

ENVIRONMENTAL IMPACT OF INDUSTRIAL EFFLUENT AND CONTRIBUTIONS OF MANAGING BODIES IN CONTEXT OF KARACHI

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Abstract—Industrial waste has been recognized as the major contamination of water resources and thus the environment. Advancement in the technology has immensely amplified the problem of industrial waste management. The environmental degradation resulting from uncontrolled release of untreated waste water along with other disposals has become a major problem in Pakistan. Tanneries, textile, petroleum, chemicals and heavy metals are some of the major polluting industries. The water contamination is the most hazardous in all types of pollution due to its direct impact on irrigation, land and marine life. In case of Karachi, seven major industrial zones have enveloped the city; They possess approximately 8000 large and small scale industrial units, which discharge large amount of their un-treated industrial effluent in to sewer drains, Malir and Lyari River to Arabian Sea. Only a small portion of this is being treated by some treatment plants below their capacity.

The paper will discuss the relation between the industrial policies, Industrial pollution and its environmental impact, the contribution of local managing bodies in developing the standards of management of industrial effluent. Recommendations for policy measures to reduced environmental impacts and the possibilities of Waste water Treatment as an Industry is addressed in this paper.

Keywords: *Industrial effluent, contamination, water pollution, environment.*

I. INTRODUCTION

Water is the primary source of life and essential for human existence, according to statistical data given by (UN, UNESCO) globally, Cultivation accounts to 70% for all water consumption, contrasted with those industries which consumes 20% while only 11% is consumed for domestic use. However, areas for higher number are claiming from commercial enterprises use and more than half of the consumable water accessible to mankind's use. In Belgium, for example, use 80% of the water accessible to production.

The human utilization of water expanded thrice over the period of last fifty years. Requirement for freshwater will be expand by 64 billion cubic meters (1 cubic meter = 1,000 liters). The world's number is rising by approximately 80 million individuals every year. Recently the manufacturing of biofuel has been improved with major impact on water demand. A single litre of biofuel is required from 1000 to 4000 litres of water. The necessity of energy is also escalating due to greater water utilization and because of that approx 80% of diseases effects on population of countries, which is causing 3million untimely death. For instance, every 17 seconds 5,000 children die consistently from diarrhea.

The critical situation of water consumption has raised the Issue of recycling. The second largest consumer are the industries, as the process of recycling is an expensive one small scale agricultural lands cannot be expected to do so on their own the responsibility thus lies on the income generating industries.

In case of Pakistan enormous quantity of atmosphere emission, water and rock-hard waste is being generated per day; due to this fact serious air, water and land pollution is taking place along with higher rate of disease in common people. The main reason of this lack of financial support and awareness in general. The short speed of environmentally manufacture processes a major danger to the public and money-making expansion of the country.(Waste Treatment and Disposal" by Paul T. Williams, John Wiley and Sons)

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Major environmental issues occurring due to the large number of the local industries of Pakistan due to the lack of proper management system. Therefore, environmental poverty due to the uninhibited and wasteful use of natural income, extreme production of risky waste and the uncontrolled discharge of solid wastes, sky pollutants, and wastewater into the natural environment has become uncontrolled and unattended in Pakistan. Tanneries, textile, petroleum, pesticides, fertilizer these are major polluting industries. (Waste Treatment and Disposal” by Paul T. Williams, John Wiley and Sons)

Karachi is the largest city of Pakistan although it is also the modern commercial and business center. At this moment through 8000 huge and more little enlisted mechanical units are working in Karachi. These manufacturing units are located in different areas of the city, the major industry covering areas are Sindh Industrial Trading Estate (SITE), Landhi, Korangi, Federal.B. industrial Area and the Port Qasim industrial area (PQA), etc (Amjad 2010) further 65 sorts from processing plants in the distinguished estates would operate in the city, for instant, such that fabric industries, tanneries, plastic and rubber industries, steel foundries, metallurgical industries, electroplating and metal covering industries, glass, tiles industries, bond industry, cleanser or detergents, energy plants, fertilizers, pesticides eatable oils, car cable, nourishment preparing units, also conductor manufacturing and so on. These commercial enterprises does not built recycle plants for the tremendous amounts of waste material production [1].

Due to the haphazard land based industrial activities and lack of monitoring the manufacturing process and procedures to operate, the vicinity (land and water sources) are under extreme degradation. The industrial discharge and waste water flows through Malir and Lyari River causing the serious environmental impacts towards the coastal belt of Karachi resulted in sedimentation of heavy metals ruining the aquatic life and disturbing the biodiversity.

Industrialization definitely needs a paramount component for the advancement of a country's economy. However it is necessary to realize the collection of manufacturing waste in order to have clearness for ways to lessen or eradicate the pollutants from this industrial waste. It may be obliged on see those effects for industrial waste of the nature's domain (freshwater, seawater, land) in place to outline profoundly effective medicine Furthermore Creating successful medicinal routines [1].

Policy makers, managing bodies and industrialists should closely work with each other in making policies, its implementation and monitoring the procedures and processes afterwards in order to minimize the negative impacts of industrial activities [1].

a. Scope Of Study

The scope of the study is limited to examine those environmental effects from claiming modern industrial growth and essentially the task of representative bodies dealing with figures in this respect to assess those viability also usage of environmental protection strategies on minimizing the environmental impacts of manufacturing ventures.

b. Objective

The main idea of the paper is to analyze the environmental impacts of industrial effluent on water sources of Karachi and contribution of local managing bodies in the management of industrial effluent.

c. Sub Objectives

- To ascertain the environmental impacts of industrial effluent on hydrosphere, biosphere and lithosphere.
- To find out the basic monitoring system to contribute in implementation of “Environmental Protection Policies” for reducing the environmental impacts of industrial effluent.
- To explore the possibilities of waste water treatment as an industry.
- To establish the suitable suggestions to reducing the environmental impacts of industrial effluent in context of Karachi.

d. Research Methodology

On meet those targets of the consider information might have been gathered from primary also secondary sources. Primary information was gathered through personal perceptions and unstructured interviews of different respondents including chief engineers and managing directors of managing and representatives of different associations such as;

- a. F.B.A.T.I Federal. B. Area Association Of Trade & Industry, Karachi;
- b. S.I.T.E. Superhighway Association of Industries, Karachi;
- c. Korangi Association of Trade and Industry (KATI);

d. Landhi Association of Trade & Industry (LATI).

However the secondary data was obtained from published research papers, journals, internet and report surveys were used to extract the required information. Data is also recorded through general observation due to author itself resident of Karachi past 30 years.

The interviews conducted were aimed to develop an understanding of the role of managing bodies and their contribution towards the management and disposal of harmful industrial effluents. For this purpose of attaining a firsthand opinion of association representatives, an unstructured interview was carried out by telephonic and in-person conversations. Open ended questions were particularly used, to encourage the participants to share their experiences. This method was very effective in gathering information and relevant information that aided the study further.

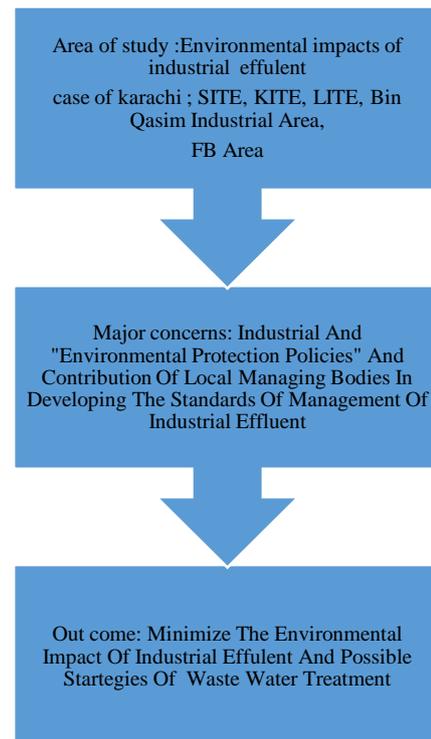
Satellite maps were used to mark the location of major industrial zones of Karachi namely Federal. B. Area, Site area, Landhi, Korangi and Port Bin Qasim industrial area, also the types of industries and the number of industrial units that are working in these areas were highlighted along with their concerned managing bodies.

The locations of existing sewerage and water treatment plants are also shown through maps. The main objective of this mapping is to identify the connections between the industrial town and the sewerage treatment plants to Layri River and the Malir river result in it is a hazardous environmental entity.

The study is limited to the documentation of these five major industrial zones of Karachi industrial hub and mainly the information is recorded using maps, commonly types of enterprises and numbers of industrial units in operational condition and the actual condition of water treatment plants.

The possible suggestion and recommendations are included as a part of the research proposal. These suggestions comprehend on the challenging situation of monitoring and implementations of protection guidelines in minimizing critical ecological impacts from industrial effluent.

e. Conceptual Frame Work



II. LITERATURE REVIEW

Punjab Environmental Act, 1997 has defined environment as biosphere, lithosphere and hydrosphere including physical infrastructure that includes building structures, road networks etc. Living organisms, eco system and ecological relations included.

Adeodun Similade Adeolu has defined effluent as a liquid waste discharged from industries, factories, sewage, nuclear plants etc.

The effluent from industries has direct impact on environment as it contains lethal and toxic pollutants that include dyes, heavy metals, Phenols, pharmaceuticals etc. The effluent based pollution is further divided into two sub categories 1. Point Source pollution that is limited to the effluents/ waste water discharged from the factories, industries, refineries etc. that can be treated at the point of generation and Non-Point source pollution that not only contains the waste water from industries but it also includes sewage waste, seepage from septic tanks, run off from agricultural fields etc.; these cannot be quite identified. Prevention of such effluent is quite challenging and demanding. As these effluent not only contaminates the hydrosphere by deposition in the base but it also have its impact on lithosphere, atmosphere/ Biosphere and impact on the eco system through food web[2].

Industrial waste include both organic (Pesticides, solvent and cleaning fluids etc.) and inorganic waste (heavy metals, phenols etc.) that may deprive the water sources in oxygen, alter the water temperature to higher side and heavy metal deposition in water sources such as cd, Mg, Pb, Zn, Hg etc. can deteriorate the aquatic and marine life, and through food web and in direct contact can lead to the serious health issues in human such as cancer, genetic defects and can affect the reproductive system. The toxics and heavy metals also disturb flora and fauna on land and under water. When slush form effluent came in contact with the land or with agricultural land the heavy metals are absorbed by the roots of the plants that may lead to the demise of that species or disturb the food web. UN treated discharged effluent also gives off foul smell due to the presence of BOD, disturbing the biosphere [3].

Karachi is one of the largest industrial hub of the country. There are more than 8000 industries running in 9 industrial estates that are enveloping the city; each industrial estate managed separately by their own organizing body (private body bridging the gap between industrialists and government). These 8000 (app) industries are subdivided into 65 categories of industrial plants that embrace, textile, leather tanneries, pharmaceuticals, plastic, glass, paper soap detergents production, fertilizer and pesticides, glass, chemical industries, material manufacturing industries etc [1]. Karachi generates approximately 362million gallons per day sewage of which 60% is constituted of industrial waste and 40% is domestic waste that is released directly into Malir and Lyari River without passing through any treatment plant which is further disposed-off into coastal belt of Karachi, Gizri, Korangi and Gharo creek. [1]. The presence of heavy metals such as Zn, Cd, Mg, Pb, Hg is 36% higher than the normal values when samples of water were tested from Malir river along korangi industrial area[4]. The un-treated industrial effluent when discharged in coastal belt of Karachi through Malir and Lyari River resulted in the contamination of superficial sediment during a study in 2010; four elements cd, Zn, Pb, Hg were found in the water sample taken from Karachi fish harbor and estuary along Karachi urban coast along with the rise in temperature of water[5].The effluent and waste water possessing heavy metal contamination has endangered marine life in Karachi resulted in severe financial failure for coastal fishermen. At the same time use of domestic waste and industrial effluent and the presence of unplanned settlement in proximity of Malir and Lyari river all add up to severe health perils. Also the biosphere is polluted due to gaseous emission form industries have increased

risk for other ailments related to respiration and cancer [5].

Environmental Policies and regulations directly address the generated environmental issues at their source point as compared to industrial policies. Pakistan had its first law in 1983 as Environmental Protection Ordinance, that didn't have a clear outline to operate till 1997 when a new act was approved by the parliament known as Pakistan Environmental Protection Act (1997). This law covers land use, noise, water and air quality also dangerous substances, solid waste and effluents, aquatic & fisheries, woodland conservation, mineral development, energy, state funded health, and so forth. This law didn't act to be efficient due to mild penalties for violation and easy to evade [5][6].

As per PEPA (Pakistan Environmental Act, 1997); any project initiated must prepare Initial Environmental Examinations (IEEs) and Environmental Impact Assessments (EIAs) before the proposal approves. On the other hand EIAs have been carried out in a chaotic manner where the developer decides the scope of EIA or if it's needed for the project [7][8].

Government Agencies should directly associate with those commercial enterprises and influenced neighborhood government units must work more nearly with each other and with the local establishment to deal with this rising problem. To lessen the impacts of industrial effluent on the environment, action is immediately required in many particular zones. In place on taking benefits the effectiveness of those on the other hand, they must be facilitated within national environmental protection vision also arrangement for those accomplishment about cleaner manufacture [9].

The key points of a comprehensive national program should include:

1. Enhance the condition of environmental hazards for all sectors of civilization and Also work out the ecological and physical condition of industrial development.
2. A scheme of principles which is more susceptible to real ambient conditions and different cost structures;
3. Improve the labor and monitoring equipment capabilities.
4. Provide regular comprehensive programme of economical, environmental instruments.
5. Assimilation of environmental concerns in financial and spatial planning.

6. Emphases on local building enforcement capacities which full fill the needs of citizen Involvement.
7. According a coherent programmeimproving the existing ecological infrastructure and creating the next ones in suitable locations with enhanced integrated ecological infrastructure.
8. Advertising of business tasks.
9. Organize the centers of environmental management.

a. Conclusion

Industrial effluents do not only contaminate the hydrosphere due to the presence of organic and inorganic wastes but they also put immense effect when I come in contact with soil and afterwards vegetation but also the biosphere. Causing damage to the bio diversity. In case of Karachi we have non-point source generated waste (effluent). Industrial effluents and domestic waste water both are flowing together from sewers drain to Malir and Lyari River and then further disposed-off to sea water. It is having an adverse effect on the environment as heavy metals contamination such as Cr, Zn, Hg etc. has sediment in sea water causing damage to the marine life (that includes aquatic plants, mangroves, fishes and other habitat. This water is also being used for irrigation purpose in Korangi Area which later comes in contact with humans while consuming those products that is creating health issues such as renal problems, reproductive problems, cancer etc. Although environmental Acts and Policies are available in Pakistan but without any monitoring systems and procedures that may counter check the situation.

III. DATA COLLECTION

a. Major Industrial Zones In Karachi

Karachi is the biggest port in the nation . Furthermore the real trade and manufacturing focal point of the country. It is dividing into nine major industrial zone such as Bin Qasim Zone, Federal B Area, Export Processing Zone Korangi, Creek Industrial Park, Pakistan textile city, S.I.T.E, Korangi, North Karachi, and West Wharf industrial Area.(as shown in the map)

Case: korangi industrial area:

As per K.A.T.I; the representative body 4500 industries are fully operative and functional in Korangi industrial Area. The responsibility of K.A.T.I is to enhance trade and industrial activities

however as S.I.T.E office it did not take any responsibility for industrial waste treatment and put the industries solely responsible for self-monitoring and maintaining the environmental standards. Although it's the largest industrial zone in Karachi.

Korangi Effluent Treatment Plant:

However a combined treatment Plant has been installed with a cost of Rs.492 million that is responsible for treating effluent discharged by 150 tanneries. Installation of plant is a combined effort of Trade Development Authority of Pakistan (TDAP), Ministry of Commerce, Govt. of Pakistan, PTA (Pakistan Tanneries Association, Southern Zone), Govt. of Netherlands, Govt. of Sindh and City District Government, Karachi.

Capacity: This treatment plant has a capacity to 26k cm/ day of household wastewater, 42,k cm / day of desecrate water and 16500 cm/ day tannery waste water .

Technology: Its first of its kind installed in Pakistan with environmental management system based on Dutch technology named as Up-Flow Anaerobic Sludge Blanket (UASB) technology having the near to the ground procedure and repairing cost.

Covered Area: This treatment plant is spread over 15 acres of land. "According to Sewerage Board PumpingStation-II (PS-II) over 12 kms bring household water waste to the main CETP in addition to bring the tannery sewage from Karachi Wastewater. Through 3.2 kms pressure pipeline and installation of pumps and other facilities within the premises of PS-II. The domestic sewage plays a major role for treatment of waste matter"

This treatment plant is installed to meet the national Environmental Quality Standards (NEQS) so that the trade can be boost up as Leather is 2nd largest export commodity of Pakistan and it's the requirement of international buyers to meet the environmental standards. It is also benefiting the tanneries as well the aquatic environment. But out of 4500 industries; 150 industries is a smaller chunk still a lot of initiatives needs to be taken.

a. Case : Site Industrial Area, Karachi

The site Industrial area is amongst the largest industrial areas of Pakistan, accommodating around 2,500 industrial units situated on west of the Lyari River and close to the coastal belt. The impacts of production activities directly fall on the marine life and degradation of the ecosystem is resulted. According to the UNIDO report 70 percent of industrial effluent reaches to sea environment without any proper handling system.

b. Institutional Planning

The semi-government industry S. I.T.E. Limited(S.I.T.E. Ltd.) are responsible for establishment of roads ,plot allotment and leasing including S.I.T.E. areas, water supply and other industrial requirements.

c. Role of managing and representing associations in the management of Site Industrial zone

S.I.T.E Organization is a commercial sector which representing the benefits of industries in the S.I.T.E industrial area. These organizations build up a general approach to resolve the problems and to establish a policies for public action by representing to the apprehensive authorities, such as S.I.T.E. Ltd and the Provincial and central Governments. The members of this organization play a vital role other main committees, task forces, executive committees and boards of infrastructure providers.

Regretfully, the managing and representative associations are only working to facilitate the trade and economical benefits to the industries. They should also simultaneously contribute their sincere efforts in the checking of "self monitoring system" of industries and for proper handling of industrial waste water discharge. This managing association must also be responsible for the implementation of environmental protection policies for reducing the unregulated and hazardous environmental impacts of industrial effluent.

IV. LAND USE PLAN AND DRAINAGE SYSTEM OF S.I.T.E AREA

Land use planning in S.I.T.E. is majorly industrial zones, although there is a large amount of commercial and residential land use. There is no proper segregation of land use in site area in both the planned and unplanned labor colonies, as well as the many Katchi Abadies within the boundaries of S.I.T.E.

The drainage system of S.I.T.E is dependent upon the nallahs (natural storm water channels) that are then disposed in to the Lyari River and from there reaches out into the Manora Channel of the Arabian Sea without any treatment before being released. It is mixed with domestic sewerage without any segregation of domestic sewerage, solid waste and industrial effluent. Irrespective of their compositional and treatment differences, they use the same channel of disposal and therefore only a small quantity of discharge water flow (that from the nallah running parallel to Estate Avenue) is directed towards Treatment Plant 1 (TP1). This is located on the banks of the Lyari River. This treatment plant is not sufficient enough for domestic waste but also bears the load to treat

industrial discharge. There is pressing need to separately locate the treatment plants for industrial zones for minimizing the environmental impacts of industrial effluent on marine environment and protection of coastal belt of Karachi.

V. CONCLUSION

There are approximately 15000 industries fully operative and functional in Karachi. Other than this so many small scale industries are working in industrial zones. Land uses have been changed on its own as in case of F. B Area. Proper documentation is required regarding the number of industries, their procedures and manufacturing process and their nature of work. So that available infrastructure is not burdened with the added load.

The scope of combined treatment plant should be taken into account as in case of treatment plant in Korangi industrial area. As it covers a large piece of land and its initial cost is higher.

Laws and procedures related to environmental policies should be made in local context so that it could be efficiently implemented and monitored.

Representative bodies should be allowed to work as managing bodies and should bridge the gap in between industrialists and Government.

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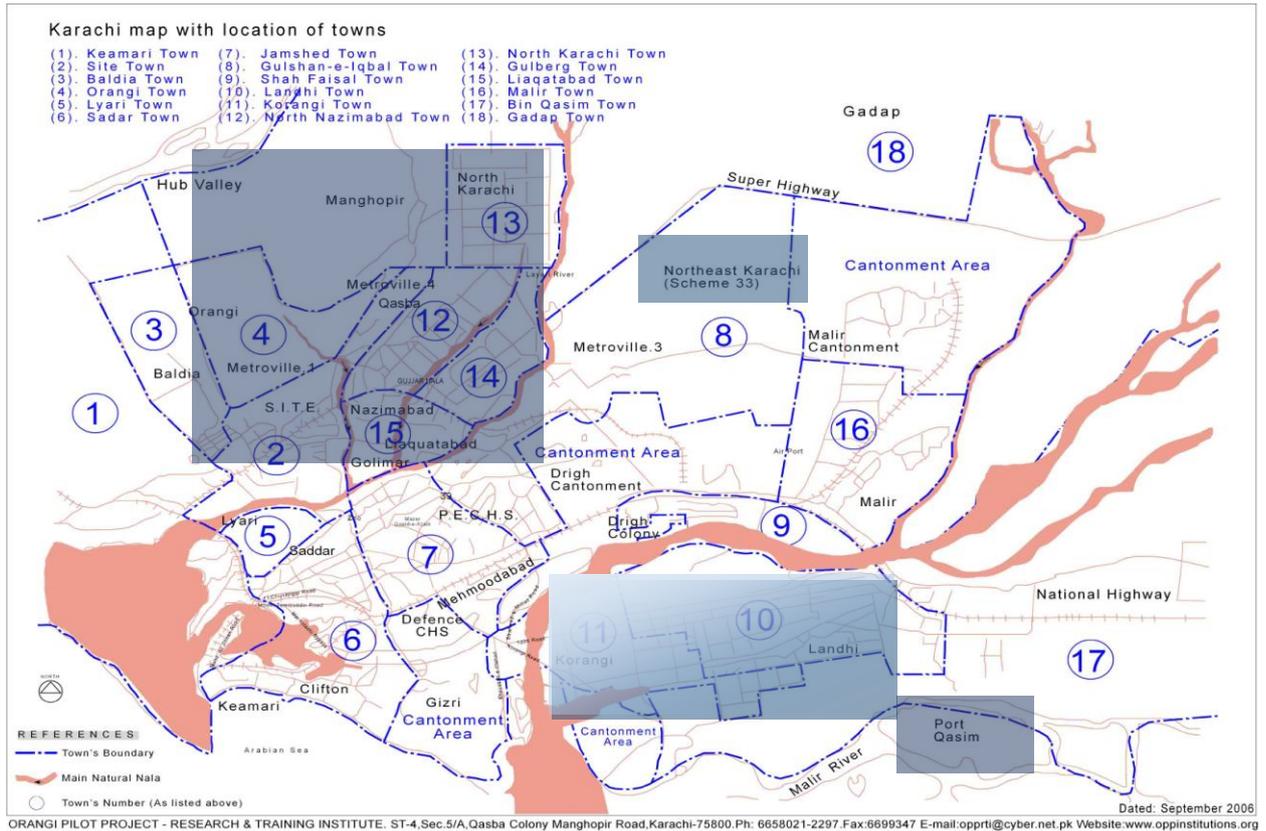


Figure.1: Karachi map with location of major industrial towns

a. Bin Qasim Industrial Zone

Location of town	Bin Qasim town
Location of industrial zone	Port Qasim
Area of land	More than 17,000 acres of land
Types of Industries	Fertilizers, Chemicals, Edible Oil Refineries, Industrial Gases, Pharmaceuticals, Automobiles, Leather, Food Processing, Warehousing Etc
Managing and representative Association	Bin Qasim Association of Trade and Industry, BQATI) is a managing body of Bin Qasim streamlined area.
Treatment plant	There is no single combined treatment plant for managing of industrial waste water.

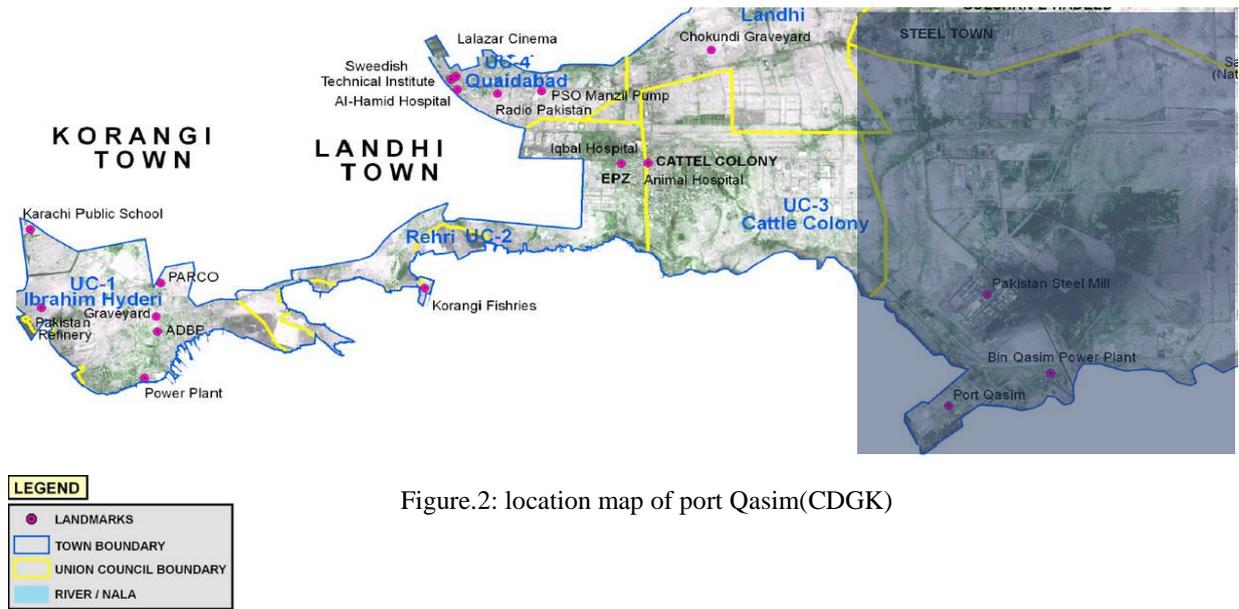


Figure.2: location map of port Qasim(CDGK)

2. FEDERAL B INDUSTRIAL AREA:

Location of town	Gulberg town
Location of industrial zone	Blocks (1 to 22) of F.B.Area is depend on the different industrial activities but 21 and 22 are the affirmed manufacturing areas.
Area of land	14.18 sq.km(block 1-22) and block 21 & 22(3.92 sq.km area)
Types of industries	Paper, leather tanneries, chemical, food processing, and more are fully exported enterprises.
Managing and representative association	F.B.A.T.I Federal B.Area Association of Trade & Industry, Karachi.
Industrial units	Around 2,000 industrial unit registered, small and cottage industries in block 1 to 20 and also mixed with residential and commercial areas
Treatment plant	No

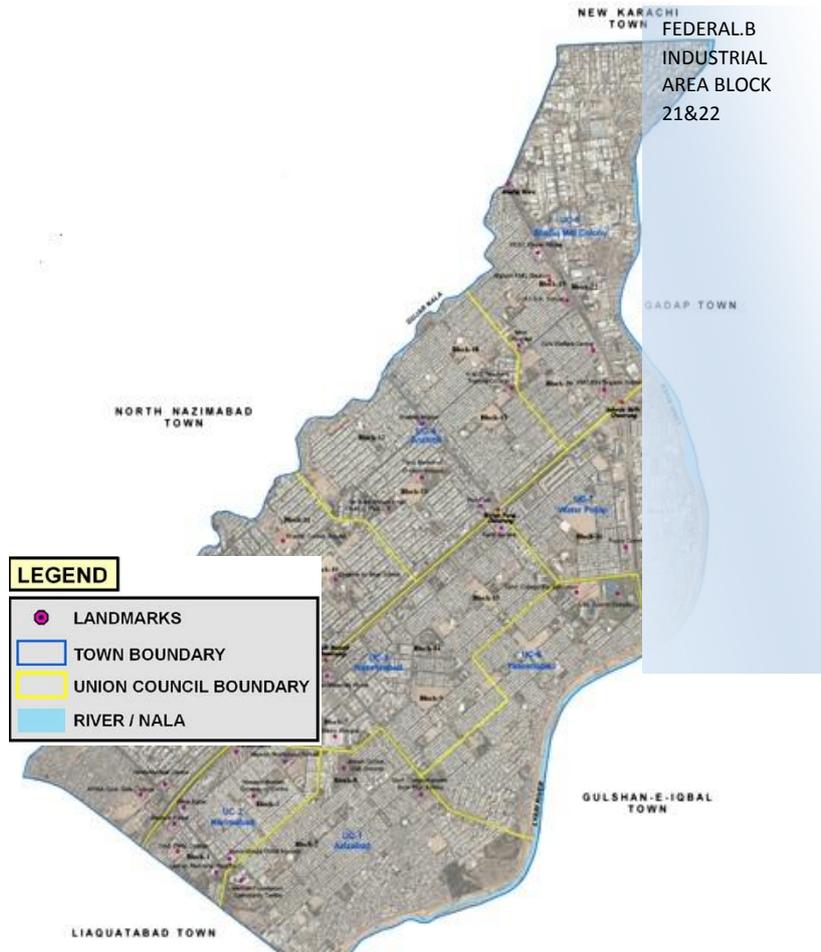


Figure.3:F.B Area Industrial Zones(block 1 -22)CDGK

VI. SITE INDUSTRIAL AREA KARACHI

Location Of Town	S.I.T.E TOWN
Location of industrial zone	Mango Pir Road Karachi District West
Area of land	25.26 sq. km
Types of industries	Engineering, Textiles, huge mechanical, material production(steel, glass, tile), paints, foodstuff and beverages, automobiles, garments etc
Managing and representative association	1) <i>S.I.T.E Sindh Industrial Trading Estate</i>
Industrial units	25,00
Treatment plant	5 Effluent treatment plants have been approved on paper by P & D (Technical committee but still needs approval from PGWD

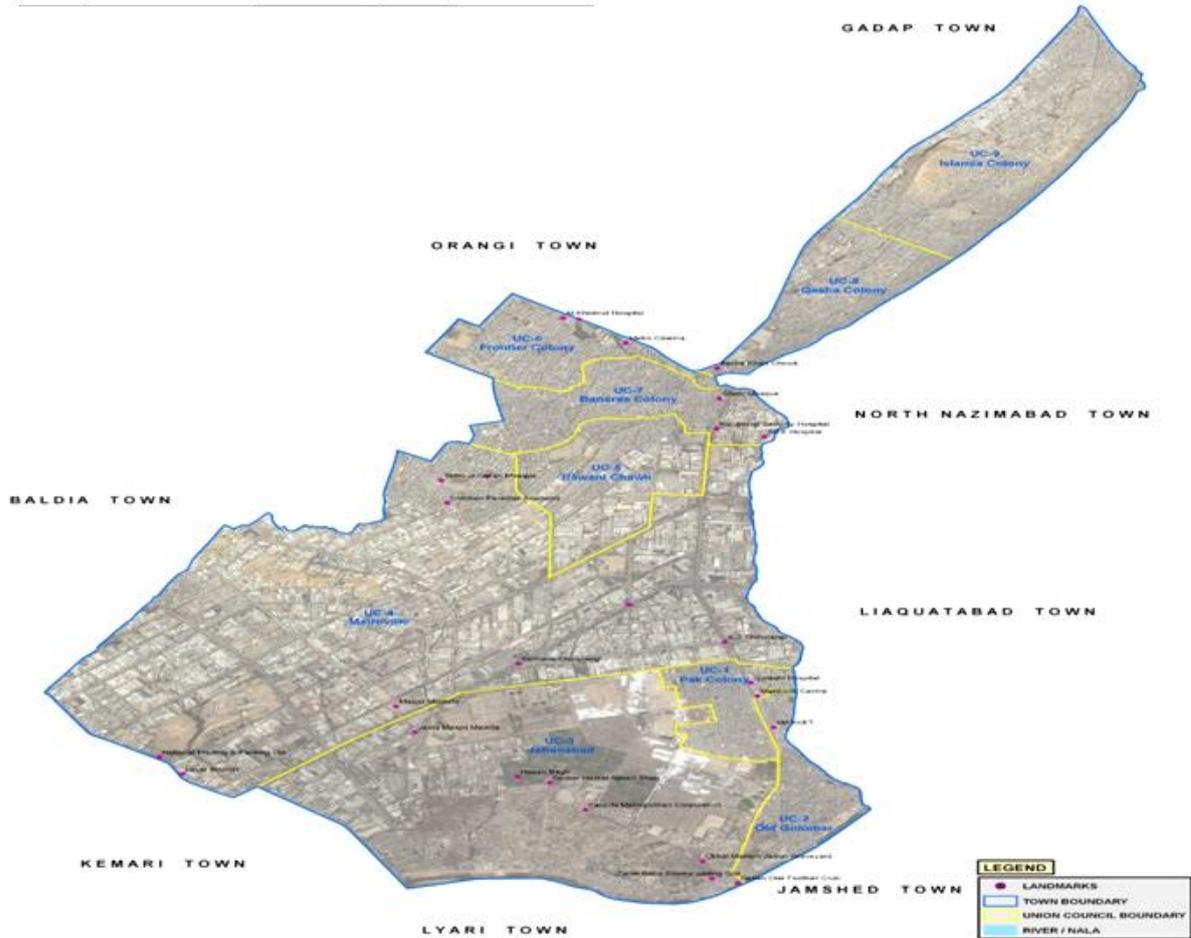


Figure.4: Site Area (CDGK)

VII. KORANGI INDUSTRIAL AREA (KIA)

Location of town	Korangi Town
Location of industrial area	The korangi commercial area is located at southeast of Karachi.
Area of land	28.59 sq.km
Types of industries	Cotton Yarn, , Hosiery, Leather products, Textile & Garments, Jute Thread, Cosmetics, chemicals manufactures, Sanitary and plumbing items, paints and LPG Plants and so on.
Industrial units	Approx 4,500
Managing and representative associations	Korangi Association of Trade and Industry (KATI)
Treatment plants	One treatment plant is working in the Korangi industrial area which is serving only leather tanneries industries estate. (combined effort of Pakistan tanneries Association)



Figure.5: Korangi industrial Area (CDGK)

LANDHI INDUSTRIAL AREA

Location of town	Landhi town
Location of industrial zone	Adjacent to the Shah Faisal town
Area of town	40.54 sq km
Types of industries	Garments, Electrical/electronics, meticulousness Machining, Light Chemicals, Leather, Food dispensation, Warehousing
Managing and representative association	Landhi Association Of Trade & Industry (LATI)
Industrial units	Approx 2,000
Treatment plant	No



Figure.6: Landhi Town (CDGK)

I. POLICIES &

RECOMMENDATION

S.No	limitations	Recommendations
1	Documentation of existing industrial units along with registration for new industrial units	GIS based Land use plan should be prepared for documenting the existing industrial sectors and mark the feasible sites for new industries and their category. The potential of industrial zones in emitting water based pollution.
2	Implementation of Environmental protection Policy Pakistan	Government should pass rules for the implementation of Environmental Policies and make the local bodies responsible for its implementation.
3	Monitoring of procedures and operations followed in discharging the industrial effluent	The representative bodies should act as regulatory bodies of the concerned industrial zone and should be monitoring the treatment of industrial effluent before being discharged to open water sources.
4	Clear Manufacturing Programme	To make the manufacturing process environmental friendly Clear Manufacturing Program should be initiated and followed to cut down the requirement of resources (water)
5	Combined Treatment Plant	Example of combined treatment plant can be followed. Example of combined effluent treatment plant operating in Korangi Industrial Area for Tanneries could be seen. Further tests would be required to deal with the types of pollutants present in each industrial zone.
6	Awareness of Environmental Problems	Awareness related activities should be promoted.
7	Lack of trained human resource	Each industry should have their internal environmentalists that could bridge the gap in between the regulatory bodies and industries