

Greater Karachi Sewerage Plan S III 2007 Form PC - I



**City District Government
Karachi Water and Sewerage Board
Planning Commission Of Pakistan**

Government Of Pakistan
PLANNING COMMISSION
FORM PC-1 (SOCIAL SECTOR)

**GREATER KARACHI
SEWERAGE PLAN (S-III)**



CITY DISTRICT GOVERNMENT KARACHI (CDGK)



KARACHI WATER & SEWERAGE BOARD

GOVERNMENT OF PAKISTAN PLANNING COMMISSION

1. **Name of the Project**
Greater Karachi Sewerage Development Plan (S-III)
2. **Location**
Karachi District comprising 18 Towns.
(See Figure-1)
3. **Authorities responsible for Sponsoring**
Local Government Department, Government of Sindh.

Execution

Karachi Water & Sewerage Board
(KW&SB)

Operation and Maintenance

Karachi Water & Sewerage Board
(KW&SB)

Concerned Federal Ministry

Ministry of Finance

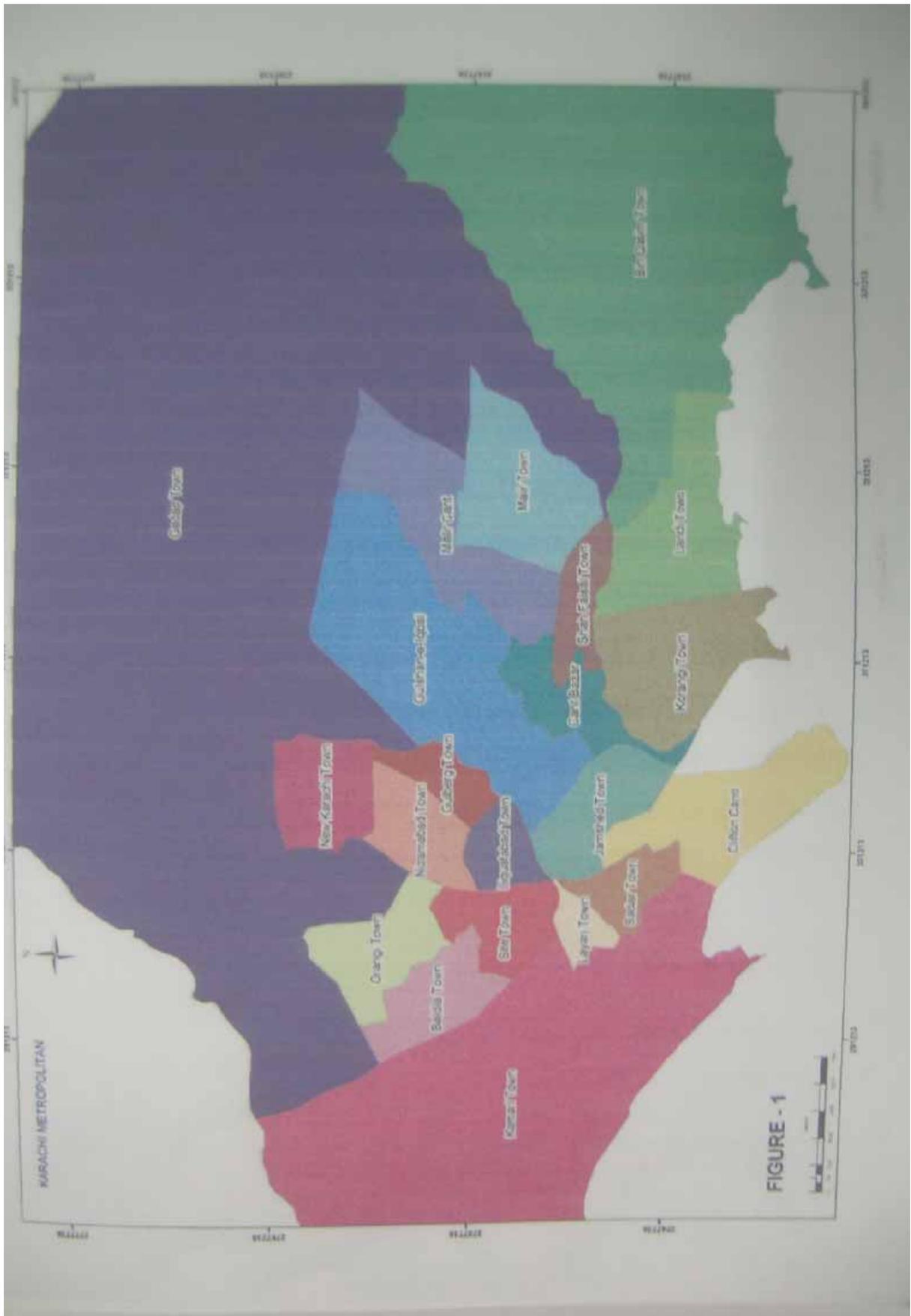
4. (a) **Plan provision**
There is no provision in PSDP – 2006-07

The scheme was presented to the Governor where it was decided that KW&SB submit PC-1 to Government of Sindh (GoS) for onward presentation to Government of Pakistan (GoP) for arranging the funds.

(b) Provision in the current year PSDP/ADP

Nil

5. **Project Objectives**
Project linkage with sector: The project falls in social sector and is a public service development work which directly or indirectly influence living in health conditions of citizens. The project is compatible with targets set out for achieving Millennium Development Goals (MDGs).



- 5.1 The Greater Karachi Plan (S-III) has been envisaged by KW&SB to improve environmental conditions in city through an integrated system of collection, treatment and disposal of sewage.
- 5.2 In the past lesser importance was given to sewerage and a backlog has accumulated. More recently though, attempts have been made by the KW&SB through the development of Sewerage Policy Document in 2002 to highlight improvement of sewerage system from environmental aspect. The draft of this policy is attached as Appendix-1 for reference. During 1988 a master plan for sewerage was prepared. The plan was only partly implemented due to lack of resources which could match the pace of the rapid population growth and expansion of the city.
- 5.3 S-I corresponds to KSDP-1. Components implemented under KSDP-1 include:
- Preparation of a Sewerage Master Plan (1988-2003)
 - Upgrading of STP-I & STP-II
 - Establishment of Sewerage Wing in 1991
(see Appendix-3 for more details)
- 5.4 S-II corresponds to KSDP-II. Implementation of KSDP-II synchronized with completion of 100 MGD K-II bulk water supply project. Sewerage components implemented under S-II include:
- a) Construction of Mauripur Sewage Treatment Plant (TP-3) – 54 MGD
 - b) Construction of Lyari Interceptor RCC Box culvert PVC lined:
 - Garden to Mauripur dual 12 kms
 - Sir Shah Suleman Road to Garden – 3 kms
 - c) Construction of Baldia Trunk Sewer 32 kms (200 mm – 1320 mm PVC lined)
 - d) Laying of Secondary sewers in Baldia.
- Following S-II components were left over due to resource constraints which need to be addressed in the proposed plan (S-III).
- e) Construction of sewage treatment plant at Korangi and other places.
 - f) Extension of Lyari Interceptor up to North Karachi & construction of trunk sewers.
- 5.5 S-III is planned to address shortfall in sewerage sector and to cope with immediate demand arising from completion of 2nd 100 MGD K-III project.

In this connection, under the chairmanship of the Deputy Chairman, Planning Commission, Islamabad a meeting was held on 04-04-2006 in which the Deputy Chairman proposed that the Federal Governments should develop and implement the projects to clean the polluted rivers in their territory with priority being given to rivers including Lyari river in Karachi: Letter in this regard is attached as Appendix-2.

Due to immediate nature of problems in water supply, an enormous backlog has accumulated over years for want of expansion of sewerage system. It is essential to start S-III to protect environment, maintain ecological balance and save the metropolitan citizens from health hazards.

6. Description and justification of project

Project Area Description

Population

Karachi is the largest metropolitan of Pakistan with estimated population of 14 million (Per Karachi Master Plan 2005) with a growth rate of about 3%. This growing population needs an immediate attention to water supply and consequent drainage requirements.

Federal Government introduced local government reforms in August 2001 under the Sindh Local Government Ordinance SLGO 2001 which abolished the previous administrative system. The present system has 18 Town in Karachi Division with each town headed by an elected Nazim while the division itself is headed by Chief Nazim.

The town-wise population as per 1998 census is summarized as under, see Figure 2:

Table 6.1

S.No	Town	Population 1998 Census	Estimated Population 2006	No. of Union Councils
1	Baldia Town	406,165	495,521	8
2	Bin Qasim Town	315,684	385,134	7
3	Gadap	289,564	353,268	8
4	Gulberg	453,490	553,258	8
5	Gulshan	664,662	810,888	13
6	Jamshed Town	733,821	895,262	13
7	Kemari	383,778	468,209	8
8	Korangi	564,504	688,695	9
9	Landhi	666,748	813,433	12
10	Liaquatabad	649,091	791,891	11
11	Lyari	607,992	741,750	11
12	Malir	398,289	485,913	7
13	New Karachi	684,183	834,703	13
14	North Nazimabad	496,194	604,357	10
15	Orangi	723,694	882,907	13
16	Saddar	606,151	751,704	11
17	Shah Faisal	335,823	409,704	7
18	SITE	467,560	570,423	9

Climate

Karachi belongs to the semi-arid dry areas in the province of Sindh. The mean annual precipitation rate is 207 mm, of which about 9 mm fall during the rainiest month of Jul. The mean annual number of days with 2.5 mm or more precipitation are 9 while 3 are to be expected in July. The air temperature is not excessively high. The annual mean temperature lies between 22C and 35C.

The relative humidity has a mean value between 44% in January and 90% in August. The annual mean is 80% (recorded at 0800 hrs) and 65% (recorded at 1700 hrs).

The main wind direction in the month of April until October is southwest. In the other months, it fluctuates between north and northeast. The mean wind velocities are:

Table: 6.2

Period	Morning		Afternoon	
	Knots	M/S	Knots	M/S
April – Sept	10	5.2	14	7.2
Oct – March	5	2.6	9	4.6

Soil & Geology

The stratigraphic sequence exposed in hills skirting Karachi is as under:-

Table: 6.3

Formation	Age	Lithology
Mancher	Pliocene	Mainly comprise of sandstone and shales with subordinate conglomerate in gritty, friable and bedded.
Gaj	Miocene	It comprises of calcareous sandstone and Limestone and has a gradation contact.
Nari	Early Miocene to Pliocene	It consists of mainly sandstone and shale with subordinating limestone and conglomerate. Limestone exists at base but is not present everywhere.

Soil in Karachi is not uniform every where and varies from locality to locality. For instance the soil in the old flood plain of two rivers namely Lyari and Malir and in their tributaries comprised of admixture of generally coarse to medium sand with gravels and silt and clay layers. While in the coastal areas it is in general fine to medium sand with clay and silt. As such the soils in Karachi Division are of varied in nature and admixture of sand, silt, gravel and layers of clay.

Drainage Pattern & Rivers

There is no perennial stream in Karachi Division except rain fed rivers like Lyari and Malir Rivers. Although the water of the perennial Hub River is being utilized for Karachi but the entire river system lies in province of Balochistan.

Flowing from north is Lyari River which discharges in Arabian Sea/crossing Bridge at Mauripur Road. It is joined by Gujar Nallah, Orangi Nallah from west before it discharges to sea.

The other torrential river is Malir River which is joined by Thadoo Nallah north of Super Highway and Sukkhan Nallah which joins Malir river near National Highway from east. Flowing through Malir town, Shah Faisal town, and near Korangi town, the Malir river discharges to Arabian sea in Defence Housing Society areas. However, the flood plain and the river bed itself has been filled and a pukka channel has been constructed which discharges flood water to sea. It may be pointed out that these rivers had a relatively longer flood plain and rather a shallow bed which results in heavy damages even in moderate rain which are magnified several fold because of unauthorized hutment in river bed (see Figure 3 for Karachi drainage pattern).

Geomorphological pattern of torrential rivers and Nallah may be classed as parallel to sub-parallel.

Thousands of households live in riverbeds and nallahs that are subject to severe flooding every five to seven years when the monsoon rains are heavy. Although the frequency of serious flooding is low, the damage is great. At least thirty lives were lost in the urban areas during 1977 monsoon and there was substantial damage to industrial, commercial and residential property. In 1967 the losses were much more severe, with hundreds of deaths and greater property damage. Even mild flooding causes sewers to over-flow and the entire city exposed to serious health hazards. Those worst effected were the poor.

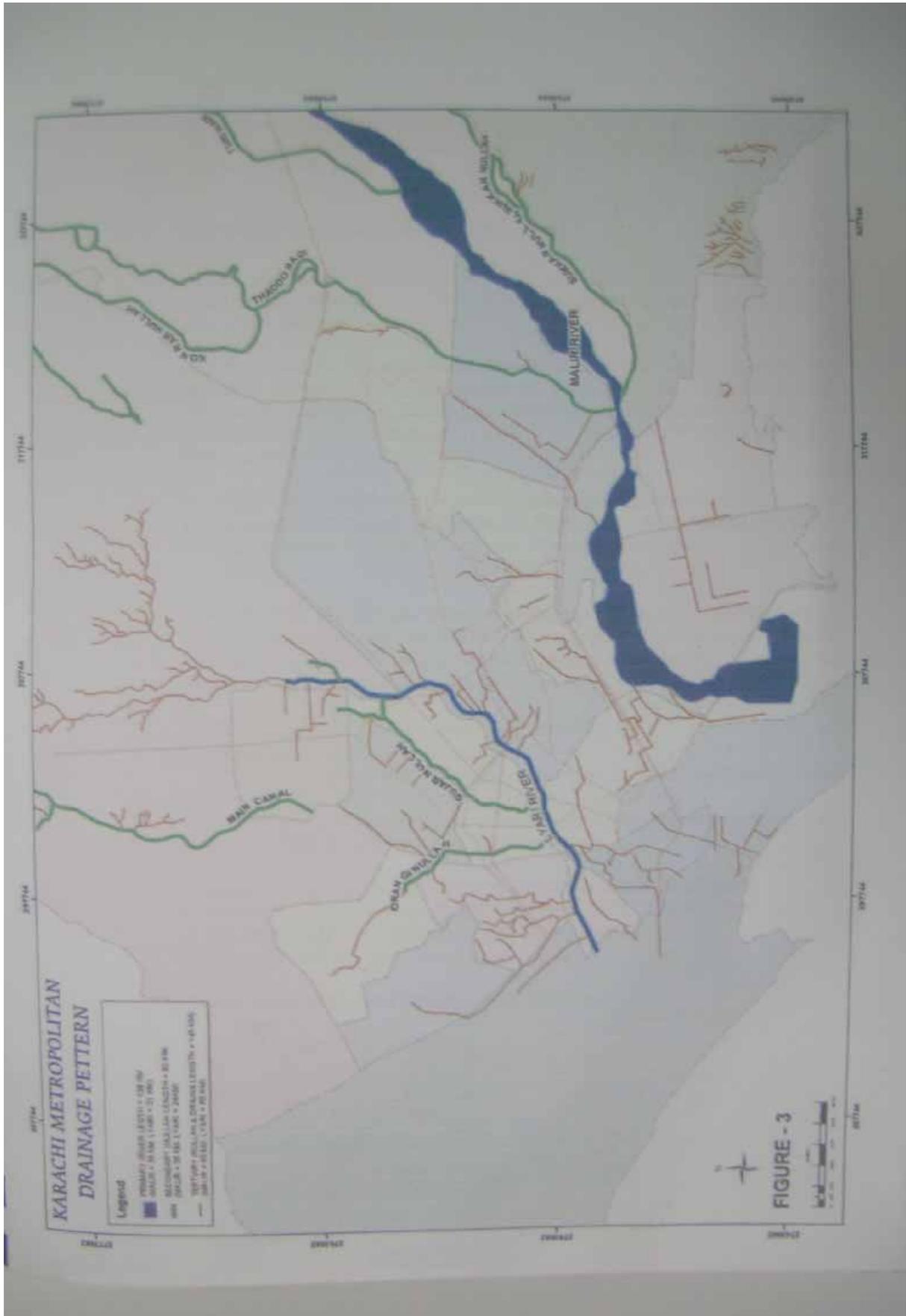
The risk of flooding in the lower reaches of the Lyari River is great. Built-up areas that are repeatedly subject to substantial flooding.

One irrigation canal exists in the region at present from the Kotri Barrage Irrigation Scheme. Two canals have been constructed to distribute irrigation waters from Hub Dam.

Goundwater

The groundwater of potable quality is in fact a rare commodity in Karachi area. However few thin aquifers of potable or sweet water as is commonly known, occur.

In SITE area and at some locations north of Karsaz potable water of limited extent, had been reported by Pittalwala in his book on Geology of Karachi. At Abdullah Shah Ghazi Mazar a slightly brakish water layer associated with sand stone is known to occur which discharges as spring.



However, the depth to water is about 150 feet or more below ground.

A number of tube wells for water supply and agriculture purposes are operational in lower Malir Basin which is over exploited. As a result the water quality is deteriorating.

Existing Facilities [S-I & S-III]

Water supply and sewerage facilities had been developed in Karachi Metropolitan from time to time. Phase wise planning and implementation are briefly described hereunder:

a) The Greater Karachi Sewer Plan (S-I) has been envisaged by KW&SB to improve environmental conditions in the city through an integrated system of collection, treatment and disposal of sewage. Sewage plan S-I corresponds to KSDP-I which included the following components:

- Master Plan for Sewerage and Wastewater Disposal 1988-2003.
- Upgrading of Sewerage Treatment Plant No.1 from 10mgd to 51mgd capacity and Sewerage Treatment Plant 2 from 12 mgd to 46 mgd capacity.

b) Phase-II of the Greater Karachi Sewerage Plan (S-II) corresponds to KSDP-II. Implementation of KSDP-II was synchronized with completion of 100 MGD K-II bulk water supply project. Sewerage components implemented under S-II included (see Figure 4):

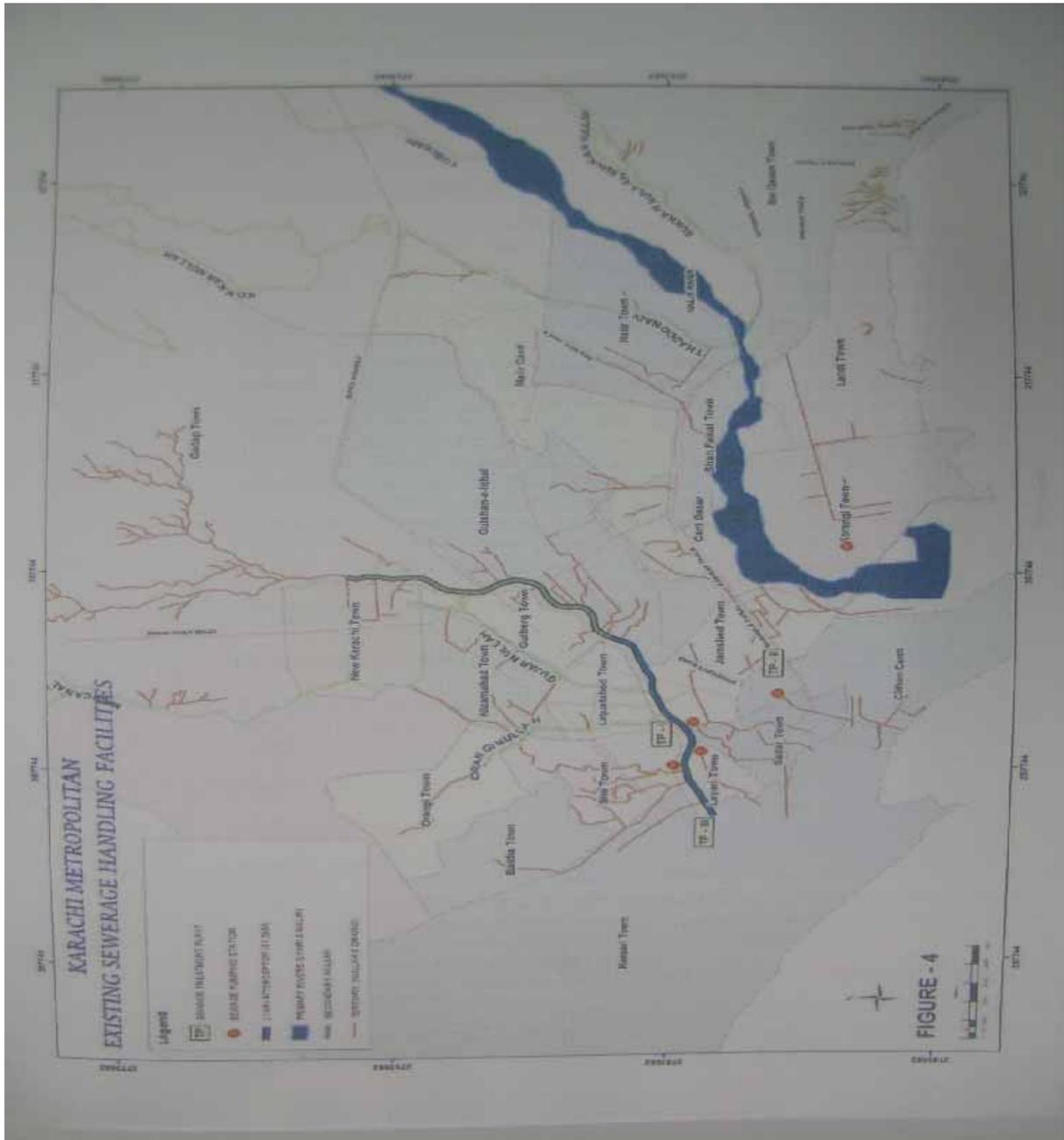
- Construction of Sewerage Treatment Plan No.3
- Construction of Lyari Interceptor
RCC Box Culvert with PVC lining (Garden to Mauripur dual 12 kms and Sir Shah Suleman Road to Garden Single 3kms)
- Construction of Baldia Trunk Sewer & laying of Secondary Sewers in Baldia (32 kms of 200 mm TO 1320 MM dia.)

Following components were left overdue to resource constraints.

- Construction of Sewerage Treatment Plants at Korangi and other areas.
- Extension of Lyari Interceptor upto North Karachi.
- Construction of Trunk Sewers.

Overall existing facilities consists of the following:

Sewerage Treatment Plants	3 Nos.
Major Sewerage Pumping Stations	6 Nos.
Sewerage Life Pumping Stations	32 Nos.
Sewerage Cleaning Machines	23 Nos.
Lateral Sewers 8" – 15" dia.	1,844 miles
Sub-Trunk Sewers 15" – 24" dia.	500 miles
Trunk Sewers 30" – 66" dia.	200 miles
Total Length of Sewer 8" – 66"	3,544 miles
No. of Manholes	250,000



Salient features of the existing sewerage treatment plants TP-I, TP-II and TP-III are tabulated in Appendix-4.

A detailed study was conducted on Lyari and Malir rivers Pollution Study in 1994 through the Environmental Protection Agency. Excerpt of this study indicating the average flow and quality of the effluent is attached as Appendix-5.

Industrial Wastewater

Karachi is home of Pakistan's biggest industrial estate SITE with more than 2000 industrial units. In addition industrial areas namely Landhi, Korangi, NKFB areas are also of significance. Industries are diversified in nature handling textile, chemical, tanneries etc. whilst the Factories Act of 1934 prohibits these industries to discharge their un-treated effluent, lack of treatment facilities and enforcement procedures (such as EPA act 1997), most of these units resorted to discharge industrial waste into nearest channel/river instead of discharging pre-treated waste into the network. As a result Lyari and Malir rivers are now perineal rivers carrying domestic / industrial waste water & serving as an open sewer through the heart of the Karachi city. BoD load of Lyari is about 1000 tons/day whereas Malir river carries 500 tons/day. In response the Interceptor Trunk Sewer laid in Lyari River bed for last two years is conveying sewage to TP-3 at Mauripur while storm water connected sewers have been converted to trunk sewers under Khushal Pakistan Programme to serve Lyari & Malir Rivers. Also proposal of Combined Effluent Treatment Plant (CETP) is under consideration. 3 industrial clusters at Landhi, Korangi and SITE have been planned by the Ministry of Environment. The treated effluent from CETP would conform to NEQS. The hazardous waste would be disposed at Jam Chakro.

Proposed Facilities Components of [S-III]

S-III project components are planned to be implemented in two stages. This PC-1 refers to Stage-1 only which is expected to be completed in 4 years.

Figure 5 shows the detail of proposed scheme.

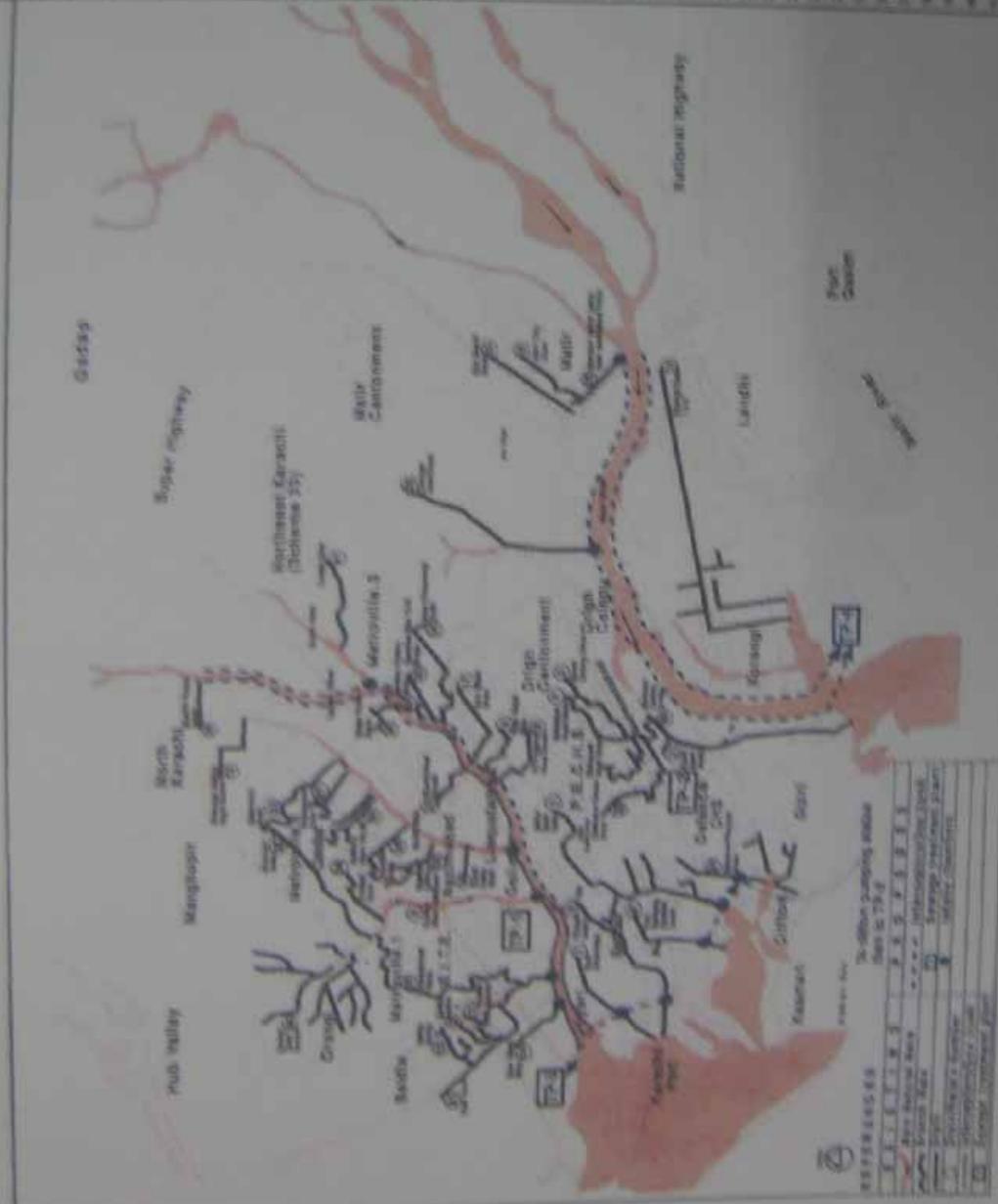
A) Phase-I Components

a) Malir Basin

- i) Interceptors along both sides of Malir river from Quaidabad bridge to proposed Korangi Sewage Treatment Plant (TP-IV) serving Landhi, Korangi, Malir, Bin Qasim, Shah Faisal, Model Colony & Gulistan-e-Jauhar.
- ii) Chakora Nallah to be connected to Malir Interceptor through intake chamber.
- iii) Trunk Sewer on Nehr-e-Khayyam to carry sewage flow to Clifton Pumping Station (CPS) and through Clifton rising mains to TP-II (Mehmoodabad) for treatment and disposal.

KARACHI DISTRICT - CONCEPTUAL PLAN FOR A REALISTIC SEWAGE DISPOSAL SYSTEM

Karachi map showing the focussed sewer lines & fringes (which are the main disposal for sewage and rain water) and the integration of these with the drains & STPs.



REFERENCES

1	Dr. Aftab Khan	Dr. Aftab Khan
2	Dr. Aftab Khan	Dr. Aftab Khan
3	Dr. Aftab Khan	Dr. Aftab Khan
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S. No.	Name of premises	Year
1	City Mall	1975
2	City Mall	1975
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50	City Mall	1975

PROPOSED SEWERAGE IMPROVEMENT PLAN

MALIR INTERCEPTOR-II



PROPOSED SEWERAGE IMPROVEMENT PLAN

MALIR INTERCEPTOR-2



PROPOSED SEWERAGE IMPROVEMENT PLAN

LINKING OF NALLAS TO MALIR INTERCEPTOR



PROPOSED SEWERAGE IMPROVEMENT PLAN



PROPOSED SEWERAGE IMPROVEMENT PLAN

NEHAR - E-KHAYYAM
IMPROVEMENT WORKS



PROPOSED SEWERAGE IMPROVEMENT PLAN

LINKING OF FRERE &
RAILWAY NALA TO NEHRU-E-
KHAYYAM



PROPOSED SEWERAGE IMPROVEMENT PLAN

LYARI INTERCEPTOR
(EXTENSION UPTO NORTH
KARACHI)



PROPOSED SEWERAGE IMPROVEMENT PLAN

PICTHER AND KALARIY
NALLAS IMPROVEMENT
WORKS



PROPOSED SEWERAGE IMPROVEMENT PLAN

ADDITIONAL SEWERAGE
FLOW IMPROVEMENT
WORKS



**KARACHI METROPOLITAN
DRAINS DISCHARGING INTO SEA**



FIGURE 6

- iv) Manzoor Colony drain to be connected to Malir Interceptor through Intake Chamber.
- v) Diversion of following Nallahs through intake chambers to Clifton Pumping Station and then to TP-II (Mehmoodabad).
 - City Railway (Ranchore Line) nallah
 - Soldier Bazar nallah
- vi) Construction of Treatment Plan (TP-IV) Korangi.
- vii) In addition to engineering aspects, project will also examine the following aspects:
 - Review of existing network and conveyance system for measures to enhance flows to Sewage Treatment Plants (STP's) from 90 mgd to 151 mgd.
 - The Environmental Protection Act 1997 and primary treatment in industries.
 - Proposals and options for Combined Effluent Treatment Plants (CETP) together with domestic sewage for dilution.

b) Lyari Basin

- i) Extension of Lyari River Interceptor upto North Karachi / Surjani Town.
- ii) Following nallahs to be connected to Lyari Interceptor through intake chambers:
 - Sher Shah Nallah
 - Gujro Nallah
 - Orangi Nallah
- iii) In addition to engineering aspects to project will aim to assess:
 - Capacities of Lyari Interceptor to carry additional loads from North Karachi and Surjani Towns.
 - Scope of utilization of North Karachi Sewerage Treatment Plant.
 - Introduction of Pre-treatment measures such as basic treatment, screening systems etc.

c) Improvement of Existing Works

- i) Enhancement of capacities of TP-I, II & III making a total ultimate treatment capacity of 150+150 = 300 mgd.
- ii) Improvement works for enhancing inflows at TP-I, II & III.

B) Phase-II Components

- i) All remaining nallahs to be provided interceptors and connected to Malir / Lyari Interceptors for separating storm sewer.
- ii) Construction of more Treatment Plants.

Project Justification

S-III is planned to address the critical and deteriorating environmental condition of the city, its beaches and hygienic conditions. Present sewage treatment capacity is stagnant at 151 MGD since 1998 and thus enormous backlog has accumulated over years for want of expansion of the sewerage system. The backlog has resulted in the metropolitan beaches converted into cess pools.

It is essential to start S-III to protect environment, maintain ecological balance and save the citizens of Karachi from health hazards as 2nd 100 MGD K-III project has become operational and study for K-IV already initiated. Quantity of sewage generation would increase with expansion of bulk water supply and is estimated to be 70% of the water supply. K-III project alone is expected to contribute about 60 mgd in the sewage generated. There exists a dire need to make up for the time lost for introduction of the S-III project as it was initially planned to be realized in tandem with the implementation of the K-III project.

Presently, Karachi Sewage is going into sea, partially untreated, through the following outfalls/nallas (natural drains), rivers (see Figure 6):

- Lyari river
- Malir river
- Nehr-e-Khayyam
- Fere nallah
- Pitcher nallah
- Kalong nallah
- Railway nallah

It is high time that sewerage sector be given high priority at par with the water supply for environmental protection. The proposed scheme includes:

- a) All drains, nallahs and rivers carrying sewage to be directed towards treatment plants before being discharged into the sea.
- b) Separation of the drainage and sewerage systems, considering ground realities and accumulated backlog; as total separation of the drainage and sewers are particularly difficult.
- c) Improvement of the sewerage system to protect eco-system, marine life and to prevent health hazards.

Technical Parameters

a) Sewage Quality

Sewerage system directly influences environmental conditions in any city and consequently the health and hygienic conditions of the residents who are exposed to their surrounding.

Presently KW&SB is complying with the National Environmental Quality [NEQ] standards at TP-3 providing BOD at 80 mg/l and SS of 15 mg/l. for TP-1 and TP-2 the effluent reaches BOD of 120 mg/l and SS of 200 mg/l which is closed to NEQ requirements.

There are a large number of Katchi Abadis in the metropolitan where more than 30% of its population reside. The population of city for which the system was originally designed has exceeded the design capacity. Consequently the sewerage network is overloaded and is rendered undersized in a number of areas. These Katchi Abadis are located on the banks of rivers/nullahs. There is a dire need of regulating these discharges for example by provision of an adequately design and network integrated interceptor drain in such areas.

For areas of Karachi such as Cantonment boards, Societies and other un-served areas, little if any O&M takes place for the existing sewerage system network. Mostly internal system is maintained by local setup and only part use of KWSB trunk sewers are made. Their system should ideally be linked to KWSB trunks sewers and interceptors.

In most of the areas in the city the system is more than 30 to 35 years old and has over lived designed life which is 25 to 30 years. Due to decay, erosion, deterioration and corrosion in the system, the pipes and manholes suddenly collapse and sewer sink down occasionally causing overflows in upstream areas besides posing danger for public due to sudden collapse.

The above conditions of existing network merits review and possible introduction of new and innovative concepts such as trench less technology and utility tunnels, atleast for the new areas.

Quality of the sewage is depicted by the samples taken and analyzed through Lyari and Malir river Pollution Study of 1994 (see appendix-5)

The break up of sewage generated and treated in the city is:

- Sewage generated 435 mgd
- Sewage treatment capacity 151 mgd
- Sewage treated actually 90 mgd
- Sewage bypassing system 345 mgd
- Shortfall in treatment capacity 284 mgd

It is proposed to convey and treat the domestic and industrial sewage separately. The system will be designed in such a way that keeps the storm water out of the system through gated structure.

During storm the conveyance system will be bypassed and the combined flow of storm and sewage, substantially diluted, will directly go to the sea. In an arid area like Karachi where the rainfall occurrences are very erratic and occasional, the affect of it on the sea would be considerably reduced.

b) Quality

Due to urgent problems in water supply the sewerage sector could only be allocated limited resources in the past which do not commensurate with demand of this sector. As a result enormous backlog has accumulated over the period.

In the absence of an adequate system capacity, part of the sewage flows through Malir and Lyari rivers and other nallahs and drains. This practice should preferably stop and sufficient resources be allocated to separate the domestic, industrial and storm water disposal.

About 70% of the water supplied to the city returns as sewage. A total quantity of 435 mgd of domestic and toxic industrial wastewater is generated at present. There are 3 sewage treatment plants in Karachi. The total designed capacity of these 3 treatment plants is 151mgd but currently only 90 mgd is being treated due to reduced capacity. The untreated sewage is disposed off in the sea through 7 nallahs including Lyari and Malir rivers.

Estimates of the expected effluent from domestic sewage and the preliminary design of the conduit sections is provided in Appendix-6.

K-III bulk water supply system is near commissioning which is going to add 100 mgd to the present system. This would further add about 70 mgd into the sewage and wastewater disposal system thus overloading it. S-III project is conceived to cater for his shortfall under this scheme.

c) Design Parameters

Following design parameters shall be used:

- Environment
Environment Protection Agency [EPA]
- Water Works Design
American Water Works Association [AWWA]
- Quality Control
National Environmental Quality Standards [NEQS]
- Structural Design
American Concrete Institute [ACI]
- Materials & Testing
American Standards for Testing & Materials [AMTS]

Governance Issues

Overall responsibility of collection, treatment and disposal of sewage in Karachi metropolitan area vests in KW&SB. The Sewerage Wing of KW&SB provides following services:

- Collection, treatment and disposal of sewage from areas under KW&SB jurisdiction.
- Operation and maintenance of the existing sewerage system.
- Prepare plans for system optimization and expansion.
- Coordination with various organizations operating in Karachi and providing sewerage services.

There seems to be no governance issue on the project as the main responsibility of the sewerage planning, implementation and maintenance are vested to KW&SB.

Water supply & sewerage

- Present and projected population and water availability / demand.
N.A.
- Indicate source and water availability (mgd) during next 51,020 years.
N.A.
- For waste water / sewerage, provide present and future disposal requirements, gaps if any and proposed treatment methods and capacity.

S-III is planned to address the crucial and deteriorating environmental condition of the city, its beaches and hygienic condition. Present sewage treatment capacity (design) is stagnant at 151 MGD since 1998 with actual treatment of only 90 MGD and thus enormous backlog has accumulated over years of want of expansion of the sewerage system.

About 70% of the water supplied to the city returns as sewage. A total quantity of 435 mgd of domestic and toxic industrial wastewater is generated at present. There are 3 sewage treatment plants in Karachi. The total designed capacity of these 3 treatment plants is 151 mgd. The untreated sewage is disposed off in the sea through 7 nallahs including Lyari and Malir rivers.

K-III bulk water supply system is commissioned recently which has added 100 mgd to the present system. This added about 70 mgd into the sewage and wastewater disposal system thus overloading it. S-III project is conceived to cater for this shortfall under this scheme.

Treatment capacity of existing plants is given as follows:

Existing:

- Sewage generated 435 mgd
(including additional 60 mgd
Sewage due to K-III project)
- Sewage treatment capacity 151 mgd
- Sewage treated actually 90 mgd
- Sewage bypassing system 345 mgd
- Shortfall in treatment capacity 284 mgd

Proposed:

- With S-III Project (Phase-I)
- Sewage generated 435 mgd
- Upgradation of existing sewage
Treatment plant: 300 mgd
(Existing 150 mgd enhanced
to 300 mgd).
- New TP-IV 200 mgd

Type of treatment envisaged is essentially conventional treatment consisting of process which employ activated sludge or forms of biological filtration. However treatment is ponds and sea disposal will also be considered depending upon projected loads and environmental requirements.

The project is not part of any Master Plan however it will become part of future Master Plan. Several planning studies are underway with foreign grants.

7. Capital cost estimates

Cost estimate is based on current market prices and prevailing market rates as of May 2006.

Capital cost of the project comes to Rs. 7.982 billion which is distributed in the 4 years of the design and construction plan. Break up of the Capital Cost is given in Appendix-7.

Estimated time for detailed design of the project is 9 months with 3 months overlap with the tendering, evaluation and physical construction in phases. Construction period is estimated to be 48 months.

Phase-I cost distribution estimate is tabulated below:

S. No	DESCRIPTION	AMOUNT (Rs in million)	COST PHASING Million Rs.				
			1 st YEAR	2 nd YEAR	3 rd YEAR	4 th YEAR	5 th YEAR
A	MALIR TRUNK SEWER 1 (L/S)	1064	150	314	200	200	200
B	MALIR TRUNK SEWER 2 (R/S)	1217	158	264	265	265	265
C	LYARI TRUNK SEWER REMAINING	921	12	266	267	267	-
D	LINKING OF NALLAHS TO LYARI & MALIR TRUNK SEWER	172	72	100	-	-	-
E	NEHR-E-KHAYYAM RAILWAY NULLAH & FRERE NALLAH IMPROVEMENT WORKS	90	35	55	-	-	-
F	PITCHER AND KALRI NULLAHS IMPROVEMENT WORKS	72	30	42	-	-	-
G	IMPROVEMENT WORKS FOR ENHANCING INFLOWS AT TP-I, II & III	450	100	175	175	-	-
H	ENHANCEMENT OF CAPACITIES OF EXISTING TP-I, II & III BY ADDITIONAL 150 MGD	1350	150	300	300	300	300
I	TREATMENT PLANT TP-IV (200 MGD CAPACITY)	1920	270	412	413	413	413
	TOTAL	7257	1086	1928	1620	1445	1178

8. Annual operating cost

Annual operating and maintenance [O&M] cost is estimated to be 5% of the capital cost of the project which comes to Rs. 399 million/year.

9. Demand supply analysis (excluding science & technology, research, governance & culture, sports & tourism sectors)

With the induction of 100MGD of the bulk water supply to Karachi through K-III project the total present supply to Karachi would approach 580 MGD considering 100 MGD from Hub. The primary source of the bulk water supply is from river Indus through Kinjhar lake. This would be serving the 11 million estimated current population at a little more than 52gallons per capita per day.

Approximately 70% of the water supplied to the city returns as sewage. A total quantity of about 435 mgd of domestic and toxic industrial was water is generated at present. There are 3 sewage treatment plants in Karachi. The total designed capacity of these 3 treatment plants was 151 mgd but the currently treat only 90 mgd. The untreated sewage is disposed off in the sea through 7 nallahs including Lyari and Malir rivers (see Figure 6).

K-III bulk water supply system has become operational which has added 100 mgd to the present system. This has further add about 70 mgd into the sewage and wastewater disposal system thus overloading it. S-III project is conceived to cater for this shortfall under this scheme.

The proposed project [S-III] is planned to channelize the domestic sewage through collectors and interceptors towards the treatment plants before being discharged into the sea – thus cleaning the beaches and sea front of Karachi metropolis.

In most of the areas in the city the system is more than 30 to 35 years old and has over lived designed life which is 25 to 30 years.

City sewage generation and treatment capacity balance is as follows:

Existing:

- Sewage generated 435 mgd
(including additional 60 mgd
Sewage due to K-III project)
- Sewage treatment capacity 151 mgd
- Sewage treated actually 90 mgd
- Sewage bypassing system 345 mgd
- Shortfall in treatment capacity 284 mgd

Proposed:

- With S-III Project (Phase-I)
- Sewage generated 435 mgd
- Upgradation of existing sewage
Treatment plant: 300 mgd
(Existing 150 mgd enhanced
to 300 mgd).
- New TP-IV 200 mgd

10. Financial Plan

Sources of financing

a) Equity:

Not Applicable

b) Debt

Not Applicable

c) Grants along with sources

Government of Pakistan Funded 100%

11. (a) Project benefits and analysis

i) Financial

It is a public service social development project; which directly or indirectly influence the living and health of the city population. The project is planned to be implemented by the KW&SB which is a non-profit organization and thus there is no financial profitability considered.

ii) Social benefits with indicators

There is no simple way of identifying the tangible benefits expected from this project. However, there are numerous intangible benefits in economic terms that include:

- Direct and indirect employment opportunities.
- Improving the image of Karachi as eco-conscious city.
- Industries will benefit as it will help them to comply with International Standards.
- Clean coast and beaches of Karachi.
- Increase in tourism.
- Better environmental conditions.
- Health and hygiene conditions improvement.
- Improved fishery catch in quantity and quality and export opportunities.
- Environmental mitigation cost savings.
- Conservation of eco-system and its balance.
- Improved aesthetics of the city beaches.

Improved health and hygiene conditions would be the major social benefiting factor for the metropolitan dwellers.

Better health would boost the public moral and affect their psychology resulting in improved traffic driving behaviour and their attitude and reactions towards daily problems.

This would improve the civic sense of the city population thereby improving their tolerance towards others – a much needed aspect which is constantly deteriorating under present health and hygiene conditions.

iii) Employment generation (direct and indirect)

There would be both, direct and indirect employment generation through the S-III project. Additional technical, administrative and support staff would be needed within the department for the operation and maintenance of the new systems. With the development activities of construction of the project elements, indirect employment would be generated through private consultants and contractors. (details are enclosed as Appendix-8)

iv) Environmental impact

There is no adverse environmental impact expected to occur resulting from this project.

On the other hand, the project would improve the overall environmental conditions of the city especially improving the metropolitan beaches which, at present, are converting into cess pools. Additionally, the local industries would also benefit from this environmental improvement by complying WTO, EPA, ISO, EU and USA standards.

Adverse environmental situation is clearly depicted by the sample photographs (see Appendix-9) taken of the Lyari and Malir rivers and their tributaries which are presently been used to dump mostly the untreated sewage and industrial effluent.

v) Impact of delays on project cost and viability

As is true for all projects, delays would cause the estimated price to increase. With the current rate of escalation surmounting day by day, it is most feasible to complete the planning, designing and construction of this much needed project as soon as possible to contain the development cost.

12. Implementation of the project

S-III project implementation schedule is planned for 4 years. Cost distribution year wise is provided in Table 12-1.

13. Management structure and manpower requirements

The client [KW&SB] will supervise the project. Specialized skills shall be provided through foreign / local consultant (JV) and local / international contractors.

14. Additional projects / decisions required

Immediate action is required to improve the quality of life of the largest metropolis of Pakistan and safeguard its beaches and marine eco-system.

15. Certificate

It is certified that the project proposal has been prepared on the basis of instructions provided by the Planning Commission for the preparation of PC-I for Social sector projects.