909	1,909				1,607	1,607
23	2030				1,614	1,614				1,909	1,909				1,607	1,607
24	2031				1,614	1,614				1,909	1,909				1,607	1,607
25	2032		10,525		1,614	12,139		11,841		1,909	13,750		10,400		1,607	12,008
26	2033				1,614	1,614				1,909	1,909				1,607	1,607
27	2034				1,614	1,614				1,909	1,909				1,607	1,607
28	2035				1,614	1,614				1,909	1,909				1,607	1,607
29	2036				1,614	1,614				1,909	1,909				1,607	1,607
30	2037		10,525		1,614	12,139		11,841		1,909	13,750		10,400		1,607	12,008
					NPV	**61,452**				**NPV**	**69,478**				**NPV**	**61,575**

NOTE:

Duration:	30 years
Discount rate:	12%
Initial cost:	(1) Based on M/P cost estimate and additional work for alternatives
	(2) 1/4 of total cost in each year of 2008, 2012, 2017, 2022
Replace cost:	(1) 40% of initial cost, after 15 years of each costruction
Land Acquisition cost:	(1) Three new pumping stations in common and TP-5 in Alternative 3 only
O&M cost:	(1) Based on M/P cost estimate and additional work for alternatives for year 2025
	(2) O&M cost of year 2008 is assumed to be 1/10 of that of year 2025
	(3) O&M cost between year 2009 and 2024 is calculated based on interpolation

Table A82.1.2 Initial Cost and O&M Cost Details for Alternatives

	Initial Cost (Million Rs.)			O&M Cost (Million Rs./y in 2025)		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
Zone West						
1. Branch Sewer						
(1) TP-1 and TP-3 District	6,357	6,357	6,357	86	86	86
(2) TP-2 District	2,326	2,326	2,326	29	29	29
2. Sub-main Sewer						
(1) TP-1 and TP-3 District	1,901	1,901	1,901			
(2) TP-2 District	625	625	625			
3. Trunk Sewer						
(1) TP-1 and TP-3 District	2,407	2,407	2,407			
(2) TP-2 District	1,171	1,171	1,171			
4. Sewage Treatment Plant						
(1) TP-1 and TP-3 District	13,312	13,312	13,312	280	280	280
(2) TP-2 District	0	0	0	0	0	0
Sub Total	**28,099**	**28,099**	**28,099**	**395**	**395**	**395**
Zone Central						
1. Branch Sewer						
(1) TP-1 and TP-3 District	1,419	1,419	1,419	17	17	17
(2) TP-2 District	3,087	10,547	3,087	38	144	38
(3) TP-4 District	7,460	0	0	106	0	0
(4) TP-5 District	0	0	7,460	0	0	106
2. Sub-main Sewer						
(1) TP-1 and TP-3 District	369	369	369			
(2) TP-2 District	839	3,176	839			
(3) TP-4 District	2,337	0	0			
(4) TP-5 District	0	0	2,337			
3. Trunk Sewer						
(1) TP-1 and TP-3 District	203	203	203			
(2) TP-2 District	1,406	6,208	1,406			
(3) TP-4 District	4,802	0	0			
(4) TP-5 District	0	0	4,802			
(5) Malir River Crossing	0	-962	-962			
4. Pumping Station						
(1) TP-1 and TP-3 District	572	572	572	19	19	19
(2) TP-2 District	1,007	1,731	1,007	62	96	62
(3) TP-4 District	262	262	262	12	12	12
(4) TP-5 District	0	2,185	0	0	101	0
5. Sewage Treatment Plant						
(1) TP-1 and TP-3 District	0	0	0	0	0	0
(2) TP-2 District	12,762	43,244	12,762	253	803	253
(3) TP-4 District	0	0	0	0	0	0
(4) TP-5 District	0	0	18,987	0	0	383
Sub Total	**36,525**	**68,954**	**54,550**	**507**	**1,192**	**890**
Zone East						
1. Branch Sewer						
(1) TP-4 District	5,140	5,140	5,140	58	58	58
2. Sub-main Sewer						
(1) TP-4 District	1,268	1,268	1,268			
3. Trunk Sewer						
(1) TP-4 District	3,197	3,197	3,197			
4. Pumping Station						
(1) TP-4 District	966	966	966	46	46	46
5. Sewage Treatment Plant						
(1) TP-4 District	30,054	10,785	10,785	608	218	218
Sub Total	**40,625**	**21,356**	**21,356**	**712**	**322**	**322**
Total	**105,249**	**118,409**	**104,005**	**1,614**	**1,909**	**1,607**
Summary						
1. Branch Sewer	25,789	25,789	25,789	334	334	334
2. Sub-main Sewer	7,339	7,339	7,339			
3. Trunk Sewer	13,186	12,224	12,224			
4. Pumping Station	2,807	5,716	2,807	139	274	139
5. Sewage Treatment Plant	56,128	67,341	55,846	1,141	1,301	1,134
Total	**105,249**	**118,409**	**104,005**	**1,614**	**1,909**	**1,607**

APPENDIX – A82.2

Sewer District-wise Catchment Area, Population, Sewage Generation and BOD Generation in 2025

Table A82.2.1 Sewer District-wise / Town-wise Catchment Area

No.	Town	Catchment Area (km^2)			Catchment Area (km^2)							
		Inner	Outer	Total	TP-1 and 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total
1	Keamari											
	Urbanized Area (TP-1 and TP-3)	2.5		2.5	2.5							2.5
	Urbanized Area (TP-2)	7.8		7.8		7.8						7.8
	Urbanized Area (TP-4)	3.9		3.9				3.9				3.9
	Other		415.6	415.6					415.6			415.6
	Total	14.2	415.6	429.8	2.5	7.8		3.9	415.6			429.8
2	SITE	25.4		25.4	25.4							25.4
3	Baldia	29.2		29.2	29.2							29.2
4	Orangi	23.5		23.5	23.5							23.5
5	Lyari	8.0		8.0	8.0							8.0
6	Saddar	24.1		24.1	4.1	11.0		9.0				24.1
7	Jamshed	23.4		23.4	7.8	12.5		3.1				23.4
8	Gulshan-e-Iqbal	53.7		53.7		20.1		33.6				53.7
9	Shah Faisal	11.7		11.7				11.7				11.7
10	Landhi	39.1		39.1				39.1				39.1
11	Korangi	41.5		41.5				41.5				41.5
12	North Nazimabad	16.7		16.7	16.7							16.7
13	New Karachi	20.5		20.5		20.5						20.5
14	Gulberg	13.8		13.8	11.9	1.9						13.8
15	Liaquatabad	10.9		10.9	10.9							10.9
16	Malir	17.8		17.8				17.8				17.8
17	Bin Qasim											
	Urbanized Area	21.1		21.1				21.1				21.1
	Other		537.2	537.2							537.2	537.2
	Total	21.1	537.2	558.3				21.1			537.2	558.3
18	Gadap											
	Urbanized Area 1 (South)	5.3		5.3	5.3							5.3
	Urbanized Area 2 (North)	20.9		20.9		20.9						20.9
	Other		1,413.7	1,413.7						1,413.7		1,413.7
	Total	26.2	1,413.7	1,439.9	5.3	20.9				1,413.7		1,439.9
	Sub-Total	420.8	2,366.5	2,787.3	145.3	94.7	0.0	180.8	415.6	1,413.7	537.2	2,787.3
19	Cantonment											
	Karachi Cantonment	5.7		5.7		5.7						5.7
	Clifton Cantonment	3.4		3.4				3.4				3.4
	Faisal Cantonment	33.9		33.9				33.9				33.9
	Malir Cantonment	71.4		71.4				71.4				71.4
	Korangi Creek Cantonment	12.4		12.4				12.4				12.4
	Total	126.8		126.8		5.7		121.1				126.8
20	Defence	38.3		38.3				38.3				38.3
	Sub-Total	165.1		165.1		5.7		159.4				165.1
	Total	585.9	2,366.5	2,952.4	145.3	100.4	0.0	340.2	415.6	1,413.7	537.2	2,952.4

Table A82.2.2 Sewer District-wise / Town-wise Population in 2025 (Total)

No.	Town	Population (person)			Population (person)							
		Domestic	Non-Domes.	Total	TP-1 or 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total
1	Keamari											
	Urbanized Area (TP-1 and TP-3)			103,920	103,920							103,920
	Urbanized Area (TP-2)			245,622		245,622						245,622
	Urbanized Area (TP-4)			154,773				154,773				154,773
	Other			1,953,993					1,953,993			1,953,993
	Total			2,458,308	103,920	245,622		154,773	1,953,993			2,458,308
2	SITE			968,127	968,127							968,127
3	Baldia			1,306,821	1,306,821							1,306,821
4	Orangi			1,560,530	1,560,530							1,560,530
5	Lyari			987,740	987,740							987,740
6	Saddar			1,197,285	203,687	546,479		447,119				1,197,285
7	Jamshed			1,737,637	579,212	928,225		230,200				1,737,637
8	Gulshan-e-Iqbal			2,941,169		1,100,884		1,840,285				2,941,169
9	Shah Faisal			652,561				652,561				652,561
10	Landhi			2,145,234				2,145,234				2,145,234
11	Korangi			2,222,627				2,222,627				2,222,627
12	North Nazimabad			1,069,572	1,069,572							1,069,572
13	New Karachi			1,329,482		1,329,482						1,329,482
14	Gulberg			977,520	842,934	134,586						977,520
15	Liaquatabad			1,054,509	1,054,509							1,054,509
16	Malir			1,027,711				1,027,711				1,027,711
17	Bin Qasim											
	Urbanized Area			1,130,053				1,130,053				1,130,053
	Other			1,690,442							1,690,442	1,690,442
	Total			2,820,495				1,130,053			1,690,442	2,820,495
18	Gadap											
	Urbanized Area 1 (South)			171,860	171,860							171,860
	Urbanized Area 2 (North)			677,714		677,714						677,714
	Other			3,279,991						3,279,991		3,279,991
	Total			4,129,565	171,860	677,714				3,279,991		4,129,565
	Sub-Total			30,586,893	8,848,912	4,962,992	0	9,850,563	1,953,993	3,279,991	1,690,442	30,586,893
19	Cantonment											
	Karachi Cantonment			50,180		50,180						50,180
	Clifton Cantonment			30,108				30,108				30,108
	Faisal Cantonment			297,737				297,737				297,737
	Malir Cantonment			627,812				627,812				627,812
	Korangi Creek Cantonment			109,282				109,282				109,282
	Total			1,115,119		50,180		1,064,939				1,115,119
20	Defence			804,356				804,356				804,356
	Sub-Total			1,919,475		50,180		1,869,295				1,919,475
	Total			32,506,368	8,848,912	5,013,172	0	11,719,858	1,953,993	3,279,991	1,690,442	32,506,368

Table A82.2.3 Sewer District-wise / Town-wise Population in 2025 (in Service Area)

No.	Town	Population (person)			Population (person)							
		Domestic	Non-Domes.	Total	TP-1 or 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total
1	Keamari											
	Urbanized Area (TP-1 and TP-3)			103,920	103,920							103,920
	Urbanized Area (TP-2)			245,622		245,622						
	Urbanized Area (TP-4)			154,773				154,773				
	Other			1,953,993					1,953,993			1,953,993
	Total			2,458,308	103,920	245,622		154,773	1,953,993			2,458,308
2	SITE			968,127	968,127							968,127
3	Baldia			1,306,821	1,306,821							1,306,821
4	Orangi			1,560,530	1,560,530							1,560,530
5	Lyari			987,740	987,740							987,740
6	Saddar			1,197,285	203,687	546,479		447,119				1,197,285
7	Jamshed			1,737,637	579,212	928,225		230,200				1,737,637
8	Gulshan-e-Iqbal			2,941,169		1,100,884		1,840,285				2,941,169
9	Shah Faisal			652,561				652,561				652,561
10	Landhi			2,145,234				2,145,234				2,145,234
11	Korangi			2,222,627				2,222,627				2,222,627
12	North Nazimabad			1,069,572	1,069,572							1,069,572
13	New Karachi			1,329,482		1,329,482						1,329,482
14	Gulberg			977,520	842,934	134,586						977,520
15	Liaquatabad			1,054,509	1,054,509							1,054,509
16	Malir			1,027,711				1,027,711				1,027,711
17	Bin Qasim											
	Urbanized Area			1,130,053				1,130,053				1,130,053
	Other			1,690,442							1,690,442	1,690,442
	Total			2,820,495				1,130,053			1,690,442	2,820,495
18	Gadap											
	Urbanized Area 1 (South)			171,860	171,860							171,860
	Urbanized Area 2 (North)			677,714		677,714						677,714
	Other			3,279,991						3,279,991		3,279,991
	Total			4,129,565	171,860	677,714				3,279,991		4,129,565
	Sub-Total			30,586,893	8,848,912	4,962,992	0	9,850,563	1,953,993	3,279,991	1,690,442	30,586,893
19	Cantonment											
	Karachi Cantonment			50,180		50,180						50,180
	Clifton Cantonment			30,108				30,108				30,108
	Faisal Cantonment			297,737				297,737				297,737
	Malir Cantonment			627,812				627,812				627,812
	Korangi Creek Cantonment			109,282				109,282				109,282
	Total			1,115,119		50,180		1,064,939				1,115,119
20	Defence			804,356				804,356				804,356
	Sub-Total			1,919,475		50,180		1,869,295				1,919,475
	Total			32,506,368	8,848,912	5,013,172	0	11,719,858	1,953,993	3,279,991	1,690,442	32,506,368

Table A82.2.4 Sewer District-wise / Town-wise Sewage Generation in 2025 (Total)

No.	Town	Sewage Generation (m^3/d)			Sewage Generation (m^3/d)							
		Domestic	Non-Domes.	Total	TP-1 or 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total
1	Keamari											
	Urbanized Area (TP-1 and TP-3)	6,216	2,143	8,359	8,359							8,359
	Urbanized Area (TP-2)	14,691	5,536	20,227		20,227						20,227
	Urbanized Area (TP-4)	9,257	3,277	12,534				12,534				12,534
	Other	116,872	40,295	157,167					157,167			157,167
	Total	147,036	51,251	198,287	8,359	20,227		12,534	157,167			198,287
2	SITE	60,463	49,864	110,327	110,327							110,327
3	Baldia	72,908	23,469	96,377	96,377							96,377
4	Orangi	87,062	15,474	102,536	102,536							102,536
5	Lyari	55,106	11,392	66,498	66,498							66,498
6	Saddar	95,055	112,409	207,464	35,295	94,693		77,476				207,464
7	Jamshed	123,548	25,957	149,505	49,835	79,864		19,806				149,505
8	Gulshan-e-Iqbal	228,339	101,609	329,948		123,500		206,448				329,948
9	Shah Faisal	44,088	28,744	72,832				72,832				72,832
10	Landhi	119,683	49,097	168,780				168,780				168,780
11	Korangi	124,001	60,725	184,726				184,726				184,726
12	North Nazimabad	80,453	14,300	94,753	94,753							94,753
13	New Karachi	74,172	13,658	87,830		87,830						87,830
14	Gulberg	71,836	13,297	85,133	73,412	11,721						85,133
15	Liaquatabad	72,376	12,864	85,240	85,240							85,240
16	Malir	61,929	78,269	140,198				140,198				140,198
17	Bin Qasim											
	Urbanized Area	69,540	98,789	168,329				168,329				168,329
	Other	104,025	147,778	251,803							251,803	251,803
	Total	173,565	246,567	420,132				168,329			251,803	420,132
18	Gadap											
	Urbanized Area 1 (South)	9,588	5,110	14,698	14,698							14,698
	Urbanized Area 2 (North)	37,810	20,150	57,960		57,960						57,960
	Other	182,991	97,520	280,511						280,511		280,511
	Total	230,389	122,780	353,169	14,698	57,960				280,511		353,169
	Sub-Total	1,922,009	1,031,726	2,953,735	737,330	475,795	0	1,051,129	157,167	280,511	251,803	2,953,735
19	Cantonment											
	Karachi Cantonment	2,800	2,858	5,658		5,658						5,658
	Clifton Cantonment	1,680	1,715	3,395				3,395				3,395
	Faisal Cantonment	16,611	16,953	33,564				33,564				33,564
	Malir Cantonment	35,026	35,747	70,773				70,773				70,773
	Korangi Creek Cantonment	6,097	6,223	12,320				12,320				12,320
	Total	62,214	63,496	125,710		5,658		120,052				125,710
20	Defence	100,969	16,635	117,604				117,604				117,604
	Sub-Total	163,183	80,131	243,314		5,658		237,656				243,314
	Total	2,085,192	1,111,857	3,197,049	737,330	481,453	0	1,288,785	157,167	280,511	251,803	3,197,049

Table A82.2.5 Sewer District-wise / Town-wise Sewage Generation in 2025 (in Service Area)

No.	Town	Sewage Generation (m^3/d)			Sewage Generation (m^3/d)							
		Domestic	Non-Domes.	Total	TP-1 or 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total
1	Keamari											
	Urbanized Area (TP-1 and TP-3)	6,216	2,143	8,359	8,359							8,359
	Urbanized Area (TP-2)	14,691	5,536	20,227		20,227						20,227
	Urbanized Area (TP-4)	9,257	3,277	12,534				12,534				12,534
	Other	116,872	40,295	157,167					157,167			157,167
	Total	147,036	51,251	198,287	8,359	20,227		12,534	157,167			198,287
2	SITE	60,463	49,864	110,327	110,327							110,327
3	Baldia	72,908	23,469	96,377	96,377							96,377
4	Orangi	87,062	15,474	102,536	102,536							102,536
5	Lyari	55,106	11,392	66,498	66,498							66,498
6	Saddar	95,055	112,409	207,464	35,295	94,693		77,476				207,464
7	Jamshed	123,548	25,957	149,505	49,835	79,864		19,806				149,505
8	Gulshan-e-Iqbal	228,339	101,609	329,948		123,500		206,448				329,948
9	Shah Faisal	44,088	28,744	72,832				72,832				72,832
10	Landhi	119,683	49,097	168,780				168,780				168,780
11	Korangi	124,001	60,725	184,726				184,726				184,726
12	North Nazimabad	80,453	14,300	94,753	94,753							94,753
13	New Karachi	74,172	13,658	87,830		87,830						87,830
14	Gulberg	71,836	13,297	85,133	73,412	11,721						85,133
15	Liaquatabad	72,376	12,864	85,240	85,240							85,240
16	Malir	61,929	78,269	140,198				140,198				140,198
17	Bin Qasim											
	Urbanized Area	69,540	98,789	168,329				168,329				168,329
	Other	104,025	147,778	251,803							251,803	251,803
	Total	173,565	246,567	420,132				168,329			251,803	420,132
18	Gadap											
	Urbanized Area 1 (South)	9,588	5,110	14,698	14,698							14,698
	Urbanized Area 2 (North)	37,810	20,150	57,960		57,960						57,960
	Other	182,991	97,520	280,511						280,511		280,511
	Total	230,389	122,780	353,169	14,698	57,960				280,511		353,169
	Sub-Total	1,922,009	1,031,726	2,953,735	737,330	475,795	0	1,051,129	157,167	280,511	251,803	2,953,735
19	Cantonment											
	Karachi Cantonment	2,800	2,858	5,658		5,658						5,658
	Clifton Cantonment	1,680	1,715	3,395				3,395				3,395
	Faisal Cantonment	16,611	16,953	33,564				33,564				33,564
	Malir Cantonment	35,026	35,747	70,773				70,773				70,773
	Korangi Creek Cantonment	6,097	6,223	12,320				12,320				12,320
	Total	62,214	63,496	125,710		5,658		120,052				125,710
20	Defence	100,969	16,635	117,604				117,604				117,604
	Sub-Total	163,183	80,131	243,314		5,658		237,656				243,314
	Total	2,085,192	1,111,857	3,197,049	737,330	481,453	0	1,288,785	157,167	280,511	251,803	3,197,049

Table A82.2.6 Sewer District-wise / Town-wise BOD Generation in 2025 (Total)

No.	Town	BOD Generation (kg/d)			BOD Generation (kg/d)								BOD (mg/l)
		Domestic	Non-Domes.	Total	TP-1 or 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total	2025
1	Keamari												
	Urbanized Area (TP-1 and TP-3)	5,196	536	5,732	5,732							5,732	686
	Urbanized Area (TP-2)	12,281	1,384	13,665		13,665						13,665	
	Urbanized Area (TP-4)	7,739	819	8,558				8,558				8,558	
	Other	97,700	10,074	107,774					107,774			107,774	686
	Total	122,916	12,813	135,729	5,732	13,665		8,558	107,774			135,729	685
2	SITE	48,406	12,466	60,872	60,872							60,872	552
3	Baldia	65,341	5,867	71,208	71,208							71,208	739
4	Orangi	78,027	3,869	81,896	81,896							81,896	799
5	Lyari	49,387	2,848	52,235	52,235							52,235	786
6	Saddar	59,864	28,102	87,966	14,965	40,150		32,851				87,966	424
7	Jamshed	86,882	6,489	93,371	31,124	49,878		12,369				93,371	625
8	Gulshan-e-Iqbal	147,058	25,402	172,460		64,552		107,908				172,460	523
9	Shah Faisal	32,628	7,186	39,814				39,814				39,814	547
10	Landhi	107,262	12,274	119,536				119,536				119,536	708
11	Korangi	111,131	15,181	126,312				126,312				126,312	684
12	North Nazimabad	53,479	3,575	57,054	57,054							57,054	602
13	New Karachi	66,474	3,415	69,889		69,889						69,889	796
14	Gulberg	48,876	3,324	52,200	45,013	7,187						52,200	613
15	Liaquatabad	52,725	3,216	55,941	55,941							55,941	656
16	Malir	51,386	19,567	70,953				70,953				70,953	506
17	Bin Qasim												
	Urbanized Area	56,503	24,697	81,200				81,200				81,200	482
	Other	84,522	36,945	121,467							121,467	121,467	482
	Total	141,025	61,642	202,667				81,200			121,467	202,667	482
18	Gadap												
	Urbanized Area 1 (South)	8,593	1,278	9,871	9,871							9,871	672
	Urbanized Area 2 (North)	33,886	5,038	38,924		38,924						38,924	
	Other	164,000	24,380	188,380						188,380		188,380	672
	Total	206,479	30,696	237,175	9,871	38,924				188,380		237,175	672
	Sub-Total	1,529,346	257,932	1,787,278	485,911	284,245	0	599,501	107,774	188,380	121,467	1,787,278	605
19	Cantonment												
	Karachi Cantonment	2,509	715	3,224		3,224						3,224	570
	Clifton Cantonment	1,505	429	1,934				1,934				1,934	570
	Faisal Cantonment	14,887	4,238	19,125				19,125				19,125	570
	Malir Cantonment	31,391	8,937	40,328				40,328				40,328	570
	Korangi Creek Cantonment	5,464	1,556	7,020				7,020				7,020	570
	Total	55,756	15,875	71,631		3,224		68,407				71,631	570
20	Defence	40,218	4,159	44,377				44,377				44,377	377
	Sub-Total	95,974	20,034	116,008		3,224		112,784				116,008	477
	Total	1,625,320	277,966	1,903,286	485,911	287,469	0	712,285	107,774	188,380	121,467	1,903,286	595

Table A82.2.7 Sewer District-wise / Town-wise BOD Generation in 2025 (in Service Area)

No.	Town	BOD Generation (kg/d)			BOD Generation (kg/d)								BOD (mg/l)
		Domestic	Non-Domes.	Total	TP-1 or 3	TP-2	TP-3	TP-4	New STP (Kearari)	New STP (Gadap)	New STP (Bin Qasim)	Total	2025
1	Keamari												
	Urbanized Area (TP-1 and TP-3)	5,196	536	5,732	5,732							5,732	686
	Urbanized Area (TP-2)	12,281	1,384	13,665		13,665						13,665	
	Urbanized Area (TP-4)	7,739	819	8,558				8,558				8,558	
	Other	97,700	10,074	107,774					107,774			107,774	686
	Total	122,916	12,813	135,729	5,732	13,665		8,558	107,774			135,729	685
2	SITE	48,406	12,466	60,872	60,872							60,872	552
3	Baldia	65,341	5,867	71,208	71,208							71,208	739
4	Orangi	78,027	3,869	81,896	81,896							81,896	799
5	Lyari	49,387	2,848	52,235	52,235							52,235	786
6	Saddar	59,864	28,102	87,966	14,965	40,150		32,851				87,966	424
7	Jamshed	86,882	6,489	93,371	31,124	49,878		12,369				93,371	625
8	Gulshan-e-Iqbal	147,058	25,402	172,460		64,552		107,908				172,460	523
9	Shah Faisal	32,628	7,186	39,814				39,814				39,814	547
10	Landhi	107,262	12,274	119,536				119,536				119,536	708
11	Korangi	111,131	15,181	126,312				126,312				126,312	684
12	North Nazimabad	53,479	3,575	57,054	57,054							57,054	602
13	New Karachi	66,474	3,415	69,889		69,889						69,889	796
14	Gulberg	48,876	3,324	52,200	45,013	7,187						52,200	613
15	Liaquatabad	52,725	3,216	55,941	55,941							55,941	656
16	Malir	51,386	19,567	70,953				70,953				70,953	506
17	Bin Qasim												
	Urbanized Area	56,503	24,697	81,200				81,200				81,200	482
	Other	84,522	36,945	121,467							121,467	121,467	482
	Total	141,025	61,642	202,667				81,200			121,467	202,667	482
18	Gadap												
	Urbanized Area 1 (South)	8,593	1,278	9,871	9,871							9,871	672
	Urbanized Area 2 (North)	33,886	5,038	38,924		38,924						38,924	
	Other	164,000	24,380	188,380						188,380		188,380	672
	Total	206,479	30,696	237,175		38,924				188,380		237,175	672
	Sub-Total	1,529,346	257,932	1,787,278	476,040	284,245	0	599,501	107,774	188,380	121,467	1,787,278	605
19	Cantonment												
	Karachi Cantonment	2,509	715	3,224		3,224						3,224	570
	Clifton Cantonment	1,505	429	1,934				1,934				1,934	570
	Faisal Cantonment	14,887	4,238	19,125				19,125				19,125	570
	Malir Cantonment	31,391	8,937	40,328				40,328				40,328	570
	Korangi Creek Cantonment	5,464	1,556	7,020				7,020				7,020	570
	Total	55,756	15,875	71,631		3,224		68,407				71,631	570
20	Defence	40,218	4,159	44,377				44,377				44,377	377
	Sub-Total	95,974	20,034	116,008		3,224		112,784				116,008	477
	Total	1,625,320	277,966	1,903,286	476,040	287,469	0	712,285	107,774	188,380	121,467	1,903,286	595

APPENDIX – A83.1

Trunk Sewer Flow Calculation Sheets

A83.1 Trunk Sewer Flow Calculation Sheets

Table A 83.1.1 (a) Flow Calculation Sheet of TP-1 and TP-3 District in 2006

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
To TP-1																	
1-1a	1-1b	6.60	6.60	139,070	139,070	0.109	0.109	0.164	27	686			1,600	660	0.80	0.296	(Existing)
1-1b	1-2	5.18	11.78	109,149	248,219	0.085	0.194	0.291	33	838			2,600	860	0.80	0.443	(Existing)
1-2	1-3	1.49	13.27	31,396	279,615	0.025	0.219	0.329	54	1,372			1,900	1,670	0.80	1.183	(Existing)
1-3	1-4	7.57	20.84	159,509	439,124	0.125	0.344	0.516	54	1,372			1,900	1,670	0.80	1.183	(Existing)
1-4	TP-1	0.79	21.63	16,646	455,770	0.013	0.357	0.536	54	1,372			2,000	1,670	0.80	1.183	(Existing)
1-5	1-6	4.77	4.77	61,095	61,095		0.000	0.000									
1-6a	1-6b	3.49	8.26	73,539	134,634		0.000	0.000									
1-6b	1-7	11.15	19.41	234,944	369,578	0.184	0.184	0.276	27	686			5,100	660	0.80	0.296	(Existing)
1-7	1-8	0.59	20.00	12,432	382,010	0.010	0.194	0.291	36	914			3,400	970	0.80	0.525	(Existing)
1-8	1-9	2.81	22.81	59,210	441,220	0.046	0.240	0.360	66	1,676			900	2,180	0.80	1.765	(Existing)
1-9	TP-1	3.28	26.09	69,114	510,334	0.054	0.294	0.441	66	1,676			1,700	2,180	0.80	1.765	(Existing)
1-10	1-11	7.16	7.16	150,870	150,870		0.000	0.000									
1-11	1-12	7.34	14.50	154,663	305,533		0.000	0.000									
1-12	1-17	6.57	21.07	138,438	443,971		0.000	0.000									
1-13	1-14	8.60	8.60	181,213	181,213		0.000	0.000									
1-14	1-15	7.87	16.47	165,831	347,044		0.000	0.000									
1-15	1-16	10.27	26.74	216,401	563,445		0.000	0.000									
1-16	1-17	10.02	57.83	211,134	774,579		0.000	0.000									
1-17	TP-1	0.00	78.90	0	1,218,550		0.000	0.000									
To TP-3																	
3-1	3-3	1.34	1.34	28,235	28,235	0.022	0.022	0.033		1,500	1,500	1	3,500	592	1.65	3.190	Lyari Interceptor (Existing))
3-2	3-3	4.84	4.84	97,605	97,605		0.000	0.000									Gujar Nallah
3-3	3-5	0.07	6.25	1,475	127,315	0.001	0.023	0.035		1,500	1,500	1	1,200	592	1.65	3.190	Lyari Interceptor (Existing))
3-4	3-5	4.98	4.98	104,935	104,935		0.000	0.000									Orangi Nallah
3-5	3-8	0.28	11.51	5,900	238,150	0.005	0.028	0.042		2,000	1,500	1	2,800	1,000	1.44	3.746	Lyari Interceptor (Existing))
3-6a	3-6b	3.82	3.82	143,703	143,703	0.121	0.121	0.182	24	610			1,200	560	0.81	0.235	(Existing)
3-6b	Jamila PS (3-7)	5.08	8.90	191,103	334,806	0.161	0.282	0.423	48	1,219			4,000	1,420	0.80	0.936	(Existing)
Jamila PS (3-7)	3-8	5.31	14.21	199,755	534,561	0.168	0.450	0.675		900			1,800	PM	0.81		Pressure (Existing)
										850			1,800	PM			
3-8	3-10	0.00	25.72	0	772,711	0.000	0.478	0.717		2,000	2,000	1	100	1,176	1.42	4.971	Lyari Interceptor (Existing))
Chakiwara PS (3-9)	3-10	5.68	5.68	213,674	213,674	0.180	0.180	0.270		800			1,400	PM	0.54		Pressure (Existing)
3-10	TP-3	8.34	39.74	143,580	1,129,965	0.110	0.768	1.152		2,000	2,000	2	3,800	2,500	0.97	6.818	Lyari Interceptor (Existing))

Summary of Pumping Stations in TP-1 and TP-3 District

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Jamila PS	0.675	1.013
Chakiwara PS	0.270	0.405
Main PS of TP-1	0.977	1.465
Main PS of TP-3	1.152	1.728

Summary of Sewage Treatment Plant, TP-1 and TP-3

	Flow (m^3/d)	Remarks
TP-1	56,246	
TP-3	66,355	
Total	122,602	

Table A83.1.1 (b) Flow Calculation Sheet of TP-2 District in 2006

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
2-1a	2-2a	11.90	11.90	10,161	10,161		0.000	0.000									
2-2a	2-3	10.08	21.98	258,211	268,372	0.154	0.154	0.231	30	762			4,600	760	0.80	0.366	(Existing)
2-1b	2-2b	9.00	9.00	7,685	7,685		0.000	0.000									
2-2b	2-3	10.42	19.42	266,920	274,605		0.000	0.000									
2-3	Iqbal PS (2-4)	1.90	43.30	86,728	629,705		0.000	0.000									
Iqbal PS (2-4)	2-6	1.01	44.31	18,301	648,006		0.000	0.000									
2-5a	2-5b	5.00	5.00	90,597	90,597		0.000	0.000									
2-5b	2-6	7.28	12.28	131,909	222,506		0.000	0.000									
2-6	2-7	5.13	61.72	92,952	963,464		0.000	0.000									
2-7	TP-2 (2-24)	13.94	75.66	169,164	1,132,628	0.189	0.189	0.284	42	1,067			4,700	1,190	0.80	0.717	(Existing)
2-8	2-9	5.83	5.83	105,636	105,636	0.117	0.117	0.176	42	1,067			1,300	1,190	0.80	0.717	(Existing)
2-9	TP-2 (2-14)	2.21	8.04	40,044	145,680	0.044	0.161	0.242	42	1,067			1,600	1,190	0.80	0.717	(Existing)
2-10	2-11	5.87	5.87	106,361	106,361		0.000	0.000									
2-11	Clifton PS (2-13)	6.92	12.79	125,386	231,747	0.139	0.139	0.209	54	1,372			4,100	1,670	0.80	1.183	(Existing)
2-12	Clifton PS (2-13)	3.91	3.91	70,847	70,847	0.079	0.079	0.119	42	1,067			1,900	1,190	0.80	0.717	(Existing)
Clifton PS (2-13)	TP-2 (2-14)	0.00	16.70	0	302,594	0.000	0.218	0.327		1,200			4,800	PM	0.29		(Existing)

Summary of Pumping Stations in TP-2 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Iqbal PS	0.000	0.000
Clifton PS	0.327	0.491
Main PS of TP-2	0.525	0.788

Summary of Sewage Treatment Plant, TP-2

	Flow (m^3/d)	Remarks
TP-2	49,075	

Table A83.1.1 (c) Flow Calculation Sheet of TP-4 District in 2006

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
4-1a	4-1b	5.89	5.89	49,838	49,838		0.000	0.000									
4-1b	4-2	6.00	11.89	50,769	100,607		0.000	0.000									
4-2	4-9	6.93	18.82	58,638	159,245		0.000	0.000									
4-3a	4-3b	5.66	5.66	47,892	47,892		0.000	0.000									
4-3b	4-4	10.74	16.40	90,877	138,769		0.000	0.000									
4-4	4-5	6.48	22.88	54,831	193,600		0.000	0.000									
4-5	4-7	2.93	25.81	24,792	218,392	0.022	0.022	0.033	48	1,219			4,400	1,420	0.80	0.936	(Existing)
4-6a	4-6b	5.33	5.33	45,100	45,100	0.040	0.040	0.060	33	838			1,800	860	0.80	0.443	(Existing)
4-6b	4-6c	6.85	12.18	57,961	103,061	0.052	0.092	0.138	36	914			2,400	970	0.80	0.525	(Existing)
4-6c	4-7	7.90	20.08	66,846	169,907	0.060	0.152	0.228	48	1,219			4,600	1,420	0.80	0.936	(Existing)
4-7	Korangi PS(4-8)	0.85	46.74	7,192	395,491	0.006	0.180	0.270	54	1,372			1,600	1,670	0.80	1.183	(Existing)
Korangi PS(4-8)	4-9	0.00	46.74	0	395,491	0.000	0.180	0.270		1,220			1,700	PM	0.23		Pressure (Existing)
4-9	TP-4 (4-27)	6.91	72.47	53,496	608,232		0.000	0.000									
4-10a	4-10b	5.65	5.65	47,808	47,808		0.000	0.000									
4-10b	B-Qasim PS(4-10c)	4.05	9.70	34,269	82,077		0.000	0.000									
B-Qasim PS(4-10c)	4-10d	0.00	9.70	0	82,077		0.000	0.000									
4-10d	4-11	6.70	16.40	56,692	138,769		0.000	0.000									
4-11	TP-4 (4-27)	11.40	27.80	39,764	178,533		0.000	0.000									
4-12	4-14	6.03	6.03	50,582	50,582		0.000	0.000									
4-13a	4-13b	5.77	5.77	48,401	48,401		0.000	0.000									
4-13b	4-14	3.51	9.28	29,443	77,844	0.039	0.039	0.059	30	762			4,800	760	0.80	0.366	(Existing)
4-14	4-17	0.00	15.31	0	128,426		0.000	0.000									
4-15a	4-15b	34.74	34.74	120,931	120,931		0.000	0.000									
4-15b	4-16	18.08	52.82	62,937	183,868		0.000	0.000									
4-16a	4-16b	15.82	68.64	75,984	259,852	0.093	0.093	0.140	24	610			4,200	560	0.81	0.235	(Existing)
4-16b	4-17	8.99	77.63	58,660	318,512	0.075	0.168	0.252	30	762			5,300	760	0.80	0.366	(Existing)
4-17	4-20	0.83	93.77	6,962	453,900		0.000	0.000									
4-18a	4-18b	13.47	13.47	66,813	66,813		0.000	0.000									
4-18b	4-18c	18.36	31.83	154,011	220,824		0.000	0.000									
4-18c	4-19	11.12	42.95	78,557	299,381		0.000	0.000									
4-19	4-20	19.97	62.92	98,560	397,941	0.121	0.121	0.182									Nallah
4-20	4-22	0.00	156.69	0	851,841		0.000	0.000									
								0.000									
4-21	4-22	13.43	13.43	58,374	58,374	0.070	0.070	0.105									Nallah
4-22	4-26	14.64	184.76	115,872	1,026,087		0.000	0.000									
4-23a	4-23b	6.08	6.08	51,002	51,002		0.000	0.000									
4-23b	Port PS (4-23c)	5.47	11.55	45,885	96,887		0.000	0.000									
Port PS (4-23c)	4-24	0.00	11.55	0	96,887		0.000	0.000									
4-24	4-25	17.03	28.58	133,185	230,072		0.000	0.000									
4-25	4-26	12.73	41.31	106,785	336,857		0.000	0.000									
4-26	TP-4 (4-27)	0.00	226.07	0	1,362,944		0.000	0.000									

Summary of Pumping Stations in TP-4 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Korangi PS	0.270	0.405
B-Qasim PS	0.000	0.000
Port PS	0.000	0.000
Main PS of TP-4	0.000	0.000

Summary of Sewage Treatment Plant, TP-4

	Flow (m^3/d)	Remarks
TP-4	0	

Table A83.1.2 (a) Flow Calculation Sheet of TP-1 and TP-3 District in 2011

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
To TP-1																	
1-1a	1-1b	6.60	6.60	186,399	186,399	0.145	0.145	0.218	27	686			1,600	660	0.80	0.296	(Existing)
1-1b	1-2	5.18	11.78	146,295	332,694	0.114	0.259	0.389	33	838			2,600	860	0.80	0.443	(Existing)
1-2	1-3	1.49	13.27	42,081	374,775	0.033	0.292	0.438	54	1,372			1,900	1,670	0.80	1.183	(Existing)
1-3	1-4	7.57	20.84	213,794	588,569	0.166	0.458	0.687	54	1,372			1,900	1,670	0.80	1.183	(Existing)
1-4	TP-1	0.79	21.63	22,311	610,880	0.017	0.475	0.713	54	1,372			2,000	1,670	0.80	1.183	(Existing)
1-5	1-6	4.77	4.77	81,520	81,520		0.000	0.000									
1-6a	1-6b	3.49	8.26	98,565	180,085		0.000	0.000									
1-6b	1-7	11.15	19.41	314,901	494,986	0.244	0.244	0.366	27	686			5,100	660	0.80	0.296	(Existing)
1-7	1-8	0.59	20.00	16,663	511,649	0.013	0.257	0.386	36	914			3,400	970	0.80	0.525	(Existing)
1-8	1-9	2.81	22.81	79,361	591,010	0.062	0.319	0.479	66	1,676			900	2,180	0.80	1.765	(Existing)
1-9	TP-1	3.28	26.09	92,635	683,645	0.072	0.391	0.587	66	1,676			1,700	2,180	0.80	1.765	(Existing)
1-10	1-11	7.16	7.16	202,214	202,214		0.000	0.000									
1-11	1-12	7.34	14.50	207,298	409,512		0.000	0.000									
1-12	1-17	6.57	21.07	185,552	595,064		0.000	0.000									
1-13	1-14	8.60	8.60	242,883	242,883		0.000	0.000									
1-14	1-15	7.87	16.47	222,266	465,149		0.000	0.000									
1-15	1-16	10.27	26.74	290,048	755,197		0.000	0.000									
1-16	1-17	10.02	57.83	282,987	1,038,184		0.000	0.000									
1-17	TP-1	0.00	78.90	0	1,633,248		0.000	0.000									
To TP-3						0.282	0.282										
3-1	3-3	1.34	1.34	37,845	37,845	0.029	0.311	0.467		1,500	1,500	1	3,500	592	1.65	3.190	Lyari Interceptor (Existing))
3-2	3-3	4.84	4.84	130,782	130,782		0.000	0.000									Gujar Nallah
3-3	3-5	0.07	6.25	1,977	170,604	0.002	0.313	0.470		1,500	1,500	1	1,200	592	1.65	3.190	Lyari Interceptor (Existing))
3-4	3-5	4.98	4.98	140,646	140,646		0.000	0.000									Orangi Nallah
3-5	3-8	0.28	11.51	7,908	319,158	0.006	0.319	0.479		2,000	1,500	1	2,800	1,000	1.44	3.746	Lyari Interceptor (Existing))
3-6a	3-6b	3.82	3.82	189,042	189,042	0.155	0.155	0.233	24	610			1,200	560	0.81	0.235	(Existing)
3-6b	Jamila PS (3-7)	5.08	8.90	251,396	440,438	0.207	0.362	0.543	48	1,219			4,000	1,420	0.80	0.936	(Existing)
Jamila PS (3-7)	3-8	5.31	14.21	262,778	703,216	0.216	0.578	0.867		900			1,800	PM	1.04		Pressure (Existing)
										850			0	PM			
3-8	3-10	0.00	25.72	0	1,022,374	0.000	0.897	1.346		2,000	2,000	1	100	1,176	1.42	4.971	Lyari Interceptor (Existing))
Chakiwara PS (3-9)	3-10	5.68	5.68	281,088	281,088	0.231	0.231	0.347		800			1,400	PM	0.69		Pressure (Existing)
3-10	TP-3	8.34	39.74	203,731	1,507,193	0.156	1.284	1.926		2,000	2,000	2	3,800	2,500	0.97	6.818	Lyari Interceptor (Existing))

Summary of Pumping Stations in TP-1 and TP-3 District

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Jamila PS	0.867	1.301
Chakiwara PS	0.347	0.520
Main PS of TP-1	1.299	1.949
Main PS of TP-3	1.926	2.889

Summary of Sewage Treatment Plant, TP-1 and TP-3

	Flow (m^3/d)	Remarks
TP-1	74,822	
TP-3	110,938	
Total	185,760	

Table A83.1.2 (b) Flow Calculation Sheet of TP-2 District in 2011

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
2-1a	2-2a	11.90	11.90	43,386	43,386		0.000	0.000									
2-2a	2-3	10.08	21.98	344,537	387,923	0.206	0.206	0.309	30	762			4,600	760	0.80	0.366	(Existing)
2-1b	2-2b	9.00	9.00	32,813	32,813		0.000	0.000									
2-2b	2-3	10.42	19.42	356,158	388,971		0.000	0.000									
2-3	**Iqbal PS (2-4)**	**1.90**	**43.30**	**96,767**	**873,661**	**0.076**	**0.282**	**0.423**	**84**	**2,134**			**9,300**	**3,000**	**0.80**	**2.865**	**Lyari Interceptor (Extended)**
Iqbal PS (2-4)	2-6	1.01	44.31	24,574	898,235		0.000	0.000									
2-5a	2-5b	5.00	5.00	121,651	121,651		0.000	0.000									
2-5b	2-6	7.28	12.28	177,124	298,775		0.000	0.000									
2-6	2-7	5.13	61.72	124,814	1,321,824		0.000	0.000									
2-7	TP-2 (2-24)	13.94	75.66	225,704	1,547,528	0.249	0.249	0.374	42	1,067			4,700	1,190	0.80	0.717	(Existing)
2-8	2-9	5.83	5.83	141,845	141,845	0.156	0.156	0.234	42	1,067			1,300	1,190	0.80	0.717	(Existing)
2-9	TP-2 (2-14)	2.21	8.04	53,770	195,615	0.059	0.215	0.323	42	1,067			1,600	1,190	0.80	0.717	(Existing)
2-10	2-11	5.87	5.87	142,818	142,818		0.000	0.000									
2-11	Clifton PS (2-13)	6.92	12.79	168,365	311,183	0.185	0.185	0.278	54	1,372			4,100	1,670	0.80	1.183	(Existing)
2-12	Clifton PS (2-13)	3.91	3.91	95,131	95,131	0.105	0.105	0.158	42	1,067			1,900	1,190	0.80	0.717	(Existing)
Clifton PS (2-13)	TP-2 (2-14)	0.00	16.70	0	406,314	0.000	0.290	0.435		1,200			4,800	PM	0.38		(Existing)

Summary of Pumping Stations in TP-2 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Iqbal PS	0.000	0.000
Clifton PS	0.435	0.653
Main PS of TP-2	0.696	1.044

Summary of Sewage Treatment Plant, TP-2

	Flow (m^3/d)	Remarks
TP-2	65,146	

Table A83.1.2 (c) Flow Calculation Sheet of TP-4 District in 2011

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
4-1a	4-1b	5.89	5.89	101,219	101,219		0.000	0.000									
4-1b	**4-2**	**6.00**	**11.89**	**103,109**	**204,328**	**0.093**	**0.093**	**0.140**	**66**	**1,676**			**6,400**	**2,180**	**0.80**	**1.765**	**Malir Interceptor (L)**
4-2	**4-9**	**6.93**	**18.82**	**119,091**	**323,419**	**0.108**	**0.201**	**0.302**	**72**	**1,829**			**4,200**	**2,450**	**0.80**	**2.101**	**Malir Interceptor (L)**
4-3a	4-3b	5.66	5.66	97,266	97,266		0.000	0.000									
4-3b	4-4	10.74	16.40	184,565	281,831		0.000	0.000									
4-4	4-5	6.48	22.88	111,358	393,189		0.000	0.000									
4-5	4-7	2.93	25.81	50,352	443,541	0.045	0.045	0.068	48	1,219			4,400	1,420	0.80	0.936	(Existing)
4-6a	4-6b	5.33	5.33	91,595	91,595	0.083	0.083	0.125	33	838			1,800	860	0.80	0.443	(Existing)
4-6b	4-6c	6.85	12.18	117,716	209,311	0.106	0.189	0.284	36	914			2,400	970	0.80	0.525	(Existing)
4-6c	4-7	7.90	20.08	135,760	345,071	0.123	0.312	0.468	48	1,219			4,600	1,420	0.80	0.936	(Existing)
4-7	Korangi PS(4-8)	0.85	46.74	14,607	803,219	0.013	0.370	0.555	54	1,372			1,600	1,670	0.80	1.183	(Existing)
Korangi PS(4-8)	4-9	0.00	46.74	0	803,219	0.000	0.370	0.555		1,220			1,700	PM	0.48		Pressure (Existing)
4-9	**TP-4 (4-27)**	**6.91**	**72.47**	**105,992**	**1,232,630**	**0.097**	**0.668**	**1.002**		**3,500**	**3,000**	**1**	**6,200**	**7,800**	**0.80**	**7.505**	**Malir Interceptor (L)**
4-10a	4-10b	5.65	5.65	97,094	97,094		0.000	0.000									
4-10b	B-Qasim PS(4-10c)	4.05	9.70	69,599	166,693		0.000	0.000									
B-Qasim PS(4-10c)	4-10d	0.00	9.70	0	166,693		0.000	0.000									
4-10d	4-11	6.70	16.40	115,139	281,832		0.000	0.000									
4-11	TP-4 (4-27)	11.40	27.80	50,498	332,330		0.000	0.000									
4-12	**4-14**	**6.03**	**6.03**	**82,343**	**82,343**	**0.103**	**0.103**	**0.155**	**42**	**1,067**			**3,300**	**1,190**	**0.80**	**0.717**	**Malir Interceptor (R)**
4-13a	4-13b	5.77	5.77	78,793	78,793		0.000	0.000									
4-13b	4-14	3.51	9.28	47,931	126,724	0.060	0.060	0.090	30	762			4,800	760	0.80	0.366	(Existing)
4-14	**4-17**	**0.00**	**15.31**	**0**	**209,067**	**0.000**	**0.163**	**0.245**	**66**	**1,676**			**3,700**	**2,180**	**0.80**	**1.765**	**Malir Interceptor (R)**
4-15a	4-15b	34.74	34.74	153,580	153,580		0.000	0.000									
4-15b	4-16	18.08	52.82	79,929	233,509		0.000	0.000									
4-16a	4-16b	15.82	68.64	109,319	342,828	0.131	0.131	0.197	24	610			4,200	560	0.81	0.235	(Existing)
4-16b	4-17	8.99	77.63	91,252	434,080	0.113	0.244	0.366	30	762			5,300	760	0.80	0.366	(Existing)
4-17	**4-20**	**0.83**	**93.77**	**11,334**	**654,481**	**0.014**	**0.421**	**0.632**		**2,750**	**2,000**	**1**	**2,800**	**5,200**	**0.80**	**3.905**	**Malir Interceptor (R)**
4-18a	4-18b	13.47	13.47	97,042	97,042		0.000	0.000									
4-18b	4-18c	18.36	31.83	250,716	347,758		0.000	0.000									
4-18c	4-19	11.12	42.95	124,146	471,904		0.000	0.000									
4-19	**4-20**	**19.97**	**62.92**	**142,974**	**614,878**	**0.172**	**0.172**	**0.258**					**9,200**				**Nallah**
4-20	**4-22**	**0.00**	**156.69**	**0**	**1,269,359**	**0.000**	**0.593**	**0.890**		**2,750**	**2,000**	**2**	**1,000**	**5,200**	**0.80**	**7.810**	**Malir Interceptor (R)**
4-21	**4-22**	**13.43**	**13.43**	**81,281**	**81,281**	**0.096**	**0.096**	**0.144**					**2,700**				**Nallah**
4-22	**4-26**	**14.64**	**184.76**	**186,847**	**1,537,487**	**0.234**	**0.923**	**1.385**		**3,250**	**2,000**	**2**	**7,800**	**5,800**	**0.80**	**9.306**	**Malir Interceptor (R)**
4-23a	4-23b	6.08	6.08	83,026	83,026		0.000	0.000									
4-23b	Port PS (4-23c)	5.47	11.55	74,696	157,722		0.000	0.000									
Port PS (4-23c)	4-24	0.00	11.55	0	157,722		0.000	0.000									
4-24	4-25	17.03	28.58	214,329	372,051		0.000	0.000									
4-25	4-26	12.73	41.31	173,835	545,886		0.000	0.000									
4-26	**TP-4 (4-27)**	**0.00**	**226.07**	**0**	**2,083,373**	**0.000**	**0.923**	**1.385**		**3,500**	**3,000**	**2**	**2,000**		**0.07**	**15.010**	**Reversed Siphon crossing Malir**

Summary of Pumping Stations in TP-4 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Korangi PS	0.555	0.833
B-Qasim PS	0.000	0.000
Port PS	0.000	0.000
Main PS of TP-4	2.387	3.580

Summary of Sewage Treatment Plant, TP-4

	Flow (m^3/d)	Remarks
TP-4	137,462	

Table A83.1.3 (a) Flow Calculation Sheet of TP-1 and TP-3 District in 2016

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
To TP-1																	
1-1a	**1-1b**	**6.60**	**6.60**	**251,780**	**251,780**	**0.204**	**0.204**	**0.306**	**42**	**1,067**			**1,600**	**1,190**	**0.80**	**0.717**	
1-1b	**1-2**	**5.18**	**11.78**	**197,609**	**449,389**	**0.160**	**0.364**	**0.546**	**54**	**1,372**			**2,600**	**1,670**	**0.80**	**1.183**	
1-2	1-3	1.49	13.27	56,841	506,230	0.046	0.410	0.615	54	1,372			1,900	1,670	0.80	1.183	(Existing)
1-3	1-4	7.57	20.84	288,784	795,014	0.234	0.644	0.966	54	1,372			1,900	1,670	0.80	1.183	(Existing)
1-4	TP-1	0.79	21.63	30,137	825,151	0.024	0.668	1.002	54	1,372			2,000	1,670	0.80	1.183	(Existing)
1-5	1-6	4.77	4.77	104,801	104,801		0.000	0.000									
1-6a	**1-6b**	**3.49**	**8.26**	**133,138**	**237,939**	**0.108**	**0.108**	**0.162**	**42**	**1,067**			**1,700**	**1,190**	**0.80**	**0.717**	
1-6b	**1-7**	**11.15**	**19.41**	**425,356**	**663,295**	**0.345**	**0.453**	**0.680**	**66**	**1,676**			**5,100**	**2,180**	**0.80**	**1.765**	
1-7	**1-8**	**0.59**	**20.00**	**22,508**	**685,803**	**0.018**	**0.471**	**0.707**	**66**	**1,676**			**3,400**	**2,180**	**0.80**	**1.765**	
1-8	1-9	2.81	22.81	107,197	793,000	0.087	0.558	0.837	66	1,676			900	2,180	0.80	1.765	(Existing)
1-9	TP-1	3.28	26.09	125,127	918,127	0.102	0.660	0.990	66	1,676			1,700	2,180	0.80	1.765	(Existing)
1-10	**1-11**	**7.16**	**7.16**	**273,144**	**273,144**	**0.222**	**0.222**	**0.333**	**42**	**1,067**			**1,600**	**1,190**	**0.80**	**0.717**	
1-11	**1-12**	**7.34**	**14.50**	**280,010**	**553,154**	**0.227**	**0.449**	**0.674**	**66**	**1,676**			**3,100**	**2,180**	**0.80**	**1.765**	
1-12	**1-17**	**6.57**	**21.07**	**250,636**	**803,790**	**0.203**	**0.652**	**0.978**	**66**	**1,676**			**5,200**	**2,180**	**0.80**	**1.765**	
1-13	**1-14**	**8.60**	**8.60**	**328,077**	**328,077**	**0.266**	**0.266**	**0.399**	**42**	**1,067**			**1,200**	**1,190**	**0.80**	**0.717**	
1-14	**1-15**	**7.87**	**16.47**	**300,229**	**628,306**	**0.244**	**0.510**	**0.765**	**66**	**1,676**			**2,200**	**2,180**	**0.80**	**1.765**	
1-15	**1-16**	**10.27**	**26.74**	**391,786**	**1,020,092**	**0.318**	**0.828**	**1.242**	**84**	**2,134**			**3,300**	**3,000**	**0.80**	**2.865**	
1-16	**1-17**	**10.02**	**57.83**	**382,248**	**1,402,340**	**0.310**	**1.138**	**1.707**		**3,000**	**1,500**	**1**	**7,200**	**4,400**	**0.80**	**3.198**	
1-17	**TP-1**	**0.00**	**78.90**	**0**	**2,206,130**	**0.000**	**1.790**	**2.685**		**3,500**	**2,000**	**1**	**100**	**6,200**	**0.80**	**4.975**	
To TP-3						0.663	0.663										
3-1	3-3	1.34	1.34	51,119	51,119	0.041	0.704	1.056		1,500	1,500	1	3,500	592	1.65	3.190	Lyari Interceptor (Existing))
3-2	**3-3**	**4.84**	**4.84**	**176,065**	**176,065**	**0.159**	**0.159**	**0.239**									**Gujar Nallah**
3-3	3-5	0.07	6.25	2,670	229,854	0.002	0.865	1.298		1,500	1,500	1	1,200	592	1.65	3.190	Lyari Interceptor (Existing))
3-4	**3-5**	**4.98**	**4.98**	**189,980**	**189,980**	**0.154**	**0.154**	**0.231**									**Orangi Nallah**
3-5	3-8	0.28	11.51	10,682	430,516	0.009	1.028	1.542		2,000	1,500	1	2,800	1,000	1.44	3.746	Lyari Interceptor (Existing))
3-6a	3-6b	3.82	3.82	238,774	238,774	0.202	0.202	0.303	24	610			1,200	560	0.81	0.235	(Existing)
3-6b	Jamila PS (3-7)	5.08	8.90	317,532	556,306	0.269	0.471	0.707	48	1,219			4,000	1,420	0.80	0.936	(Existing)
Jamila PS (3-7)	3-8	5.31	14.21	331,908	888,214	0.281	0.752	1.128		900			1,800	PM	1.36		Pressure (Existing)
										850			0	PM			
3-8	3-10	0.00	25.72	0	1,318,730	0.000	1.780	2.670		2,000	2,000	1	100	1,176	1.42	4.971	Lyari Interceptor (Existing))
Chakiwara PS (3-9)	3-10	5.68	5.68	355,035	355,035	0.301	0.301	0.452		800			1,400	PM	0.90		Pressure (Existing)
3-10	TP-3	8.34	39.74	282,274	1,956,039	0.228	2.309	3.464		2,000	2,000	2	3,800	2,500	0.97	6.818	Lyari Interceptor (Existing))

Summary of Pumping Stations in TP-1 and TP-3 District

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Jamila PS	1.128	1.692
Chakiwara PS	0.452	0.677
Main PS of TP-1	4.677	7.016
Main PS of TP-3	3.464	5.195

Summary of Sewage Treatment Plant, TP-1 and TP-3

	Flow (m^3/d)	Remarks
TP-1	269,395	
TP-3	199,498	
Total	468,893	

Table A83.1.3 (b) Flow Calculation Sheet of TP-2 District in 2016

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
2-1a	2-2a	11.90	11.90	98,271	98,271		0.000	0.000									
2-2a	**2-3**	**10.08**	**21.98**	**442,931**	**541,202**	**0.279**	**0.279**	**0.419**	**66**	**1,676**			**4,600**	**2,180**	**0.80**	**1.765**	
2-1b	2-2b	9.00	9.00	74,322	74,322		0.000	0.000									
2-2b	**2-3**	**10.42**	**19.42**	**457,872**	**532,194**	**0.289**	**0.289**	**0.434**	**66**	**1,676**			**5,900**	**2,180**	**0.80**	**1.765**	
2-3	Iqbal PS (2-4)	1.90	43.30	114,174	1,187,570	0.095	0.663	0.995	84	2,134			9,300	3,000	0.80	2.865	Lyari Interceptor (Extended)
Iqbal PS (2-4)	2-6	1.01	44.31	33,181	1,220,751		0.000	0.000									
2-5a	2-5b	5.00	5.00	164,261	164,261		0.000	0.000									
2-5b	2-6	7.28	12.28	239,164	403,425		0.000	0.000									
2-6	2-7	5.13	61.72	168,532	1,792,708		0.000	0.000									
2-7	TP-2 (2-24)	13.94	75.66	302,351	2,095,059	0.344	0.344	0.516	42	1,067			4,700	1,190	0.80	0.717	(Existing)
2-8	2-9	5.83	5.83	191,528	191,528	0.217	0.217	0.326	42	1,067			1,300	1,190	0.80	0.717	(Existing)
2-9	TP-2 (2-14)	2.21	8.04	72,603	264,131	0.082	0.299	0.449	42	1,067			1,600	1,190	0.80	0.717	(Existing)
2-10	2-11	5.87	5.87	192,842	192,842		0.000	0.000									
2-11	Clifton PS (2-13)	6.92	12.79	227,337	420,179	0.258	0.258	0.387	54	1,372			4,100	1,670	0.80	1.183	(Existing)
2-12	Clifton PS (2-13)	3.91	3.91	128,452	128,452	0.146	0.146	0.219	42	1,067			1,900	1,190	0.80	0.717	(Existing)
Clifton PS (2-13)	TP-2 (2-14)	0.00	16.70	0	548,631	0.000	0.404	0.606		1,200			4,800	PM	0.54		(Existing)

Summary of Pumping Stations in TP-2 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Iqbal PS	0.000	0.000
Clifton PS	0.606	0.909
Main PS of TP-2	0.965	1.447

Summary of Sewage Treatment Plant, TP-2

	Flow (m^3/d)	Remarks
TP-2	90,461	

TableA 83.1.3 (c) Flow Calculation Sheet of TP-2 District in 2016

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
4-1a	4-1b	5.89	5.89	174,164	174,164		0.000	0.000									
4-1b	4-2	6.00	11.89	177,417	351,581	0.167	0.167	0.251	66	1,676			6,400	2,180	0.80	1.765	Malir Interceptor (L)
4-2	4-9	6.93	18.82	204,916	556,497	0.193	0.360	0.540	72	1,829			4,200	2,450	0.80	2.101	Malir Interceptor (L)
4-3a	4-3b	5.66	5.66	167,363	167,363		0.000	0.000									
4-3b	4-4	10.74	16.40	317,576	484,939		0.000	0.000									
4-4	4-5	6.48	22.88	191,610	676,549		0.000	0.000									
4-5	4-7	2.93	25.81	86,638	763,187	0.082	0.082	0.123	48	1,219			4,400	1,420	0.80	0.936	(Existing)
4-6a	4-6b	5.33	5.33	157,605	157,605	0.148	0.148	0.222	33	838			1,800	860	0.80	0.443	(Existing)
4-6b	4-6c	6.85	12.18	202,551	360,156	0.191	0.339	0.509	36	914			2,400	970	0.80	0.525	(Existing)
4-6c	4-7	7.90	20.08	233,599	593,755	0.220	0.559	0.839	48	1,219			4,600	1,420	0.80	0.936	(Existing)
4-7	Korangi PS(4-8)	0.85	46.74	25,134	1,382,076	0.024	0.665	0.998	54	1,372			1,600	1,670	0.80	1.183	(Existing)
Korangi PS(4-8)	4-9	0.00	46.74	0	1,382,076	0.000	0.665	0.998		1,220			1,700	PM	0.85		Pressure (Existing)
4-9	TP-4 (4-27)	6.91	72.47	180,314	2,118,887	0.171	1.196	1.794		3,500	3,000	1	6,200	7,800	0.80	7.505	Malir Interceptor (L)
4-10a	4-10b	5.65	5.65	167,067	167,067		0.000	0.000									
4-10b	B-Qasim PS(4-10c)	4.05	9.70	119,756	286,823		0.000	0.000									
B-Qasim PS(4-10c)	4-10d	0.00	9.70	0	286,823		0.000	0.000									
4-10d	4-11	6.70	16.40	198,115	484,938		0.000	0.000									
4-11	TP-4 (4-27)	11.40	27.80	63,368	548,306		0.000	0.000									
4-12	4-14	6.03	6.03	125,363	125,363	0.159	0.159	0.239	42	1,067			3,300	1,190	0.80	0.717	Malir Interceptor (R)
4-13a	4-13b	5.77	5.77	119,958	119,958		0.000	0.000									
4-13b	4-14	3.51	9.28	72,973	192,931	0.092	0.092	0.138	30	762			4,800	760	0.80	0.366	(Existing)
4-14	4-17	0.00	15.31	0	318,294	0.000	0.251	0.377	66	1,676			3,700	2,180	0.80	1.765	Malir Interceptor (R)
4-15a	4-15b	34.74	34.74	192,716	192,716		0.000	0.000									
4-15b	4-16	18.08	52.82	100,297	293,013		0.000	0.000									
4-16a	4-16b	15.82	68.64	152,782	445,795	0.187	0.187	0.281	24	610			4,200	560	0.81	0.235	(Existing)
4-16b	4-17	8.99	77.63	134,898	580,693	0.169	0.356	0.534	30	762			5,300	760	0.80	0.366	(Existing)
4-17	4-20	0.83	93.77	17,256	916,243	0.022	0.629	0.944		2,750	2,000	1	2,800	5,200	0.80	3.905	Malir Interceptor (R)
4-18a	4-18b	13.47	13.47	136,608	136,608		0.000	0.000									
4-18b	4-18c	18.36	31.83	381,703	518,311		0.000	0.000									
4-18c	4-19	11.12	42.95	185,456	703,767		0.000	0.000									
4-19	4-20	19.97	62.92	201,079	904,846	0.246	0.246	0.369					9,200				Nallah
4-20	4-22	0.00	156.69	0	1,821,089	0.000	0.875	1.313		2,750	2,000	2	1,000	5,200	0.80	7.810	Malir Interceptor (R)
4-21	4-22	13.43	13.43	110,691	110,691	0.134	0.134	0.201					2,700				Nallah
4-22	4-26	14.64	184.76	282,774	2,214,554	0.357	1.366	2.049		3,250	2,000	2	7,800	5,800	0.80	9.306	Malir Interceptor (R)
4-23a	4-23b	6.08	6.08	126,403	126,403		0.000	0.000									
4-23b	Port PS (4-23c)	5.47	11.55	113,721	240,124		0.000	0.000									
Port PS (4-23c)	4-24	0.00	11.55	0	240,124		0.000	0.000									
4-24	4-25	17.03	28.58	323,948	564,072		0.000	0.000									
4-25	4-26	12.73	41.31	264,656	828,728		0.000	0.000									
4-26	TP-4 (4-27)	0.00	226.07	0	3,043,282		1.366	2.049		3,500	3,000	2	2,000		0.11	15.010	Reversed Siphon crossing Malir

Summary of Pumping Stations in TP-4 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Korangi PS	0.998	1.496
B-Qasim PS	0.000	0.000
Port PS	0.000	0.000
Main PS of TP-4	3.843	5.765

Summary of Sewage Treatment Plant, TP-4

	Flow (m^3/d)	Remarks
TP-4	221,357	

TableA 83.1.4 (a) Flow Calculation Sheet of TP-1 and TP-3 District in 2021

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
To TP-1																	
1-1a	1-1b	6.60	6.60	319,855	319,855	0.287	0.287	0.431	42	1,067			1,600	1,190	0.80	0.717	
1-1b	1-2	5.18	11.78	251,038	570,893	0.225	0.512	0.768	54	1,372			2,600	1,670	0.80	1.183	
1-2	**1-3**	**1.49**	**13.27**	**72,210**	**643,103**	**0.065**	**0.577**	**0.866**	**54**	**1,372**			**1,900**	**1,670**	**0.80**	**1.183**	
1-3	**1-4**	**7.57**	**20.84**	**366,864**	**1,009,967**	**0.329**	**0.906**	**1.359**	**66**	**1,676**			**1,900**	**2,180**	**0.80**	**1.765**	
1-4	**TP-1**	**0.79**	**21.63**	**38,286**	**1,048,253**	**0.034**	**0.940**	**1.410**	**72**	**1,829**			**2,000**	**2,450**	**0.80**	**2.101**	
1-5	1-6	4.77	4.77	131,494	131,494		0.000	0.000									
1-6a	1-6b	3.49	8.26	169,135	300,629	0.152	0.152	0.228	42	1,067			1,700	1,190	0.80	0.717	
1-6b	1-7	11.15	19.41	540,361	840,990	0.485	0.637	0.956	66	1,676			5,100	2,180	0.80	1.765	
1-7	1-8	0.59	20.00	28,593	869,583	0.026	0.663	0.995	66	1,676			3,400	2,180	0.80	1.765	
1-8	**1-9**	**2.81**	**22.81**	**136,181**	**1,005,764**	**0.122**	**0.785**	**1.178**	**66**	**1,676**			**900**	**2,180**	**0.80**	**1.765**	
1-9	**TP-1**	**3.28**	**26.09**	**158,958**	**1,164,722**	**0.143**	**0.928**	**1.392**	**72**	**1,829**			**1,700**	**2,450**	**0.80**	**2.101**	
1-10	1-11	7.16	7.16	346,994	346,994	0.312	0.312	0.468	42	1,067			1,600	1,190	0.80	0.717	
1-11	1-12	7.34	14.50	355,717	702,711	0.319	0.631	0.947	66	1,676			3,100	2,180	0.80	1.765	
1-12	1-17	6.57	21.07	318,401	1,021,112	0.286	0.917	1.376	66	1,676			5,200	2,180	0.80	1.765	
1-13	1-14	8.60	8.60	416,780	416,780	0.374	0.374	0.561	42	1,067			1,200	1,190	0.80	0.717	
1-14	1-15	7.87	16.47	381,403	798,183	0.342	0.716	1.074	66	1,676			2,200	2,180	0.80	1.765	
1-15	1-16	10.27	26.74	497,713	1,295,896	0.447	1.163	1.745	84	2,134			3,300	3,000	0.80	2.865	
1-16	1-17	10.02	57.83	485,598	1,781,494	0.436	1.599	2.399		3,000	1,500	1	7,200	4,400	0.80	3.198	
1-17	TP-1	0.00	78.90	0	2,802,606	0.000	2.516	3.774		3,500	2,000	1	100	6,200	0.80	4.975	
To TP-3																	
3-1	3-3	1.34	1.34	64,940	64,940	0.058	0.058	0.087		1,500	1,500	1	3,500	592	1.65	3.190	Lyari Interceptor (Existing))
3-2	3-3	4.84	4.84	223,485	223,485	0.204	0.204	0.306									Gujar Nallah
3-3	3-5	0.07	6.25	3,392	291,817	0.003	0.265	0.398		1,500	1,500	1	1,200	592	1.65	3.190	Lyari Interceptor (Existing))
3-4	3-5	4.98	4.98	241,345	241,345	0.217	0.217	0.326									Orangi Nallah
3-5	3-8	0.28	11.51	13,570	546,732	0.012	0.494	0.741		2,000	1,500	1	2,800	1,000	1.44	3.746	Lyari Interceptor (Existing))
3-6a	**3-6b**	**3.82**	**3.82**	**293,632**	**293,632**	**0.273**	**0.273**	**0.410**	**42**	**1,067**			**1,200**	**1,190**	**0.80**	**0.717**	
3-6b	**Jamila PS (3-7)**	**5.08**	**8.90**	**390,485**	**684,117**	**0.364**	**0.637**	**0.956**	**54**	**1,372**			**4,000**	**1,670**	**0.80**	**1.183**	
Jamila PS (3-7)	**3-8**	**5.31**	**14.21**	**408,164**	**1,092,281**	**0.380**	**1.017**	**1.526**		**1,200**			**1,800**	**PM**			**Pressure**
3-8	3-10	0.00	25.72	0	1,639,013	0.000	1.511	2.267		2,000	2,000	1	100	1,176	1.42	4.971	Lyari Interceptor (Existing))
Chakiwara PS (3-9)	**3-10**	**5.68**	**5.68**	**436,605**	**436,605**	**0.407**	**0.407**	**0.611**		**800**			**1,400**	**PM**	**1.22**		**Pressure**
3-10	TP-3	8.34	39.74	366,172	2,441,790	0.326	2.244	3.366		2,000	2,000	2	3,800	2,500	0.97	6.818	Lyari Interceptor (Existing))

Summary of Pumping Stations in TP-1 and TP-3 District

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Jamila PS	1.526	2.288
Chakiwara PS	0.611	0.916
Main PS of TP-1	6.576	9.864
Main PS of TP-3	3.366	5.049

Summary of Sewage Treatment Plant, TP-1 and TP-3

	Flow (m^3/d)	Remarks
TP-1	378,778	
TP-3	193,882	
Total	572,659	

TableA 83.1.4 (b) Flow Calculation Sheet of TP-2 District in 2021

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
2-1a	2-2a	11.90	11.90	198,114	198,114		0.000	0.000									
2-2a	2-3	10.08	21.98	555,746	753,860	0.393	0.393	0.590	66	1,676			4,600	2,180	0.80	1.765	
2-1b	2-2b	9.00	9.00	149,834	149,834		0.000	0.000									
2-2b	2-3	10.42	19.42	555,746	705,580	0.407	0.407	0.611	66	1,676			5,900	2,180	0.80	1.765	
2-3	Iqbal PS (2-4)	1.90	1.90	125,514	1,584,954	0.117	0.917	1.376	84	2,134			9,300	3,000	0.80	2.865	Lyari Interceptor (Extended)
Iqbal PS (2-4)	**2-6**	**1.01**	**2.91**	**44,624**	**1,629,578**	**0.055**	**0.972**	**1.458**		**1,500**			**1,200**	**PM**	**0.83**		
2-5a	**2-5b**	**5.00**	**5.00**	**220,909**	**220,909**	**0.273**	**0.273**	**0.410**	**42**	**1,067**			**1,700**	**1,190**	**0.80**	**0.717**	
2-5b	**2-6**	**7.28**	**12.28**	**321,644**	**542,553**	**0.398**	**0.671**	**1.007**	**66**	**1,676**			**3,000**	**2,180**	**0.80**	**1.765**	
2-6	**2-7**	**5.13**	**20.32**	**226,653**	**2,398,784**	**0.280**	**1.923**	**2.885**		**3,500**	**2,000**	**1**	**3,100**	**6,200**	**0.80**	**4.975**	
2-7	**TP-2 (2-24)**	**13.94**	**34.26**	**403,215**	**2,801,999**	**0.499**	**2.422**	**3.633**		**4,000**	**2,000**	**1**	**4,700**	**6,700**	**0.80**	**5.717**	
2-8	**2-9**	**5.83**	**5.83**	**257,580**	**257,580**	**0.318**	**0.318**	**0.477**	**42**	**1,067**			**1,300**	**1,190**	**0.80**	**0.717**	
2-9	**TP-2 (2-14)**	**2.21**	**8.04**	**97,642**	**355,222**	**0.121**	**0.439**	**0.659**	**48**	**1,219**			**1,600**	**1,420**	**0.80**	**0.936**	
2-10	**2-11**	**5.87**	**5.87**	**259,348**	**259,348**	**0.321**	**0.321**	**0.482**	**42**	**1,067**			**1,300**	**1,190**	**0.80**	**0.717**	
2-11	**Clifton PS (2-13)**	**6.92**	**12.79**	**305,739**	**565,087**	**0.378**	**0.699**	**1.049**	**66**	**1,676**			**4,100**	**2,180**	**0.80**	**1.765**	
2-12	**Clifton PS (2-13)**	**3.91**	**3.91**	**172,751**	**172,751**	**0.214**	**0.214**	**0.321**	**42**	**1,067**			**1,900**	**1,190**	**0.80**	**0.717**	
Clifton PS (2-13)	**TP-2 (2-14)**	**0.00**	**16.70**	**0**	**737,838**	**0.000**	**0.913**	**1.370**		**1,200**			**4,800**	**PM**	**1.21**		**Pressure**

Summary of Pumping Stations in TP-2 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Iqbal PS	1.458	
Clifton PS	1.370	2.054
Main PS of TP-2	4.292	6.437

Summary of Sewage Treatment Plant, TP-2

	Flow (m^3/d)	Remarks
TP-2	326,074	

Table A83.1.4 (c) Flow Calculation Sheet of TP-4 District in 2021

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
4-1a	4-1b	5.89	5.89	273,420	273,420		0.000	0.000									
4-1b	4-2	6.00	11.89	278,526	551,946	0.289	0.289	0.434	66	1,676			6,400	2,180	0.80	1.765	Malir Interceptor (L)
4-2	4-9	6.93	18.82	321,698	873,644	0.333	0.622	0.933	72	1,829			4,200	2,450	0.80	2.101	Malir Interceptor (L)
4-3a	4-3b	5.66	5.66	262,743	262,743		0.000	0.000									
4-3b	**4-4**	**10.74**	**16.40**	**498,562**	**761,305**	**0.517**	**0.517**	**0.776**	**66**	**1,676**			**6,100**	**2,180**	**0.80**	**1.765**	
4-4	**4-5**	**6.48**	**22.88**	**300,808**	**1,062,113**	**0.312**	**0.829**	**1.244**	**84**	**2,134**			**5,500**	**3,000**	**0.80**	**2.865**	
4-5	**4-7**	**2.93**	**25.81**	**136,014**	**1,198,127**	**0.141**	**0.970**	**1.455**	**84**	**2,134**			**4,400**	**3,000**	**0.80**	**2.865**	
4-6a	**4-6b**	**5.33**	**5.33**	**247,424**	**247,424**	**0.256**	**0.256**	**0.384**	**42**	**1,067**			**1,800**	**1,190**	**0.80**	**0.717**	
4-6b	**4-6c**	**6.85**	**12.18**	**317,984**	**565,408**	**0.330**	**0.586**	**0.879**	**66**	**1,676**			**2,400**	**2,180**	**0.80**	**1.765**	
4-6c	**4-7**	**7.90**	**20.08**	**366,726**	**932,134**	**0.380**	**0.966**	**1.449**	**72**	**1,829**			**4,600**	**2,450**	**0.80**	**2.101**	
4-7	**Korangi PS(4-8)**	**0.85**	**46.74**	**39,458**	**2,169,719**	**0.041**	**1.977**	**2.966**		**3,500**	**2,000**	**1**	**1,600**	**6,200**	**0.80**	**4.975**	
Korangi PS(4-8)	**4-9**	**0.00**	**46.74**	**0**	**2,169,719**	**0.000**	**1.977**	**2.966**		**2,000**			**1,700**	**PM**	**0.94**		**Pressure**
4-9	TP-4 (4-27)	6.91	72.47	281,225	3,324,588		2.599	3.899		3,500	3,000	1	6,200	7,800	0.80	7.505	Malir Interceptor (L)
4-10a	4-10b	5.65	5.65	262,279	262,279		0.000	0.000									
4-10b	B-Qasim PS(4-10c)	4.05	9.70	188,005	450,284		0.000	0.000									
B-Qasim PS(4-10c)	4-10d	0.00	9.70	0	450,284		0.000	0.000									
4-10d	4-11	6.70	16.40	311,021	761,305		0.000	0.000									
4-11	TP-4 (4-27)	11.40	27.80	78,399	839,704		0.000	0.000									
4-12	4-14	6.03	6.03	194,887	194,887	0.268	0.268	0.402	42	1,067			3,300	1,190	0.80	0.717	Malir Interceptor (R)
4-13a	**4-13b**	**5.77**	**5.77**	**186,484**	**186,484**	**0.256**	**0.256**	**0.384**	**42**	**1,067**			**1,500**	**1,190**	**0.80**	**0.717**	
4-13b	**4-14**	**3.51**	**9.28**	**113,442**	**299,926**	**0.156**	**0.412**	**0.618**	**48**	**1,219**			**4,800**	**1,420**	**0.80**	**0.936**	
4-14	4-17	0.00	15.31	0	494,813	0.000	0.680	1.020	66	1,676			3,700	2,180	0.80	1.765	Malir Interceptor (R)
4-15a	**4-15b**	**34.74**	**34.74**	**238,427**	**238,427**	**0.298**	**0.298**	**0.447**	**42**	**1,067**			**2,100**	**1,190**	**0.80**	**0.717**	
4-15b	**4-16**	**18.08**	**52.82**	**124,086**	**362,513**	**0.155**	**0.453**	**0.680**	**48**	**1,219**			**4,000**	**1,420**	**0.80**	**0.936**	
4-16a	**4-16b**	**15.82**	**68.64**	**217,196**	**579,709**	**0.289**	**0.742**	**1.113**	**66**	**1,676**			**4,200**	**2,180**	**0.80**	**1.765**	
4-16b	**4-17**	**8.99**	**77.63**	**203,714**	**783,423**	**0.277**	**1.019**	**1.529**	**84**	**2,134**			**5,300**	**3,000**	**0.80**	**2.865**	
4-17	4-20	0.83	93.77	26,825	1,305,061	0.037	1.736	2.604		2,750	2,000		2,800	5,200	0.80	3.905	Malir Interceptor (R)
4-18a	**4-18b**	**13.47**	**13.47**	**195,801**	**195,801**	**0.261**	**0.261**	**0.392**	**42**	**1,067**			**2,200**	**1,190**	**0.80**	**0.717**	
4-18b	**4-18c**	**18.36**	**31.83**	**593,389**	**789,190**	**0.815**	**1.076**	**1.614**	**84**	**2,134**			**3,700**	**3,000**	**0.80**	**2.865**	
4-18c	**4-19**	**11.12**	**42.95**	**283,025**	**1,072,215**	**0.386**	**1.462**	**2.193**		**2,500**	**2,000**	**1**	**1,900**	**4,800**	**0.80**	**3.557**	
4-19	4-20	19.97	62.92	287,903	1,360,118	0.384	1.846	2.769					9,200				Nallah
4-20	4-22	0.00	156.69	0	2,665,179	0.000	3.582	5.373		2,750	2,000	2	1,000	5,200	0.80	7.810	Malir Interceptor (R)
4-21	4-22	13.43	13.43	152,651	152,651	0.200	0.200	0.300					2,700				Nallah
4-22	4-26	14.64	184.76	437,078	3,254,908	0.599	4.381	6.572		3,250	2,000	2	7,800	5,800	0.80	9.306	Malir Interceptor (R)
4-23a	**4-23b**	**6.08**	**6.08**	**196,503**	**196,503**	**0.270**	**0.270**	**0.405**	**42**	**1,067**			**2,600**	**1,190**	**0.80**	**0.717**	
4-23b	**Port PS (4-23c)**	**5.47**	**11.55**	**176,788**	**373,291**	**0.243**	**0.513**	**0.770**	**54**	**1,372**			**4,200**	**1,670**	**0.80**	**1.183**	
Port PS (4-23c)	**4-24**	**0.00**	**11.55**	**0**	**373,291**	**0.000**	**0.513**	**0.770**		**1,000**			**2,200**	**PM**	**0.98**		
4-24	**4-25**	**17.03**	**28.58**	**500,093**	**873,384**	**0.685**	**1.198**	**1.797**	**84**	**2,134**			**4,800**	**3,000**	**0.80**	**2.865**	
4-25	**4-26**	**12.73**	**41.31**	**411,429**	**1,284,813**	**0.565**	**1.763**	**2.645**		**2,750**	**2,000**		**2,800**	**5,200**	**0.80**	**3.905**	
4-26	TP-4 (4-27)	0.00	226.07	0	4,539,721	0.000	6.144	9.216		3,500	3,000	2	2,000		0.48	15.010	Reversed Siphon crossing Malir

Summary of Pumping Stations in TP-4 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Korangi PS	2.966	4.448
B-Qasim	0.000	0.000
Port PS	0.770	1.154
Main PS of TP-4	13.115	19.672

Summary of Sewage Treatment Plant, TP-4

	Flow (m^3/d)	Remarks
TP-4	755,395	

Table A83.1.5 (a) Flow Calculation Sheet of TP-1 and TP-3 District in 2025

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
To TP-1																	
1-1a	1-1b	6.60	6.60	381,773	381,773	0.365	0.365	0.548	42	1,067			1,600	1,190	0.80	0.717	
1-1b	1-2	5.18	11.78	299,634	681,407	0.287	0.652	0.978	54	1,372			2,600	1,670	0.80	1.183	
1-2	1-3	1.49	13.27	86,188	767,595	0.083	0.735	1.103	54	1,372			1,900	1,670	0.80	1.183	
1-3	1-4	7.57	20.84	437,882	1,205,477	0.419	1.154	1.731	66	1,676			1,900	2,180	0.80	1.765	
1-4	TP-1	0.79	21.63	45,697	1,251,174	0.044	1.198	1.797	72	1,829			2,000	2,450	0.80	2.101	
1-5	1-6	4.77	4.77	154,674	154,674	0.153	0.153	0.230	24	610			1,800	560	0.81	0.235	Branch (Gadap)
1-6a	1-6b	3.49	8.26	201,877	356,551	0.193	0.346	0.519	42	1,067			1,700	1,190	0.80	0.717	
1-6b	1-7	11.15	19.41	644,964	1,001,515	0.617	0.963	1.445	66	1,676			5,100	2,180	0.80	1.765	
1-7	1-8	0.59	20.00	34,128	1,035,643	0.033	0.996	1.494	66	1,676			3,400	2,180	0.80	1.765	
1-8	1-9	2.81	22.81	162,543	1,198,186	0.156	1.152	1.728	66	1,676			900	2,180	0.80	1.765	
1-9	TP-1	3.28	26.09	189,729	1,387,915	0.182	1.334	2.001	72	1,829			1,700	2,450	0.80	2.101	
1-10	1-11	7.16	7.16	414,165	414,165	0.396	0.396	0.594	42	1,067			1,600	1,190	0.80	0.717	
1-11	1-12	7.34	14.50	424,577	838,742	0.406	0.802	1.203	66	1,676			3,100	2,180	0.80	1.765	
1-12	1-17	6.57	21.07	380,037	1,218,779	0.364	1.166	1.749	66	1,676			5,200	2,180	0.80	1.765	
1-13	1-14	8.60	8.60	497,461	497,461	0.476	0.476	0.714	42	1,067			1,200	1,190	0.80	0.717	
1-14	1-15	7.87	16.47	455,235	952,696	0.436	0.912	1.368	66	1,676			2,200	2,180	0.80	1.765	
1-15	1-16	10.27	26.74	594,061	1,546,757	0.569	1.481	2.222	84	2,134			3,300	3,000	0.80	2.865	
1-16	1-17	10.02	57.83	579,600	2,126,357	0.555	2.036	3.054		3,000	1,500	1	7,200	4,400	0.80	3.198	
1-17	TP-1	0.00	78.90	0	3,345,136	0.000	3.202	4.803		3,500	2,000	1	100	6,200	0.80	4.975	
To TP-3																	
3-1	3-3	1.34	1.34	77,511	77,511	0.074	0.074	0.111		1,500	1,500	1	3,500	592	1.65	3.190	Lyari Interceptor (Existing))
3-2	3-3	4.84	4.84	266,495	266,495	0.256	0.256	0.384					11,100				Gujar Nallah
3-3	3-5	0.07	6.25	4,049	348,055	0.004	0.334	0.501		1,500	1,500	1	1,200	592	1.65	3.190	Lyari Interceptor (Existing))
3-4	3-5	4.98	4.98	288,065	288,065	0.276	0.276	0.414					10,400				Orangi Nallah
3-5	3-8	0.28	11.51	16,196	652,316	0.016	0.626	0.939		2,000	1,500	1	2,800	1,000	1.44	3.746	Lyari Interceptor (Existing))
3-6a	3-6b	3.82	3.82	339,892	339,892	0.337	0.337	0.506	42	1,067			1,200	1,190	0.80	0.717	
3-6b	Jamila PS (3-7)	5.08	8.90	452,002	791,894	0.448	0.785	1.178	54	1,372			4,000	1,670	0.80	1.183	
Jamila PS (3-7)	3-8	5.31	14.21	472,467	1,264,361	0.468	1.253	1.880		1,200			1,800	PM	1.66		Pressure
3-8	3-10	0.00	25.72	0	1,916,677	0.000	1.879	2.819		2,000	2,000	1	100	1,176	1.42	4.971	Lyari Interceptor (Existing))
Chakiwara PS (3-9)	3-10	5.68	5.68	505,388	505,388	0.501	0.501	0.752		800			1,400	PM	1.50		Pressure
3-10	TP-3	8.34	39.74	441,731	2,863,796	0.420	2.800	4.200		2,000	2,000	2	3,800	2,500	0.97	6.818	Lyari Interceptor (Existing))

Summary of Pumping Stations in TP-1 and TP-3 District

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Jamila PS	1.880	2.819
Chakiwara PS	0.752	1.127
Main PS of TP-1	8.601	12.902
Main PS of TP-3	4.200	6.300

Summary of Sewage Treatment Plant, TP-1 and TP-3

	Flow (m^3/d)	Remarks
TP-1	495,418	
TP-3	241,920	
Total	737,338	

Table A83.1.5 (b) Flow Calculation Sheet of TP-2 District in 2025

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
2-1a	**2-2a**	**11.90**	**11.90**	**385,875**	**385,875**	**0.382**	**0.382**	**0.573**	**42**	**1,067**			**2,900**	**1,190**	**0.80**	**0.717**	
2-2a	2-3	10.08	21.98	653,716	1,039,591	0.500	0.882	1.323	66	1,676			4,600	2,180	0.80	1.765	
2-1b	**2-2b**	**9.00**	**9.00**	**291,839**	**291,839**	**0.289**	**0.289**	**0.434**	**42**	**1,067**			**2,900**	**1,190**	**0.80**	**0.717**	
2-2b	2-3	10.42	19.42	675,766	967,605	0.517	0.806	1.209	66	1,676			5,900	2,180	0.80	1.765	
2-3	Iqbal PS (2-4)	1.90	1.90	134,586	2,141,782	0.136	1.824	2.736	84	2,134			9,300	3,000	0.80	2.865	Lyari Interceptor (Extended)
Iqbal PS (2-4)	2-6	1.01	2.91	55,436	2,197,218	0.072	1.896	2.844		1,500			1,200	PM	1.61		
2-5a	2-5b	5.00	5.00	274,437	274,437	0.358	0.358	0.537	42	1,067			1,700	1,190	0.80	0.717	
2-5b	2-6	7.28	12.28	399,580	674,017	0.522	0.880	1.320	66	1,676			3,000	2,180	0.80	1.765	
2-6	2-7	5.13	20.32	281,572	3,152,807	0.368	3.144	4.716		3,500	2,000	1	3,100	6,200	0.80	4.975	
2-7	TP-2 (2-24)	13.94	34.26	502,452	3,655,259	0.656	3.800	5.700		4,000	2,000	1	4,100	6,700	0.80	5.717	
2-8	2-9	5.83	5.83	319,993	319,993	0.418	0.418	0.627	42	1,067			1,300	1,190	0.80	0.717	
2-9	TP-2 (2-14)	2.21	8.04	121,301	441,294	0.158	0.576	0.864	48	1,219			1,600	1,420	0.80	0.936	
2-10	2-11	5.87	5.87	322,189	322,189	0.421	0.421	0.632	42	1,067			1,300	1,190	0.80	0.717	
2-11	Clifton PS (2-13)	6.92	12.79	379,820	702,009	0.496	0.917	1.376	66	1,676			4,100	2,180	0.80	1.765	
2-12	Clifton PS (2-13)	3.91	3.91	214,610	214,610	0.280	0.280	0.420	42	1,067			1,900	1,190	0.80	0.717	
Clifton PS (2-13)	TP-2 (2-14)	0.00	16.70	0	916,619	0.000	1.197	1.796		1,200			4,800	PM	1.59		Pressure

Summary of Pumping Stations in TP-2 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Iqbql PS	2.844	4.266
Clifton PS	1.796	2.693
Main PS of TP-2	6.564	9.846

Summary of Sewage Treatment Plant, TP-2

	Flow (m^3/d)	Remarks
TP-2	481,507	

Table A83.1.5 (c) Flow Calculation Sheet of TP-4 District in 2025

Node		Area (km^2)		Population (In covered area)		Average Flow (m^3/s) (Flow to STP)		Peak Flow (m^3/s)	Diameter (inch)	Diameter /Width (mm)	Hight (mm)	Number of Stream	Length (m)	Gradient (1/x)	Velocity (m/sec)	Flow Capacity (m^3/s)	Remarks
From	To	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative										
4-1a	**4-1b**	**5.89**	**5.89**	**368,530**	**368,530**	**0.405**	**0.405**	**0.608**	**42**	**1,067**			**2,800**	**1,190**	**0.80**	**0.717**	
4-1b	4-2	6.00	11.89	375,412	743,942	0.412	0.817	1.226	66	1,676			6,400	2,180	0.80	1.765	Malir Interceptor (L)
4-2	4-9	6.93	18.82	433,601	1,177,543	0.476	1.293	1.940	72	1,829			4,200	2,450	0.80	2.101	Malir Interceptor (L)
4-3a	**4-3b**	**5.66**	**5.66**	**354,139**	**354,139**	**0.389**	**0.389**	**0.584**	**42**	**1,067**			**1,500**	**1,190**	**0.80**	**0.717**	
4-3b	4-4	10.74	16.40	671,988	1,026,127	0.738	1.127	1.691	66	1,676			6,100	2,180	0.80	1.765	
4-4	4-5	6.48	22.88	405,445	1,431,572	0.445	1.572	2.358	84	2,134			5,500	3,000	0.80	2.865	
4-5	4-7	2.93	25.81	183,326	1,614,898	0.201	1.773	2.660	84	2,134			4,400	3,000	0.80	2.865	
4-6a	4-6b	5.33	5.33	333,491	333,491	0.366	0.366	0.549	42	1,067			1,800	1,190	0.80	0.717	
4-6b	4-6c	6.85	12.18	428,596	762,087	0.471	0.837	1.256	66	1,676			2,400	2,180	0.80	1.765	
4-6c	4-7	7.90	20.08	494,293	1,256,380	0.543	1.380	2.070	72	1,829			4,600	2,450	0.80	2.101	
4-7	Korangi PS(4-8)	0.85	46.74	53,183	2,924,461	0.058	3.211	4.817		3,500	2,000	1	1,600	6,200	0.80	4.975	
Korangi PS(4-8)	4-9	0.00	46.74	0	2,924,461	0.000	3.211	4.817		2,000			1,700	PM	1.53		Pressure
4-9	TP-4 (4-27)	6.91	72.47	378,594	4,480,598	0.418	4.922	7.383		3,500	3,000	1	6,200	7,800	0.80	7.505	Malir Interceptor (L)
4-10a	**4-10b**	**5.65**	**5.65**	**353,513**	**353,513**	**0.388**	**0.388**	**0.582**	**42**	**1,067**			**900**	**1,190**	**0.80**	**0.717**	
4-10b	**B-Qasim PS(4-10c)**	**4.05**	**9.70**	**253,403**	**606,916**	**0.278**	**0.666**	**0.999**	**54**	**1,372**			**3,400**	**1,670**	**0.80**	**1.183**	
B-Qasim PS(4-10c)	**4-10d**	**0.00**	**9.70**	**0**	**606,916**	**0.000**	**0.666**	**0.999**		**900**			**400**	**PM**	**1.57**		
4-10d	**4-11**	**6.70**	**16.40**	**419,210**	**1,026,126**	**0.461**	**1.127**	**1.691**	**66**	**1,676**			**2,500**	**2,180**	**0.80**	**1.765**	
4-11	**TP-4 (4-27)**	**11.40**	**27.80**	**100,469**	**1,126,595**	**0.131**	**1.258**	**1.887**	**72**	**1,829**			**4,500**	**2,450**	**0.80**	**2.101**	
4-12	4-14	6.03	6.03	264,901	264,901	0.385	0.385	0.578	42	1,067			3,300	1,190	0.80	0.717	Malir Interceptor (R)
4-13a	4-13b	5.77	5.77	253,479	253,479	0.368	0.368	0.552	42	1,067			1,500	1,190	0.80	0.717	
4-13b	4-14	3.51	9.28	154,196	407,675	0.224	0.592	0.888	48	1,219			4,800	1,420	0.80	0.936	
4-14	4-17	0.00	15.31	0	672,576	0.000	0.977	1.466	66	1,676			3,700	2,180	0.80	1.765	Malir Interceptor (R)
4-15a	4-15b	34.74	34.74	305,550	305,550	0.399	0.399	0.599	42	1,067			2,100	1,190	0.80	0.717	
4-15b	4-16	18.08	52.82	159,020	464,570	0.207	0.606	0.909	48	1,219			4,000	1,420	0.80	0.936	
4-16a	4-16b	15.82	68.64	289,069	753,639	0.405	1.011	1.517	66	1,676			4,200	2,180	0.80	1.765	
4-16b	4-17	8.99	77.63	275,081	1,028,720	0.395	1.406	2.109	84	2,134			5,300	3,000	0.80	2.865	
4-17	4-20	0.83	93.77	36,462	1,737,758	0.053	2.436	3.654		2,750	2,000		2,800	5,200	0.80	3.905	Malir Interceptor (R)
4-18a	4-18b	13.47	13.47	261,122	261,122	0.367	0.367	0.551	42	1,067			2,200	1,190	0.80	0.717	
4-18b	4-18c	18.36	31.83	806,565	1,067,687	1.171	1.538	2.307	84	2,134			3,700	3,000	0.80	2.865	
4-18c	4-19	11.12	42.95	383,102	1,450,789	0.552	2.090	3.135		2,500	2,000	1	1,900	4,800	0.80	3.557	
4-19	4-20	19.97	62.92	383,852	1,834,641	0.539	2.629	3.944					9,200				Nallah
4-20	4-22	0.00	156.69	0	3,572,399	0.000	5.065	7.598		2,750	2,000	2	1,000	5,200	0.80	7.810	Malir Interceptor (R)
4-21	4-22	13.43	13.43	201,605	201,605	0.278	0.278	0.417	33				2,700				Nallah
4-22	4-26	14.64	184.76	593,337	4,367,341	0.860	6.203	9.305		3,250	2,000	2	7,800	5,800	0.80	9.306	Malir Interceptor (R)
4-23a	4-23b	6.08	6.08	267,098	267,098	0.388	0.388	0.582	42	1,067			2,600	1,190	0.80	0.717	
4-23b	Port PS (4-23c)	5.47	11.55	240,300	507,398	0.349	0.737	1.106	54	1,372			2,000	1,670	0.80	1.183	Pressure
Port PS (4-23c)	4-24	0.00	11.55	0	507,398	0.000	0.737	1.106		1,000			2,200	PM	1.41		
4-24	4-25	17.03	28.58	678,687	1,186,085	0.983	1.720	2.580	84	2,134			4,800	3,000	0.80	2.865	
4-25	4-26	12.73	41.31	559,236	1,745,321	0.812	2.532	3.798		2,750	2,000		2,800	5,200	0.80	3.905	
4-26	TP-4 (4-27)	0.00	226.07	0	6,112,662	0.000	8.735	13.103		3,500	3,000	2	2,000		0.68	15.010	Reversed Siphon crossing Malir

Summary of Pumping Stations in TP-4 Catchment

	Design Flow (peak) (m^3/s)	Required capacity (m^3/s)
Korangi PS	4.817	7.225
B-Qasim PS	0.999	1.499
Port PS	1.106	1.658
Main PS of TP-4	22.373	33.559

Summary of Sewage Treatment Plant, TP-4

	Flow (m^3/d)	Remarks
TP-4	1,288,656	

APPENDIX – A83.2

Process Design Sheet of Sewage Treatment Plants

A83.2 Process Design Sheet of Sewage Treatment Plants

A. Sewage Treatment Plant TP-1

1 DESIGN FLOW

	2011	2016	2021	2025	
Total Flow	0	262,000	375,000	495,000	m^3/day
Flow to Existing Facility	0	110,000	55,000	0	m^3/day
Flow to New Facility	0	152,000	320,000	495,000	m^3/day

2 DESIGN BASIS FOR NEW FACILITY

2.1 DESIGN PARAMETERS AND CRITERIA

	2011	2016	2021	2025	
Design Capacity (Average)	0	167,000	333,000	500,000	m^3/day
Design Flow (Average, per train)				83,333	m^3/day
Number of Trains	0	2	4	6	Trains
Influent concentration					
BOD concentration				600	mg/l
Design effluent concentration (target)					
BOD concentration				80	mg/l
Wastewater Quantity and Characteristics for New Facility					
Average daily flow in 2025				500,000	m^3/day
BOD concentration				600	mg/l
Pollutants Removal Efficiencies					
BOD removal efficiency with UASB				50	%
BOD removal efficiency with primary settling tank				40	%
BOD removal efficiency with High rate trickling filter				55.6	%
Overall BOD removal efficiency				86.7	%
Effluent Qualities					
BOD concentration				79.9	mg/l
Component Facilities					
(a) UASB Reactor					
Hydraulic retention time				10.0	hr
Effective depth				6.0	m
(b) Primary Settling Tank					
Hydraulic overflow rate in dry weather				50	$m^3/m^2/d$
Hydraulic retention time				1.5	hr
Effective depth				3.0	m
(c) High Rate Trickling Filter					
Hydraulic loading				15.0	$m^3/m^2/d$
BOD volumetic loading				1.2	$kg/m^3/d$
Effective depth				1.5	m
(d) Final Settling Tank					
Hydraulic overflow rate				30	m^3/m^2/day
Hydraulic retention time				3.0	hr
Effective depth				3.0	m
(e) Sludge Thickeners (Gravity)					
Inflow raw sludge solids concentration				1.2	%
Thickened sludge solids concentration (2.0～4.0)				3.0	%
Solids surface loading (60～90)				90	kg/m^2/day
Effective depth				4.0	m
(f) Sludge Drying Bed					
Sludge depth				0.20	m
Solids content of sludge cake				40	%
Drying days				14	days
(g) Sludge Dewatering (Belt press filter)					
Per unit solids loads of filter				140	kg/m/hr
Belt filter width				3.0	m
Solids content of sludge cake				20	%
Operation days a week				6	days
Operation time a day				7	hr/day

2.2 DESIGN WASTEWATER CHARACTERISTICS

Parameters	Influent	PST Infl.	TF Infl.	Final Effl.
BOD concentration (mg/l)	600.0	300.0	180.0	79.9
BOD loading (t/d)	300.0	150.0	90.0	40.0

2.3 SLUDGE PRODUCTION

	2011	2016	2021	2025	
UASB Sludge					
Design Flow (Total)	0	262,000	375,000	495,000	m^3/d
BOD concentration of influent	600	600	600	600	mg/l
BOD reduction rate	0.50	0.50	0.50	0.50	
Conversion rate	0.60	0.60	0.60	0.60	
UASB Sludge Production	0.0	47.2	67.5	89.1	dbt/d
Raw Sludge					
Design Flow (Actual)	0	262,000	375,000	495,000	m^3/d
BOD concentration of influent	300	300	300	300	mg/l
BOD reduction rate	0.40	0.40	0.40	0.40	
Conversion rate	1.00	1.00	1.00	1.00	
UASB Sludge Production	0.0	31.4	45.0	59.4	dbt/d
Excess Sludge					
Design Flow (Actual)	0	262,000	375,000	495,000	m^3/d
BOD concentration of influent	180	180	180	180	mg/l
BOD reduction rate	0.56	0.56	0.56	0.56	
Conversion rate	0.55	0.55	0.55	0.55	
Excess Sludge Production	0.0	14.4	20.6	27.2	dbt/d
Total Sludge Production	0.0	93.0	133.1	175.7	dbt/d

*** This design flow involves flow to existing facility**

3 OUTLINE OF FACILITY

3.1 UASB REACTOR

	2011	2016	2021	2025	
Design flow				500,000	m^3/d
Shape of reactor			Rectangular		
Number of stream				6	trains
Number of tank per stream				1	tanks/train
Total number				6	tanks
Width				100.0	m
Length				78.0	m
Depth				6.0	m
Volume Effective Rate				0.75	
Total tank capacity				210,600	m^3
Hydraulic retention time (10)				10.11	hr

3.2 PRIMARY SETTLING TANK

Design flow				500,000	m^3/d
Shape of settling tank			Circular tank with a center-driven sludge scraper		
Number of train				6	trains
Number of tank per train				2	tanks/train
Total number				12	tanks
Internal diameter				33.0	m
Effective depth				3.0	m
Total water surface area				10,264	m^2
Total tank capacity				30,791	m^3
Hydraulic overflow rate (50)				48.7	$m^3/m^2/d$
Hydraulic retention time (1.5)				1.5	hr

3.3 HIGH RATE TRICKLING FILTER

Design flow				500,000	m^3/d
BOD loading				90,000	kg/d
Number of train				6	trains
Number of tank per train				6	tanks/train
Total number				36	tanks
Internal diameter				42.0	m
Effective depth				1.5	m
Total water surface area				49,876	m^2
Total tank capacity				74,814	m^3
Hydraulic loading (15)				10.0	$m^3/m^2/d$
BOD volumetic loading (1.2)				1.20	$kg/m^3/d$
Hydraulic retention time				3.6	hr

3.4 FINAL SETTLING TANK

Design flow (Maximum daily)	500,000	m^3/d
Shape of settling tank	Circular tank with a center-driven sludge scraper	
Number of train	6	train
Number of tank per train	2	tanks/train
Total number	12	tanks
Internal diameter	43.0	m
Effective depth	3.0	m
Total water surface area	17,426	m^2
Total tank capacity	52,279	m^3
Hydraulic overflow rate (30)	28.7	$m^3/m^2/d$
Hydraulic retention time (3.0)	2.5	hr

3.5 SLUDGE TREATMENT AND DISPOSAL

(1) Gravity Sludge Thickeners	2011	2016	2021	2025	
Design sludge flow (Solid)	0.0	93.0	133.1	175.7	dbt/d
Tank geometry		Circular radial flow type			
Total number		5	7	8	tanks
Internal diameter		18.0	18.0	18.0	m
Effective depth		4.0	4.0	4.0	m
Total water surface area		1,272	1,781	2,036	m^2
Unit surface loading (90)		73.1	74.7	86.3	$kg/m^2/d$
Solids concentration of sludge		3.0	3.0	3.0	%

(2) Sludge Drying Bed				
Design sludge flow (Solid)	48.8	0.0	0.0	dbt/d
Design sludge flow	1,627	0	0	wbt/d
Bed surface area				
Sludge drying lagoon	32,600	0	0	m^2
Sludge drying bed	81,200	0	0	m^2
Total	113,800	0	0	m^2
Effective ratio	0.65	0.65	0.65	
Effective surface area	73,970	0	0	m^2
Effective depth	0.2	0.2	0.2	m
Bed capacity	22,760	0	0	m^3
Detention time (14)	14.0	#DIV/0!	#DIV/0!	day

(3) Belt Press Filter				
Design sludge flow (Solid)	44.2	133.1	175.7	dbt/d
Design sludge flow	1,474	4,438	5,858	wbt/d
Per unit solids loads of filter	140	140	140	kg/m/hr
Belt filter width	3	3	3	m
Operation days a week	6	6	6	days
Operation time a day	7	7	7	hr/day
Number of machine (on duty)	18	53	70	nos.
Number of machine (standby)	2	6	8	nos.
Number of machine (total)	20	59	78	nos.

(4) Sludge Cake				
1) Drying bed				
Design sludge amount	48.8	0.0	0.0	dbt/d
Sludge moisture	60	60	60	%
Cake amount	122	0	0	wbt/d
2) Belt press filter				
Design sludge amount	44.2	133.1	175.7	dbt/d
Sludge moisture	80	80	80	%
Cake amount	221	666	879	wbt/d
3) Total cake amount	343	666	879	wbt/d

B. Sewage Treatment Plant TP-2

1 DESIGN FLOW

	2011	2016	2021	2025	
Total Flow	0	0	326,000	482,000	m^3/day
Flow to Existing Facility	0	0	55,000	0	m^3/day
Flow to New Facility	0	0	271,000	482,000	m^3/day

2 DESIGN BASIS FOR NEW FACILITY

2.1 DESIGN PARAMETERS AND CRITERIA

	2011	2016	2021	2025	
Design Capacity (Average)	0	0	306,000	490,000	m^3/day
Design Flow (Average, per train)				61,250	m^3/day
Number of Trains	0	0	5	8	Train

Influent concentration		
BOD concentration	600	mg/L
Design effluent concentration (target)		
BOD concentration	80	mg/L
Wastewater Quantity and Characteristics for New Facility		
Average daily flow in 2025	490,000	m^3/day
BOD concentration	600	mg/L
Pollutants Removal Efficiencies		
BOD removal efficiency with UASB	50	%
BOD removal efficiency with primary settling tank	40	%
BOD removal efficiency with High rate trickling filter	55.6	%
Overall BOD removal efficiency	86.7	%
Effluent Qualities		
BOD concentration	79.9	mg/L
Component Facilities		
(a) UASB Reactor		
Hydraulic retention time	10.0	hr
Effective depth	6.0	m
(b) Primary Settling Tank		
Hydraulic overflow rate in dry weather	50	$m^3/m^2/d$
Hydraulic retention time	1.5	hr
Effective depth	3.0	m
(c) High Rate Trickling Filter		
Hydraulic loading	15.0	$m^3/m^2/d$
BOD volumetic loading	1.2	$kg/m^3/d$
Effective depth	1.5	m
(d) Final Settling Tank		
Hydraulic overflow rate	30	m^3/m^2/day
Hydraulic retention time	3.0	hr
Effective depth	3.0	m
(e) Sludge Thickeners (Gravity)		
Inflow raw sludge solids concentration	1.2	%
Thickened sludge solids concentration (2.0～4.0)	3.0	%
Solids surface loading (60～90)	90	kg/m^2/day
Effective depth	4.0	m
(f) Sludge Drying Bed		
Sludge depth	0.20	m
Solids content of sludge cake	40	%
Drying days	14	days
(g) Sludge Dewatering (Belt press filter)		
Per unit solids loads of filter	140	kg/m/hr
Belt filter width	3.0	m
Solids content of sludge cake	20	%
Operation days a week	6	days
Operation time a day	7	hr/day

2.2 DESIGN WASTEWATER CHARACTERISTICS

Parameters	Influent	PST Infl.	TF Infl.	Final Effl.
BOD concentration (mg/l)	600.0	300.0	180.0	79.9
BOD loading (t/d)	294.0	147.0	88.2	39.2

2.3 SLUDGE PRODUCTION

	2011	2016	2021	2025	
UASB Sludge					
Design Flow (Total)	0	0	326,000	482,000	m^3/d
BOD concentration of influent	600	600	600	600	mg/l
BOD reduction rate	0.50	0.50	0.50	0.50	
Conversion rate	0.60	0.60	0.60	0.60	
UASB Sludge Production	0.0	0.0	58.7	86.8	dbt/d
Raw Sludge					
Design Flow (Actual)	0	0	326,000	482,000	m^3/d
BOD concentration of influent	300	300	300	300	mg/l
BOD reduction rate	0.40	0.40	0.40	0.40	
Conversion rate	1.00	1.00	1.00	1.00	
UASB Sludge Production	0.0	0.0	39.1	57.8	dbt/d
Excess Sludge					
Design Flow (Actual)	0	0	326,000	482,000	m^3/d
BOD concentration of influent	180	180	180	180	mg/l
BOD reduction rate	0.56	0.56	0.56	0.56	
Conversion rate	0.55	0.55	0.55	0.55	
Excess Sludge Production	0.0	0.0	17.9	26.5	dbt/d
Total Sludge Production	0.0	0.0	115.7	171.1	dbt/d

*** This design flow involves flow to existing facility**

3 OUTLINE OF FACILITY

3.1 UASB REACTOR

	2011	2016	2021	2025	
Design flow				490,000	m^3/d
Shape of reactor			Rectangular		
Number of train				8	trains
Number of tank per train				1	tanks/train
Total number				8	tanks
Width				80.0	m
Length				71.0	m
Depth				6.0	m
Volume Effective Rate				0.75	
Total tank capacity				204,480	m^3
Hydraulic retention time (10)				10.02	hr

3.2 PRIMARY SETTLING TANK

Design flow				490,000	m^3/d
Shape of settling tank			Circular tank with a center-driven sludge scraper		
Number of train				8	trains
Number of tank per train				2	tanks/train
Total number				16	tanks
Internal diameter				28.0	m
Effective depth				3.0	m
Total water surface area				9,852	m^2
Total tank capacity				29,556	m^3
Hydraulic overflow rate (50)				49.7	$m^3/m^2/d$
Hydraulic retention time (1.5)				1.4	hr

3.3 HIGH RATE TRICKLING FILTER

Design flow				490,000	m^3/d
BOD loading				88,200	kg/d
Number of stream				8	trains
Number of tank per stream				6	tanks/train
Total number				48	tanks
Internal diameter				36.0	m
Effective depth				1.5	m
Total water surface area				48,858	m^2
Total tank capacity				73,287	m^3

3.4 FINAL SETTLING TANK

Design flow (Maximum daily)	490,000	m^3/d
Shape of settling tank	Circular tank with a center-driven sludge scraper	
Number of train	8	train
Number of tank per train	2	tanks/train
Total number	16	tanks
Internal diameter	37.0	m
Effective depth	3.0	m
Total water surface area	17,203	m^2
Total tank capacity	51,610	m^3
Hydraulic overflow rate (30)	28.5	$m^3/m^2/d$
Hydraulic retention time (3.0)	2.5	hr

3.5 SLUDGE TREATMENT AND DISPOSAL

(1) Gravity Sludge Thickeners	2011	2016	2021	2025	
Design sludge flow (Solid)	0.0	0.0	115.7	171.1	dbt/d
Tank geometry		Circular radial flow type			
Total number			6	8	tanks
Internal diameter			18.0	18.0	m
Effective depth			4.0	4.0	m
Total water surface area			1,527	2,036	m^2
Unit surface loading (90)			75.8	84.1	$kg/m^2/d$
Solids concentration of sludge			3.0	3.0	%
(2) Sludge Drying Bed					
Design sludge flow (Solid)			0.0	0.0	dbt/d
Design sludge flow			0	0	wbt/d
Bed surface area					
Sludge drying lagoon			0	0	m^2
Sludge drying bed			0	0	m^2
Total			0	0	m^2
Effective ratio			0.65	0.65	
Effective surface area			0	0	m^2
Effective depth			0.2	0.2	m
Bed capacity			0	0	m^3
Detention time (14)			#DIV/0!	#DIV/0!	day
(3) Belt Press Filter					
Design sludge flow (Solid)		0.0	115.7	171.1	dbt/d
Design sludge flow		#DIV/0!	3,858	5,704	wbt/d
Per unit solids loads of filter		140	140	140	kg/m/hr
Belt filter width		3	3	3	m
Operation days a week		6	6	6	days
Operation time a day		7	7	7	hr/day
Number of machine (on duty)		1	46	68	nos.
Number of machine (standby)		1	5	7	nos.
Number of machine (total)		2	51	75	nos.
(4) Sludge Cake					
1) Drying bed					
Design sludge amount		0.0	0.0	0.0	dbt/d
Sludge moisture		60	60	60	%
Cake amount		0	0	0	wbt/d
2) Belt press filter					
Design sludge amount		0.0	115.7	171.1	dbt/d
Sludge moisture		80	80	80	%
Cake amount		0	579	856	wbt/d
3) Total cake amount		0	579	856	wbt/d

C. Sewage Treatment Plant TP-3

1 DESIGN FLOW

	2011	2016	2021	2025	
Total Flow	111,000	199,000	194,000	242,000	m^3/d
Flow to Existing Facility	111,000	199,000	194,000	242,000	m^3/d
Flow to New Facility	0	0	0	0	m^3/d

2 DESIGN BASIS FOR NEW FACILITY

2.1 DESIGN PARAMETERS AND CRITERIA

	2011	2016	2021	2025	
Design Capacity (Average)	245,000	245,000	245,000	245,000	m^3/d
Design Flow (Average, per train)				40,833	m^3/d
Number of Trains	6	6	6	6	train
Influent concentration					
BOD concentration				600	mg/l
Design effluent concentration (target)					
BOD concentration				80	mg/l
Wastewater Quantity and Characteristics for New Facility					
Average daily flow in 2025				245,000	m^3/d
BOD concentration				600	mg/l
Pollutants Removal Efficiencies					
BOD removal efficiency with anaerobic pond				60	%
BOD removal efficiency with aerobic pond				67	%
Overall BOD removal efficiency				86.8	%
Effluent Qualities					
BOD concentration				79.2	mg/l

2.2 DESIGN WASTEWATER CHARACTERISTICS

Parameters	Anae. Influ.	Facul. Influ.	Final Effl.
BOD concentration (mg/l)	600.0	240.0	79.2
BOD loading (t/d)	147.0	58.8	19.4

2.3 SLUDGE PRODUCTION

	2011	2016	2021	2025	
Anaerobic Pond Sludge					
Design Flow	111,000	199,000	194,000	242,000	m^3/d
BOD concentration of influent	600	600	600	600	mg/l
BOD reduction rate	0.60	0.60	0.60	0.60	
Conversion Rate	0.60	0.60	0.60	0.60	
ANP Sludge Production	24.0	43.0	41.9	52.3	dbt/d
Aerobic Pond Sludge					
Design Flow	111,000	199,000	194,000	242,000	m^3/d
BOD concentration of influent	240	240	240	240	mg/l
BOD reduction rate	0.67	0.67	0.67	0.67	
Conversion rate	0.50	0.50	0.50	0.50	
UASB Sludge Production	8.9	16.0	15.6	19.5	dbt/d
Total Sludge Production	32.9	59.0	57.5	71.7	dbt/d

3 OUTLINE OF FACILITY

3.1 ANAEROBIC POND

	2011	2016	2021	2025	
Design flow				245,000	m^3/d
BOD loading				147.0	t/d
Shape of reactor			Rectangular		
Number of train				6	trains
Number of pond per train				1	pond/train
Total number				6	pond
Width				150.0	m
Length				150.0	m
Depth				2.5	m
Total pond capacity				337,500	m^3

3.2 FACULTATIVE POND

Design flow				245,000	m^3/d
BOD loading				58.8	t/d
Shape of reactor			Rectangular		
Number of train				6	trains
Number of pond per train				1	pond/train
Total number				6	pond
Width				150	m
Length (weighted average)				1,150	m
Depth				1.5	m
Total surface area				1,035,000	m^2
Total tank capacity				1,552,500	m^3

3.3 SLUDGE TREATMENT AND DISPOSAL

(1) Sludge Drying Bed

		2011	2016	2021	2025	
Design sludge flow (Solid)		32.9	59.0	57.5	71.7	dbt/d
Solids concentration of sludge		5.0	5.0	5.0	5.0	%
Design sludge flow		658	1,180	1,150	1,435	wbt/d
Bed surface area						
Sludge drying bed 1 (130x170x2)		44,200	44,200	44,200	44,200	m^2
Sludge drying bed 2 (200x290x1)		58,000	58,000	58,000	58,000	m^2
Sludge drying bed 2 (190x130x1)		24,700	24,700	24,700	24,700	
Total		126,900	126,900	126,900	126,900	m^2
Effective ratio		0.65	0.65	0.65	0.65	
Effective surface area		82,485	82,485	82,485	82,485	m^2
Effective depth		0.2	0.2	0.2	0.2	m
Bed capacity		16,497	16,497	16,497	16,497	m^3
Detention time		25.1	14.0	14.3	11.5	day

(2) Sludge Cake

Design sludge amount	:	32.9	59.0	57.5	71.7	dbt/d
Sludge moisture		60	60	60	60	%
Cake amount	:	82.3	147.5	143.8	179.3	wbt/d

D. Sewage Treatment Plant TP-4

1 DESIGN FLOW

	2011	2016	2021	2025	
Total Flow	137,000	221,000	755,000	1,289,000	m^3/day
Flow to Existing Facility	0	0	0	0	m^3/day
Flow to New Facility	137,000	221,000	755,000	1,289,000	m^3/day

2 DESIGN BASIS FOR NEW FACILITY

2.1 DESIGN PARAMETERS AND CRITERIA

	2011	2016	2021	2025	
Design Capacity (Average)	161,250	242,000	806,000	1,290,000	m^3/day
Design Flow (Average, per train)				80,625	m^3/day
Number of Trains	2	3	10	16	Trains

Influent concentration		
BOD concentration	600	mg/l
Design effluent concentration (target)		
BOD concentration	80	mg/l
Wastewater Quantity and Characteristics for New Facility		
Average daily flow in 2025	1,290,000	m^3/day
BOD concentration	600	mg/l
Pollutants Removal Efficiencies		
BOD removal efficiency with UASB	50	%
BOD removal efficiency with primary settling tank	40	%
BOD removal efficiency with High rate trickling filter	55.6	%
Overall BOD removal efficiency	86.7	%
Effluent Qualities		
BOD concentration	79.9	mg/l
Component Facilities		
(a) UASB Reactor		
Hydraulic retention time	10.0	hr
Effective depth	6.0	m
(b) Primary Settling Tank		
Hydraulic overflow rate in dry weather	50	$m^3/m^2/d$
Hydraulic retention time	1.5	hr
Effective depth	3.0	m
(c) High Rate Trickling Filter		
Hydraulic loading	15.0	$m^3/m^2/d$
BOD volumetic loading	1.2	$kg/m^3/d$
Effective depth	1.5	m
(d) Final Settling Tank		
Hydraulic overflow rate	30	m^3/m^2/day
Hydraulic retention time	3.0	hr
Effective depth	3.0	m
(e) Sludge Thickeners (Gravity)		
Inflow raw sludge solids concentration	1.2	%
Thickened sludge solids concentration (2.0～4.0)	3.0	%
Solids surface loading (60～90)	90	kg/m^2/day
Effective depth	4.0	m
(f) Sludge Drying Bed		
Sludge depth	0.20	m
Solids content of sludge cake	40	%
Drying days	14	days
(g) Sludge Dewatering (Belt press filter)		
Per unit solids loads of filter	140	kg/m/hr
Belt filter width	3.0	m
Solids content of sludge cake	20	%
Operation days a week	6	days
Operation time a day	7	hr/day

2.2 DESIGN WASTEWATER CHARACTERISTICS

Parameters	Influent	PST Infl.	TF Infl.	Final Effl.
BOD concentration (mg/l)	600.0	300.0	180.0	79.9
BOD loading (t/d)	774.0	387.0	232.2	103.1

2.3 SLUDGE PRODUCTION

	2011	2016	2021	2025	
UASB Sludge					
Design Flow (Total)	137,000	221,000	755,000	1,289,000	m^3/d
BOD concentration of influent	600	600	600	600	mg/l
BOD reduction rate	0.50	0.50	0.50	0.50	
Conversion rate	0.60	0.60	0.60	0.60	
UASB Sludge Production	24.7	39.8	135.9	232.0	dbt/d
Raw Sludge					
Design Flow (Actual)	137,000	221,000	755,000	1,289,000	m^3/d
BOD concentration of influent	300	300	300	300	mg/l
BOD reduction rate	0.40	0.40	0.40	0.40	
Conversion rate	1.00	1.00	1.00	1.00	
UASB Sludge Production	16.4	26.5	90.6	154.7	dbt/d
Excess Sludge					
Design Flow (Actual)	137,000	221,000	755,000	1,289,000	m^3/d
BOD concentration of influent	180	180	180	180	mg/l
BOD reduction rate	0.56	0.56	0.56	0.56	
Conversion rate	0.55	0.55	0.55	0.55	
Excess Sludge Production	7.5	12.2	41.6	71.0	dbt/d
Total Sludge Production	48.6	78.5	268.1	457.7	dbt/d

*** This design flow involves flow to existing facility**

3 OUTLINE OF FACILITY

3.1 UASB REACTOR

	2011	2016	2021	2025	
Design flow				1,290,000	m^3/d
Shape of reactor			Rectangular		
Number of train				16	trains
Number of tank per train				1	tanks/train
Total number				16	tanks
Width				90.0	m
Length				83.0	m
Depth				6.0	m
Volume Effective Rate				0.75	
Total tank capacity				537,840	m^3
Hydraulic retention time (10)				10.01	hr

3.2 PRIMARY SETTLING TANK

Design flow				1,290,000	m^3/d
Shape of settling tank			Circular tank with a center-driven sludge scraper		
Number of train				16	trains
Number of tank per train				2	tanks/train
Total number				32	tanks
Internal diameter				33.0	m
Effective depth				3.0	m
Total water surface area				27,370	m^2
Total tank capacity				82,109	m^3
Hydraulic overflow rate (50)				47.1	$m^3/m^2/d$
Hydraulic retention time (1.5)				1.5	hr

3.3 HIGH RATE TRICKLING FILTER

Design flow				1,290,000	m^3/d
BOD loading				232,200	kg/d
Number of train				16	trains
Number of tank per train				6	tanks/train
Total number				96	tanks
Internal diameter				42.0	m
Effective depth				1.5	m
Total water surface area				133,003	m^2
Total tank capacity				199,504	m^3
Hydraulic loading (15)				9.7	$m^3/m^2/d$
BOD volumetic loading (1.2)				1.16	$kg/m^3/d$
Hydraulic retention time				3.7	hr

3.4 FINAL SETTLING TANK

Design flow (Maximum daily)	1,290,000	m^3/d
Shape of settling tank	Circular tank with a center-driven sludge scraper	
Number of stream	16	train
Number of tank per stream	2	tanks/train
Total number	32	tanks
Internal diameter	42.0	m
Effective depth	3.0	m
Total water surface area	44,334	m^2
Total tank capacity	133,003	m^3
Hydraulic overflow rate (30)	29.1	$m^3/m^2/d$
Hydraulic retention time (3.0)	2.5	hr

3.5 SLUDGE TREATMENT AND DISPOSAL

(1) Gravity Sludge Thickeners	2011	2016	2021	2025	
Design sludge flow (Solid)	48.6	78.5	268.1	457.7	dbt/d
Tank geometry	Circular radial flow type				
Total number	3	4	12	20	tanks
Internal diameter	18.0	18.0	18.0	18.0	m
Effective depth	4.0	4.0	4.0	4.0	m
Total water surface area	763	1,018	3,054	5,089	m^2
Unit surface loading (90)	63.7	77.1	87.8	89.9	$kg/m^2/d$
Solids concentration of sludge	3.0	3.0	3.0	3.0	%
(2) Sludge Drying Bed					
Design sludge flow (Solid)	48.6	78.5	117.0	117.0	dbt/d
Design sludge flow	1,620	2,617	3,900	3,900	wbt/d
Bed surface area					
Sludge drying bed 1	125,000	250,000	250,000	250,000	m^2
Sludge drying bed 2	38,000	38,000	38,000	38,000	m^2
Sludge drying bed 3	0	0	51,000	51,000	
Sludge drying bed 4	84,000	84,000	84,000	84,000	
Total	247,000	372,000	423,000	423,000	m^2
Effective ratio	0.65	0.65	0.65	0.65	
Effective surface area	160,550	241,800	274,950	274,950	m^2
Effective depth	0.2	0.2	0.2	0.2	m
Bed capacity	32,110	48,360	54,990	54,990	m^3
Detention time (14)	19.8	18.5	14.1	14.1	day
(3) Belt Press Filter					
Design sludge flow (Solid)	0.0	0.0	151.1	340.7	dbt/d
Design sludge flow	0	0	5,035	11,355	wbt/d
Per unit solids loads of filter			140	140	kg/m/hr
Belt filter width			3	3	m
Operation days a week			6	6	days
Operation time a day			7	7	hr/day
Number of machine (on duty)			60	136	nos.
Number of machine (standby)			7	14	nos.
Number of machine (total)			67	150	nos.
(4) Sludge Cake					
1) Drying bed					
Design sludge amount	48.6	78.5	117.0	117.0	dbt/d
Sludge moisture	60	60	60	60	%
Cake amount	122	196	293	293	wbt/d
2) Belt press filter					
Design sludge amount	0.0	0.0	151.1	340.7	dbt/d
Sludge moisture	80	80	80	80	%
Cake amount	0	0	755	1,703	wbt/d
3) Total cake amount	122	196	1,048	1,996	wbt/d

CHAPTER 9

APPENDIX – A91.1

International Reform Examples

A91.1 International Reform Examples

The examples of international practice in the following table provide the following guidance for reforms within KW&SB:

- In all cases, Governments provide strong leadership in sector policy and planning
- Service delivery by public enterprises or utilities is most common
- Public (government) ownership and control of sector assets is most common
- Effective economic regulation is a critical part of controlling and optimising prices and service quality
- Rigorous economic regulation at the national/regional level has been a critical part of privatising the sector in England, Wales and Chile

Effective economic regulation is not well established in Pakistan – even with best efforts, it would take 3 to 5 years to accomplish such regulation at either the Federal, Provincial or local government levels.

Table A91.1.1 International Practice - Water Sector Institutional Structure (1/2)

SYDNEY AUSTRALIA	ENGLAND & WALES	CHILE	FRANCE	USA & CANADA	BERLIN GERMANY
Role of Government					
▪ Sector Regulation (independent regulatory body)				▪ Policy & Planning	
Role of Private Enterprise					
▪ Subcontractor to public enterprise (various forms of contracts used)	▪ Sector operations – service delivery Since 1990	▪ Sector operations – service delivery to 80% of nation's customers ▪ Government has > 35% shareholding in the private companies ▪ Progression to further privatisation	▪ Subcontractor to public enterprise (various forms of contracts used) ▪ Most service delivery in France is done by large private companies under sub-contract to many public enterprises (municipalities); various forms of contracts used	▪ Subcontractor to public agency ▪ Limited role in sector operations - service delivery ▪ Private utilities serve only a small number of users nationwide	▪ Subcontractor to public enterprise
Role of Public Enterprise					
▪ Sector operations – service delivery	▪ None	▪ Sector operations – service delivery to 20% of nation's customers	▪ Sector operations – service delivery	▪ Most sector operations – service delivery – are by public sector agencies/ utilities ▪ Limited commercialisation of the sector	▪ Sector operations – service delivery ▪ In 1998, Berlin sold 49.9% of shares in the public enterprise to the private sector through a trade sale

Table 91.1.1 International Practice - Water Sector Institutional Structure (2/2)

SYDNEY AUSTRALIA	ENGLAND & WALES	CHILE	FRANCE	USA & CANADA	BERLIN GERMANY
Asset Ownership					
▪ Public ▪ BOOT assets transfer to public ownership at end of term	▪ Private	▪ Mostly private ▪ Government has > 35% shareholding in the private companies	▪ Public	▪ Mostly public ▪ Small amount of private ownership by private utilities	▪ Government is majority shareholder in service delivery enterprise
Sector Economic Regulation					
▪ Service standards and other conditions of operations are regulated under an operating license and customer contract issued by Government to public utility; environmental and health regulation by Government; prices established through independent regulatory process	▪ Strong regulation by national government ▪ Prices and service standards are regulated by Government	▪ Strong regulation by national government ▪ Prices and service standards are regulated by Government – for both public and private enterprises	▪ Pricing and service standards are specified by municipalities in contracts with private service providers ▪ Higher use of competition and lower use of regulation to control price and service standards ▪ Shorter term contracts – 5 to 12 years – enables competition; some longer term contracts with competition at time of award	▪ Limited formal economic regulation ▪ Usually, only private utilities are subject to formal regulation on price and service standards	▪ Strong regulation by national & regional governments
Sector Funding					
▪ Mostly public ▪ Private < 25% of total funding needs (through BOOT contracts and developer contributions) ▪ Some government subsidies to offset revenue gaps or deal with Government obligations	▪ Private ▪ Enterprises are financially self-sufficient (companies listed on stock exchange)	▪ Mostly private ▪ Some government subsidies to offset revenue gaps	▪ Mostly public ▪ Some capital provided through private sector contracts	▪ Mostly public ▪ Revenues are from a mix of tariffs and government subsidies	▪ The public enterprise is self- financing

APPENDIX – A94.1

RFP for Provision of Equipment, Products and Networking Services to Link KW&SB CSCs with IRS Central Host (February, 2007)

A94.1 RFP for Provision of Equipment, Products and Networking Services to Link KW&SB CSCs with IRS Central Host (February, 2007)

Water Supply Planning Study Team

1st Floor, KW&SB Training Centre

9th Mile Karsaz, Shara e faisal, Karachi

RFP for Provision of Equipment, Products and Networking Services to Link KW&SB CSCs with IRS Central Host (February, 2007)

Submitted by

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Definition of Terms

For better understanding of this RFP, the readers are requested to get familiar with the following terms.

JICA	The Owner of this RFP
JICAST	JICA Study Team
BOQ	Bill of Quantities, IT Non-IT, NW, HW, and SW to be procured by bidder
CDGK	City District Government Karachi
CSC	Consumer Service Center. There are 7 CSCs, see Appendix A for list of CSCs.
CMS	Complaint Management System, the sub-system within IRS.
IRS	Integrated Revenue System, implemented by MSCL at Revenue Secretariat KW&SB.
RMCS	Revenue Management *Complete* System, an application package developed and owned by MSCL. RMCS is integral and core of IRS.
IRS Central Host	The server installed at Revenue Sectt. KW&SB. RMCS Server is installed on this server. Besides this the RMCS Central database also reside here.
KW&SB	Karachi Water & Sewerage Board.
MSCL	Millennium System & Consultants (Pvt.) Limited, the KW&SB Contractor. MSCL has provided IRS solution to KW&SB.
SOW	Scope of Work i.e. work to be performed under this RFP
RFP	Request For Proposal, the final deliverable of this project
Owner	The RFP owner, in this case it is JICA or JICAST
NWCD	Network Configuration Diagram which provides the view of overall solution to be implemented under this RFP
MIS	Management Information System

Table of Contents

1 Preface

This Request for Proposal (RFP), documents the requirements of KW&SB for extending their Integrated Revenue System (IRS) access to Consumers Service Centres (CSCs). Its purpose is to invite proposals from the short-listed bidders.

The document summarizes the scope of the work, and Bill of Quantities (BOQ). It consists of the following sections:

2. **Purpose:** Summarizes the purpose of this RFP for bidders to take early Go / No-Go decision.

3. **Project Overview:** This section provides background of the project and an overview of the IRS system.

4. **Bill of Quantities (BOQ):** The minimum products IT, non IT and Networking, to be provided under this RFP are listed here with generic specification.

5. **Network Configuration:** Network Configuration diagram explaining a broader framework of the Network proposed to be established under this project and broader Network requirements are given here.

6. **Scope of Networking Services**: The services to be provided by bidder under this project to establish the Network are documented here.

7. **Proposal Formats:** The formats of technical and financial proposals are explained here. The bidder must submit its proposals in the formats specified here.

8. **Proposal Submission procedure:** Guideline for proposal submission is given here.

9. **High level Implementation Plan**: The schedule indicating key milestones with target completion dates are given here.

10. **Evaluation Criteria**: The criterion based on which technical proposals will be evaluated is given here.

7. **Appendix:**

   A. List of CRCs

   B. Budgetary Prices and cost estimates: Given only for information. ***(This is not part of RFP)***

   c. Detailed technical evaluation criteria given only for guidance ***(This is not part of RFP)***

For any clarification relating to any aspect of this RFP, please contact:

Give contact details ……

[To be filled in by JICA]

2 Purpose

The purpose of this RFP is to solicit proposals from vendors who wish to provide turn key solution for Hardware, NW software and networking services to JICA for providing Wide Area Network Solution to KW&SB.

The goal of this project is to connect 7 Consumer Service Centers (CSCs) of KW&SB with Integrated IRS Central Host implemented by MSCL at Revenue Secretariat KW&SB through connectivity that best meets the requirements as identified in this RFP. The successful bidder will provide hardware, networking software and provide networking services to establish network as described in section 5 based on BOQ given in section 4 of this document.

The purpose of the RFP is also to ensure transparency in procurement process and select the winner based on well defined criteria.

The major problems that must be overcome in providing connectivity and its benefits are:

a) Provide real time IRS access to CSCs resulting in better management of consumers' complaints
b) Provide fast and accurate response to consumers' queries
c) Provide better understanding of consumers' need through MIS
d) Improve consumers' satisfaction and
e) Improve Revenue Collection.

3 Project Overview

3.1 Background of the Project

KW&SB coverage is divided into 18 substations (Towns) within Karachi and one additional "W" division (i.e. 19th) comprises of cantonment areas.
In view of high focus of Government, on ensuring the supply of clean water to the people of this mega city, the management of Karachi Water & Sewerage Board has decided to establish the organizational readiness of the Karachi Water & Sewerage Board. As first step KW&SB decided to implement the integrated revenue system (IRS) at Revenue Secretariat. IRS has been implemented in two phases:

Phase I: Printing of Bills, on monthly basis. This phase was completed from August 2006 for printing July 2006 bills.

Phase II: Implementation of Billing System, Complaint Management System (CMS), Collection System and other support systems. These sub-systems have been implemented since December 2006 at Revenue Secretariat as part of IRS.

Now there is requirement to extend CMS and some facilities of Billing System to 7 CSCs mentioned above. For this purpose the IT equipment need to be procured and connectivity across CSCs and IRS Central Host system located at Revenue Secretariat through LAN/WAN need to be provided.

3.2 Integrated Revenue System (IRS) an overview

At the core of IRS is Revenue Management *Complete* System (RMCS), a MSCL product, is a set of integrated tools, which enhances Revenue Department (of Utility companies) effectiveness, by automating Revenue processes like Billing, Collection, Complaint Management, MIS, Consumer Management, Performance Management etc. It allows all team members to work in a collaborative manner throughout the Revenue cycle i.e. from billing to collection. RMCS is completely integrated system, well documented, and based on latest Relational Database technology. Through online connectivity this system can be accessed in a controlled manner at towns, union councils, CSCs and other departments. Its Disaster Recovery module ensures System Availability. It is protected from unauthorized system access by its User Management Module. Developed specially for Utility Companies it can play the significant role in reforming the Revenue Department of KW&SB. For production use RMCS runs on IRS Central Host System installed at Revenue Directorate of KW&SB.

For effective utilization of RMCS, it has been decided that all CSCs be connected to IRS Central Host for making following RMCS functions to the users at CSCs.

1) Duplicate Bills printing
2) Special Bills on demand
3) Complaint Management System
4) Basic consumer related on-line inquires

Availability of these sub-systems will provide information to consumers at the locations nearer to them. This will improve the effectiveness of the KW&SB staff and result in enhanced consumer satisfaction.

This RFP has been prepared to provide guidance to the bidders to submit their proposals both technical and financial.

4 Bill of Quantities (BOQ)

Under this RFP the following minimum IT, non IT and NW equipment is required. The bidders are advised propose full solution and update this BOQ to meet the objective of this RFP.

Important Note: Hardware products must be provided with required up-to-date system software to ensure smooth operations.

4.1 Hardware

S. No.	Item	Configuration	Quantity	Remarks
H1	Personal Computers (Branded)	Tower casing, Intel® Pentium D 3 GHz Processor / 800 MHz FSB, 2 MB Cache, Intel® 915 GV Express with ICH6, Memory: 1GB Non-ECC Shared DDR2 SDRAM, 40 GB SATA (7,200rpm) Hard Disk Drive,CD ROM Drive, Storage Shelves : 2 Internal 3.5" , 1 external 3.5", 2 external 5.25", Expamsion Slots : 2PCI , 1 PCI-e I/O Connectors: 1 Ethernet (RJ45), 1 Serial (9-Pin),1 Parallel (25 – hole , bidirectional) , 1 VGA out, 3 USB ports,15" flat screen colour monitor,NW Interface: Integrated 10/100/1000 Ethernet,56K Modem USB Keyboard & 2 - button Mouse USB Operating System: Windows XP Professional pre-installed with original license	7	
H2	Laser Printers	Type: LASERJET, Cut-Form Printer Minimum Speed: 30 ppm Resolution: Upto 600 DPI Minimum RAM: 80MB I/O Port: USB Color Support: Black & White Required updated SW Driver	7	
H3	Printer - Dot Matrix	Serial/Parallel dot matrix impact printer 24 pins 132 columns. Network attachable. Maximum 240 x 144 Dpi resolution, Print direction bi-directional optimized in text. Noise level less than 47.5 dBA during printing (ISO 7779) Power consumption less than 30 watts 220 cps in draft at 10 cpi, 53 cps in LQ at 12 cpi, 44 cps in LQ at 10 cpi.	7	
H4	UPSes	Capacity: 3KVA Technology: True on-line Input Power: Single Phase Output Power: Single Phase Input voltage variation range: 150 to 300 Minimum Backup Time: Minimum 15 minutes Operating Temperature range: 10 to 50 deg centigrade LED display	6	

H5	Switch for centers	8 ports 10/100 switch with patch panel	6	
H6	Routers for centers (Optional)	High speed, Modular architecture, LAN and WAN support, 128MB SDRAM, VPN Remote and Server support, USB port.	6	
H7	Switch for central site	24 ports 10/100 switch with patch panel	1	
H8	Router for Central Site	Provide seamless connectivity with IRS Host and CSCs enabling IRS Host application access and file transfer facilities. Minimum following features are required: High speed, Modular architecture, LAN and WAN support, 128MB SDRAM, VPN Remote and Server support, USB port.	1	
H9	Additional Cabling material as per requirement	Pair Cable Face Plates & Back Boxes Patch Cord Clipsal Patch Cord Cable Management Panel	As required	

Delivery: within 30 days of receiving order.

Warranty: All equipment to be provided should be covered under three years warranty both parts and labor.

4.2 Software:

Important Note: Hardware products given in section 4.1 will be supplied with required system software to ensure smooth operations. So system software and drivers are NOT included here.

S. No.	Item	Configuration	Quantity	Remarks
S1	Network Manager	Operating Environment: Window 2000 and above Should be able to manage all client PCs attached to IRS Central Host. License Requirement: Single Server, 10 Clients.	1	

5 Network Configuration

5.1 Network Configuration Diagram (NWCD)

The NWCD provides a framework on how this project is visualised to be implemented. The bidders are required to meet minimum level of connectivity and requirements given in section 5.2 however not limited to this. Any suggested improvement should be highlighted in management summary and detailed in BOQ and Scope of NW Services sections of technical proposal. The suggested Network in NWCD is router based. Bidder may propose any other strategy (for example VPN), ensuring meeting purpose of this RFP.

Please see file "NWCD for JICA RFP.doc" and NWCD for JICAWithout Routers

5.2 *Requirements of the Networking*

Functional / Technical Requirements:

- **Addressing (IP addressing):** The network addressing should be static. This means all workstations should have fixed IP address.
- **Messaging features:** Should allow message exchange between CSC Workstation the host system operator. Host System IP address including PC Name will be pre-assigned.
- **Electronic File Transfer:** File transfer to and from IRS FTP Server should be possible at 32 Killo Bytes per second.
- **Remote maintenance and testing capability:** The software application installation, maintenance and testing facilities at CSCs through IRS Central Host should be possible.
- **Security and firewall provisions:** The network should be protected using firewall and other network security mechanism. The solution provider has to provide a security concept for the solution which will cover physical network security, virtual security and processes necessary for successful implementation of a secure network.
- **Traffic and usage data collection:** The data exchange statistics across network should be available at Central Host Site.

Support Requirements

- **Remote monitoring capability:** The Central site system operator should be able to disable, enable, connect, and disconnect any workstation or user across the network. The Central operator should also be able to define new user/s or remove any user at CSCs.
- **Continuing availability of spares;** The respondent should ensure availability of required spare parts to ensure reasonable availability of network.
- **Documentation provided:** The respondent is responsible for providing complete network diagrams, documentation (user manuals, installation manuals, configuration manuals etc.) and testing certification
- **Training for users and administrators**: The bidder is responsible for providing training to the staff nominated by KW&SB, on all the equipment deployed during the course of the project. The training to be provided for 12 users and 2 administrators.