

# **Cyclone Contingency Plan for Karachi City 2008**



**National Disaster Management Authority  
Government of Pakistan**

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**Acronyms**

CDGK	City District Government Karachi
CAA	Civil Aviation Authority
COMKAR	Commander Karachi
DDMA	District Disaster Management Authority
DG	Director General
DHA	Defence Housing Society
DO	District Officer
DCO	District Coordination Officer
EPI	Expanded Program on Immunization
EDO	Executive District Officer
GOP	Government of Pakistan
HQ	Head Quarters
INGO	International Non Governmental Organization
JPMC	Jinnah Postgraduate Medical College
KM/H	Kilo Meters Per Hour
KDA	Karachi Development Authority
KESC	Karachi Electric Supply Company
KSEW	Karachi Shipyard & Engineering Works
KSWB	Karachi Sewerage & Water Board
KBCA	Karachi Building Control Authority
KPT	Karachi Port Trust
LRBT	Layton Rahmatulla Benevolent Trust Eye Hospital
MSA	Maritime Security Agency
MW	Mega Watt
MM	Milli Metre
MOH	Ministry of Health
NGO	Non Governmental Organization
NIH	National Institute of Health
OBM	Out Board Motor
PDMA	Provincial Disaster Management Authority
PMD	Pakistan Meteorological Department
PHC	Primary Health Care
PTCL	Pakistan Telecommunication Authority
PN	Pakistan Navy
PAF	Pakistan Air Force
SAR	Search and Rescue
SITE	Sindh Industrial & Trading Unit
SOP	Standard Operating Procedures
SSGC	Sui Southern Gas Company
TMA	Tehsil Municipal Administration
US	United States
UN	United Nations
UC	Union Council
VHF	Very High Frequency
WAPDA	Water & Power Development Authority
WMO	World Meteorological Organization

## EXECUTIVE SUMMARY

1. In the aftermath of Earthquake of 2005, Government of Pakistan through an ordinance constituted a comprehensive disaster management system to deal with the whole spectrum of disaster risk reduction (Management). Accordingly National Disaster Management Commission (NDMC) was established under the chairmanship of the Prime Minister with the mandate of policy formulation at National level. National Disaster Management Authority (NDMA) was created to act as the implementing and coordinating body of the NDMC. In light of NDMA's National Disaster Risk Management Frame work, NDMA has initiated preparation of contingency plans in different sub sectors of disaster risk reduction/ management.
2. Keeping in view the economic importance of Karachi city being the nerve centre of National Economy and gateway of Pakistan vis-à-vis imports and exports of the country, it became imperative to prepare a disaster management plan for Karachi, with focus on tropical cyclone. So NDMA as a first step, has prepared a cyclone contingency plan for Karachi.
3. The contingency planning exercise aims at sensitizing Karachi City stakeholders on the grave threat posed by a cyclone and its possible humanitarian consequences. This exercise relies on primary sources in developing scenarios, recorded history of cyclone occurrence in Pakistan and in gauging the state of preparedness of key stakeholders in Karachi to a possible cyclone impact.
4. With population of over 15 million spread over 18 towns covering nearly 3530 square kilometres, Karachi is built to generally poor urban development standards which makes it very vulnerable to natural and man made disasters. Even moderate to high rains tend to bring parts of the City to a standstill with excessive flooding of low lying areas and consequent disruption/ damage to the communication infrastructure. Though Karachi has not experienced cyclone impact as yet, but cyclones have gone close to it like Yemyin causing much losses in the form of human toll and fallen infrastructure in 2007. Cyclones have also recorded land falls in the adjoining districts of Thatta and Badin. Karachi is vulnerable to a major earthquake as numerous fault lines traverse close to the city. A destructive tsunami wave generated by a 7.8 Richter Scale earthquake played much havoc off the Balochistan coast west of Karachi in 1945.
5. With regard to the rain emergencies, City District Government Karachi (CDGK), its constituent towns and independent corporations and public sector entities like Pakistan Steel Mills, Port and Airport Authorities, armed forces and Maritime Security Agency have plans for response, though integrating diverse stakeholders' response remains a challenge. However, no plans exist for responding to a possible cyclone landing.
6. In the absence of historical records of cyclone occurrence in Karachi, Pakistan Meteorological Department has framed two scenarios. Scenario 1 depicts a Cyclone Category III or above landfall in Karachi City. Its key impacts are: (1) a storm surge wave of 12-15 feet or above which is likely to traverse 5 kilometers in to the City, (2) strong winds up to 116-222 kmh, and (3) heavy rainfall approximating 200 -225

mm. The significant risks that it poses are that significant population segments are likely to be marooned / isolated. High winds are likely to cause widespread damage and take a heavy human toll. Blockage of storm water drains is likely to accentuate the post cyclone flood impact and relief operations are likely to be seriously undermined due to flooding of essential communication infrastructure. Break down of essential services like electricity and water will accentuate the humanitarian impact of the disaster. Most significantly, relative lack of preparation of Karachi City for cyclone response i.e absence of shelters, evacuation plans and poor state of emergency response services makes the City increasingly vulnerable. The impact of Scenario 2, the milder version, approximates heavy rains in Karachi City.

7. Extrapolating impact of Scenario 1 on Karachi City with the help of its key stakeholders, CDGK in particular, about 670,700 population will require relief support, 4,667,900 are likely to be affected, and 1,825,800 will have to be evacuated from five worst affected towns of Korangi, Saddar, Kemari, Lyari and Defence Housing Authority.

8. More emphasis must be given to prepare the City for such an eventuality by putting in place relatively long term preparatory measures. These include cyclone impact hazard mapping, preparing cyclone shelters, improving coastal cyclone protection works, dredging of storm water drains / channels, defining articulation of control and resource mapping for response, registration of fishermen boats and isolated coastal localities for communication of early warning, community awareness and mobilization for response and creating a vulnerable population evacuation plan.

9. To conclude, while this contingency planning exercise should be perceived as a first step in addressing response to a possible cyclone landing in Karachi city; however, a deliberate exercise should follow which should benefit from computer based cyclone risk mapping/modelling and which also draws from wider inputs from key Karachi City stakeholders.

**General**

1. Karachi is a disaster prone city. Global warming related hydro- meteorological hazards tend to occur with increasing frequency in the shape of sustained rains. Cyclones have made landfall in the adjoining districts of Thatta and Badin. Karachi is also located dangerously close to numerous fault-lines that can trigger a devastating earthquake, though it has experienced milder versions. The City has also grown phenomenally in size over the past decades but the development has occurred to very poor standards. Flood water drainage system tends to get choked even in moderate rains bringing parts of the City to a standstill. High rise buildings have proliferated with scant regards to relevant safety codes.

2. Given the scale of man made and natural hazards that occur in Karachi, emergency response services of the City are not suited for localized employment due to limited capacities. They are manned by largely ill trained human resource and they are not served by mechanisms that facilitate integrated response. We must also bear in mind that City District Government of Karachi (CDGK) does not administer significant segments of the City like cantonment areas and Defence Housing Authority (DHA). The shared governance arrangements tend to retard enforcement of common standards both in urban development and in responding to disasters.

3. With reference to the ongoing monsoon season, this is meant to be a quick contingency planning exercise for Karachi City with regards to tropical cyclone hazard in which possible impact of a cyclone on the city would be examined. Historical records do not substantiate occurrence of such a scenario, though in 2007 cyclones Gonu and Yemyin went past south of the City to impact coast of Oman and Balochistan, respectively. Strong wind and rains generated by Cyclone Yemyin caused about 150 deaths in the City mainly due to felling of bill boards, electrocution and collapse of flimsily developed infrastructure. It may also be noted that in all probability cyclone impact would spread much beyond Karachi to impact the adjoining districts of Thatta and Badin and Hyderabad City or even beyond. However, this study is restricted to its impact on Karachi City.

4. Given the time restraints this is a summarized contingency planning exercise based on inputs received from PMD and key stakeholders of Karachi City. It will be followed by a deliberate exercise that would benefit from computer modeling and elaborate inputs from key stakeholders.

**Aim**

5. Undertake contingency planning based on the scenario depicting tropical cyclone hazard impacting Karachi City, define associated risks, planning assumptions, and preparatory cum response measures.

**Scope**

6. Scope of Cyclone Contingency Plan for Karachi City 2008, is as follows:-

- a. Briefly study the phenomenon of tropical cyclone occurrence with historical examples with a view to draw pertinent conclusions.

- b. Introduce Karachi City, its administrative structures and role of its stakeholders in disaster response.
  - c. Identify cyclone impact scenarios for Karachi City, summaries risks and planning assumptions.
  - d. Proposed preparatory and response measures.
7. This exercise relies on primary sources in developing scenarios, recording history of cyclone occurrence in Pakistan and in gauging the state of preparedness of key stakeholders in Karachi to a possible cyclone impact on the City. Secondary sources have been accessed in studying historical examples and in developing general information on tropical cyclone occurrence.

### **Tropical Cyclones<sup>1</sup>**

8. Tropical cyclone is a generic term used for defining cyclonic activity originating over tropical or sub-tropical waters with a definite cyclonic surface wind circulation. Such storms generally occur in South West and East Indian Ocean and also in the South Pacific. Tropical cyclones tend to occur in May – June or October – December periods. Such storms generate three types of consequent impact that cause much destruction in their wake:-

- a. **Storm Surge Wave**. It normally occurs from shoreward movement of water under the action of wind stress. Another contributing factor could be rise of water owing to low barometer pressure that is caused due to the metrological depression that precedes a cyclone. Depending on the strength of the storm and coastal topography storm surge may penetrate up to 20 kilometres inland.
  - b. **Strong Winds**. These precede, accompany and follow a cyclone in its wake.
  - c. **Torrential Rains**. Tend to impact a much adjoining regions.
9. **Cyclone Storm Categories**
- a. **Category 1.** Depression/ Deep Depression with wind speeds between 17-33 knots (31 – 61 kmh).
  - b. **Category II.** Cyclonic Storm with wind speed between 34 – 47 knots ( 62 – 88 kmh).
  - c. **Category III.** Severe Cyclonic Storm with wind speeds between 48 – 63 knots (89 – 118 kmh).
  - d. **Category IV.** Very Severe Cyclonic Storm with wind speeds between 64 -119 knots (119 -221 kmh).
  - e. **Category V.** Super Cyclonic Storm with wind speeds above 120 knots ( 221 kmh).

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<sup>1</sup> <http://severe.worldweather.wmo.int/tc/in.acronyms.html> (source of definitions)

### **Case Studies – Major Cyclones**

10. In the South Asian region, the northern part of Bay of Bengal is known to generate some of the most devastating cyclones. Out of the ten recorded cases of loss of life ranging from 40,000 to 200,000 owing to cyclonic activity in the world, eight have occurred in Bay of Bengal and Arabian Sea (*five in Bangladesh and three in India*). World's highest cyclone storm tide of 45 feet height landed in 1876 in Bakherganj near Meghna estuary in Bangladesh. We will briefly review some historical examples related to the South Asian region. Basic definitions and information related to classification of tropical cyclone, are given at Annex A.

11. **1999 Orissa Cyclone**<sup>2</sup>. The cyclone storm impacted Orissa coast on 29 October 1999 as a Category V super cyclone. Its wind speed on impact was about 250 kmh and the storm surge wave rose to 26 feet and travelled more than 20 kilometers inland. Its humanitarian impact and damage is as follows:-

- a. 10,000 killed.
- b. 1.67 million rendered homeless and 175,000 houses destroyed.
- c. 19.5 million affected.
- d. 2.5 million livestock perished.
- e. 17,000 square kilometers of crop destroyed.
- f. Considerable soil erosion occurred in the affected regions.
- g. Economic damage was estimated at \$ 4.5 billion.

12. The response was mostly indigenous as Indian government refused external assistance. In terms of response management, the local authorities were by and large able to early warn and also evacuate the severely hit districts and vulnerable population was protected by storm shelters.

13. **1991 Cyclone in Bangladesh**. It was one of the deadliest cyclones ever recorded. It made a landfall in Chittagong district in south-eastern Bangladesh on 28 April 1991. Its speed on costal impact was approximately 250 kmh. The storm surge wave rose to 20 feet on coastal impact and went 15- 20 kilometers inland. Its humanitarian and economic impact is as follows:-

- a. 138,000 killed.
- b. 10 million rendered homeless. More than 1 million homes destroyed.
- c. 2 million evacuated before storm impact.
- d. Overall damages estimated at \$ 1.5 billion.
- e. Chittagong Port and adjoining naval and Air Force bases suffered extensive damage.
- f. Massive land erosion occurred and millions of trees uprooted.

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<sup>2</sup> [http://en.wikipedia.org/wiki/tropical\\_Cyclone\\_05B](http://en.wikipedia.org/wiki/tropical_Cyclone_05B)



14. **Hurricane Katrina's Impact on New Orleans in 2005**<sup>3</sup>. Katrina impacted New Orleans, Louisiana, North Central Gulf Coast, Bahamas, South Florida, Mississippi, Alabama and Cuba. The Cyclone was formed on 23 August 2005 and it impacted upon New Orleans on 28 August with a speed of 280 kmh as a Category V Cyclone. Immediate response was from Army Corps of Engineers. 57 coastal communities were provided shelter. Its humanitarian impact is as follows:-

- a. 1,836 killed.
- b. 26,000 provided relief.
- c. 3 Million people affected.
- d. Economic damage worth approximately \$ 80 billion.

15. **Conclusions**

- a. Ability of the national / regional early warning agencies to track Cyclone formation and its route from inception till impact in a coordinated manner. This information should be disseminated to relevant stakeholders.
- b. Capacity of national, regional and local agencies to early warn the vulnerable communities using media and all other resources.
- c. Development of well rehearsed cyclone evacuation plans and mobilization of emergency logistic support.
- d. Building of cyclone shelters as per contingency planning.
- e. Ensuring evacuation of the vulnerable population into storm shelters as per local contingency plans.
- f. Generating awareness among vulnerable communities on all aspects relevant to their response and survival including evacuation to shelters.
- g. Ensuring mobilization of administrative resources to force evacuation of likely victims from vulnerable regions.
- h. The humanitarian toll indicates relative preparedness to cyclone impact being the poorest in case of the Bangladesh Cyclone of 1991. Weakness lay in inability to early warn vulnerable communities or to force evacuation where needed.

**Historical Perspective - Cyclone Occurrences in Pakistan**

16. Over the past years cyclones tend to recur frequently though, most did not seriously impact Pakistan's coast. However, cyclone of 1999 seriously impacted Thatta and Badin districts of Sindh and affected 0.6 million people and caused loss of 202 lives. Cyclone Yemyin in 2007 had a much wider imprint

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<sup>3</sup> [http://en.wikipedia.org/wiki/Hurricane\\_Katrina](http://en.wikipedia.org/wiki/Hurricane_Katrina)

affecting 26 districts of Balochistan / Sindh and 2.5 million people, causing 400 fatalities. History of cyclone occurrence along and on the Pakistan coast is given at Annex B.

17. **Lessons Learnt**

- a. Establishment of an efficient mechanism to respond to natural hazards / calamities is imperative to minimize loss of life and property by initiating requisite mitigation measures and by initiating a well coordinated response in the event of such an eventuality. Lot is required to be done in this regard, i.e. establishment of PDMAs/DDMAs to perform these tasks efficiently.
- b. No contingency plan existed with District Government for a coastal region evacuation.
- c. Local communities should be made aware of the rains / cyclone hazards and should be involved in local contingency planning.
- d. Employment of armed forces helicopters should be factored in evacuation, search and rescue operations.
- e. Responsibilities of the line departments to be clearly identified, especially for camp management.
- f. Revenue Department's capacities should be built for post disaster assessment and management.
- g. Essential rescue equipment should be pre-positioned in vulnerable areas.
- h. Mobile civil – military medical teams should be constituted to work against epidemic outbreak and to provide emergency first aid.
- i. As part of preparatory measures surface water drains in urban areas should be routinely cleaned to avoid local flooding.
- j. Outreach veterinary services should be provided to administer vaccination and to provide feed to animals.
- k. Arrangement should be made for apt media handling to pre-empt disinformation and unfounded alarms.

**General Information - Karachi (Map attached as Annex P)**

18. With a population of 15 million plus, Karachi City is divided into 20 administrative units, which include 18 towns, cantonment areas and DHA. The population varies from 1 million plus in Landhi and New

Karachi to 300,000 plus in DHA. The City is spread over 3,530 Square kilometers. Population of Karachi City Towns is reflected below.

S.No	Town	Population	Area in Acre	Pop Density
1	Saddar	935,566	5,967	157
2	Jamshed Town	1,114,235	5,790	192
3	North Nazimabad	753,423	4,127	183
4	Gulberg	688,580	3,417	202
5	SITE	709,944	6,286	113
6	Shah Faisal	509,915	2,901	176
7	Gulshan-e-Iqbal	949,351	13,260	72
8	Landhi	1,012,391	9,670	105
9	Korangi	829,813	10,247	81
10	New Karachi	1,038,865	5,058	205
11	Cantonment	464,882	31,336	15
12	DHA	379,596	9,454	40
13	Baldia	616,722	7,217	85
14	Malir	604,763	4,395	138
15	Orangi	1,098,859	5,803	189
16	Bin Qasim	480,854	137,961	3
17	Kemari	583,640	106,217	5
18	Gadap	439,674	355,798	1
19	Lyari	923,176	1,977	467
20	Liaquatabad	985,581	2,685	367
	<b>Total</b>	<b>15,119,830</b>	<b>729,566</b>	

19. Karachi is vulnerable to earthquake and hydro-meteorological hazards. Numerous fault lines pass in the close proximity of the City. In 1945 a major earthquake off the Mekran Coast measuring 7.8 on the Richter scale generated a tsunami wave whose impact centered on Pasni along the Balochistan coast, west of Karachi. A major earthquake could have a devastating impact on the City, given the fact that rapid urbanization has occurred with little regards to coherent town planning or building codes.

20. Moderate to severe rains (past data reflected at Annex C) tend to cause paralysis in large sections of the City as water stagnates on major roads and inundates low lying areas bringing civic life to standstill. Despite improvements, absence of an efficient water drainage system retards measures aimed at addressing the problem. CDGK has made considerable efforts to open storm drains, which saved many areas from flooding in 2007. Following 2007 experience, DHA has undertaken major works to improve storm drainage.

21. The natural drainage system of the City flows within and astride Malir and Lyari Rivers, which tend to surge amid heavy rains and cause flooding of adjoining low lying areas. More than 500 storm water drains serve the City but many are blocked due to debris accumulation or ill planned construction / encroachments. Karachi City generates 8,000 tons of solid waste with the disposal capacity for 4,000 tons per day. Excess waste ends up in storm water drains.

### Existing Disaster Response Structure - Karachi

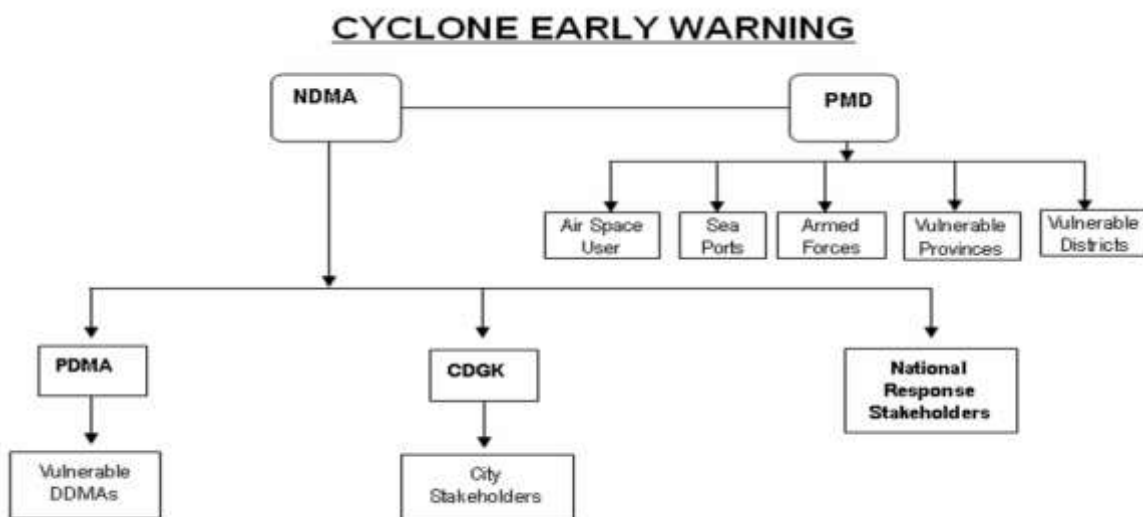
22. **Law and Order**. Law and order situations are handled by Sindh Rangers (para-military force) and Police, Army is called in to manage major civil disturbances.

23. **Fire Hazards and Medical Emergencies**. Emergency response with regards to fire hazards and medical emergencies are responded to by the local fire brigade and ambulance services.

24. **Miscellaneous Emergencies**. CDGK emergency response services respond to most emergencies, various autonomous entities like Pakistan Steel Mills, Civil Aviation Authority, Port Authorities and Cantonment areas maintain their own emergency response services which can be called upon to respond to larger emergencies.

25. **Excessive Rains**. Natural hazards mostly occur in the shape of rains approximating or exceeding 50 mm. City's constituent towns, cantonment areas, DHA and independent authorities like CAA, KPT, Port Qasim respond as per their well defined SOPs and emergency response plans. Excerpts from rains emergency response plan of the CDGK is attached as Annexure D. However, in case of major rains affecting large segments of the City, CDGK assumes the role of central coordination and Army, Sindh Rangers, naval units and other Federal agencies respond as per their defined role.

26. **Cyclone Early Warning**. NDMA is responsible for issuing national wide alert based on PMD's input. PMD is responsible for cyclone early warning and for this purpose besides relying on its own monitoring of cyclone weather systems that can possibly impact Pakistan; it also draws from the inputs of WMO regional cyclone weather monitoring and by Joint Typhoon Warning System USA. Moreover, PMD Cyclone Early Warning Centre is being created in Karachi. The work on the project is underway and it will involve setting up of a number of automatic weather stations deployed along the coast and a high speed computerised nerve centre.s It is likely to be operational in two years<sup>4</sup>. Graphic illustration of cyclone early warning is given below:-



## 27. Role of Key Stakeholders in Natural Disaster / Emergency Response

### a. Army - Headquarters 5 Corps<sup>5</sup>

- (1) Local Army units on requisitioning for relief operations within overall plan of CDGK and PDMA.
- (2) Medical support.
- (3) Provision of rescue boats and related equipment . Details of overall available assets are given at Annex E.

### b. Commander Karachi Pakistan Navy (COMKAR)<sup>6</sup>

- (1) Pakistan Navy participates both in SAR and relief efforts in the City and also in similar operations along the coast. Navy's flood response area in Karachi City includes Kemari and Saddar.
- (2) Provision of rescue boats and related equipment . Details of overall available assets are given at Annex E.

### c. Maritime Security Agency (MSA)<sup>7</sup> . Provision of rescue boats and related equipment . Details of overall available assets are given at Annex E.

### d. Summary of Key Response Agencies

S.No	Agency	Task
1	PMD	Early warning
2	PDMA	Coordinate relief operation
3	Armed Forces	SAR, Emergency response and relief
4	CDGK	Relief operations, de-watering, emergency response
5	MSA	SAR, relief
6	Coast Guards	SAR, relief
7	Sind Rangers	Response, law & order
8	KESCO	Restoration of electricity
9	KSWB	Restoration of potable water, dewatering
10	CAA	Restoration of air traffic
11	KPT, Port Qasim	Restoration of port operations
12	Police	Maintenance of law and order
13	Health	Provision of medical first aid
14	Fire brigade	Emergency response to fire outbreaks

## Scenarios for Tropical Cyclone Impact - Karachi City

28. Despite absence of historical data of cyclone impact on Karachi two scenarios have been identified by PMD, which have been deliberated in the succeeding paragraphs.

<sup>5</sup> Source: Brig Akhtar Rao, Commander Corps Engineers Karachi

<sup>6</sup> Source: Commodore Iftikhar Ahmad. Principal Staff Officer

<sup>7</sup> Source: Vice Admiral Tayyab Ali Dogar, DG MSA

29. **Scenario 1 – Cyclone Category III or above (Worst Case Scenario)**. It depicts a WMO defined Category III cyclone storm or above making landfall in Karachi City. Its key impacts are depicted graphically in Annexure F and are also summarised below: -

a. **Storm Surge Wave**

- (1) It would start to impact Karachi City with increasing velocity when the Cyclone is 25-30 kilometres from the coast.
- (2) It reaches peak about 2 kilometres from the coast with maximum speed.
- (3) Height of the surge wave could range between 12-15 feet or above.
- (4) The wave is likely to travel up to 5 kilometres inland.
- (5) The topography of Karachi City adjoining the coast does not offer any natural resistance to the tidal wave. Impediments would be in the shape of city infrastructure or built up area.
- (6) Depending on the point of impact the water inflows would be regulated along the road network and along Malir and Lyari rivers plus other storm water drains.
- (7) Immediate impact would be total paralysis within 3-5 kilometres of the coastal region depending on the point of the impact of storm surge wave.
- (8) However communications paralysis can occur in low lying areas located much deeper from the point of impact.
- (9) **Conclusion**. City authorities would have to evacuate population within atleast 2 kilometres along the coast.

b. **Storm Wind**

- (1) Wind speed up to 64 – 120 knots (118-222 kmh) is expected.
- (2) Wind impact would commence when the cyclone is 25-30 kilometres from the coast.
- (3) Its impact is most likely to be severe along the centre / eye of the cyclone.
- (4) Wind impact would vary depending on the direction / axis of the cyclone movement.
- (5) Wind pressure decreases as cyclone passes certain point.

c. **Rainfall**

- (1) Approximately 200 -225 mm rainfall (9-10 inches) is expected over a period of 36 hours in the City.
- (2) Its intensity is likely to be more pronounced along the centre / eye of the cyclone.

d. **Water Backflow in to the Sea.** On termination of cyclone impact water in major channels would commence reverse flow towards the sea and this could occur from 3-4 days post cyclone and could continue up to 1-2 weeks.

e. **Summary of Risks**

- (1) Significant population segments are likely to be marooned / isolated due to storm surge wave and ensuing heavy rains.
- (2) High winds are likely to cause widespread damage and take a heavy human toll as was the case with Cyclone Yemyin.
- (3) Blockage of storm water drains is likely to accentuate the post cyclone flooding impact.
- (4) Relief operations are likely to be seriously undermined due to flooding of essential communication infrastructure.
- (5) Break down of essential services like electricity and water will accentuate the humanitarian impact of the disaster.
- (6) Absence of shelters, evacuation plans and poor state of emergency response services makes the City increasingly vulnerable to a cyclone.
- (7) Humanitarian toll of cyclone impact is likely to be very high due to dense population and poorly planned infrastructure.

f. **Triggers**

- (1) Early Warning of Tropical cyclone formation in the Bay of Bengal / North Arabian Sea by PMD to key national stakeholders.
- (2) NDMA's cyclone warning to PDMA Sindh and to CDGK.
- (3) PDMA and CDGK provides early warning to key stakeholders within City and activate cyclone contingency plan.

g. **End State.** Activation of routine life in Karachi City after termination / dissipation of key indicators associated with storm impact, flooding of vulnerable parts of the City in particular.

30. **Scenario 2 – Cyclone Category I / II**

a. It depicts up to WMO defined category II cyclone making a landfall in Karachi City, It is graphically explained at Annex I and its principal impacts are as following:-

- (1) **Strom Surge Wave.** It is likely to be confined up to 3-5 feet with negligible inland impact.

- (2) **Rainfall.** Approximately 50-75 mm over 24- 36 hours. Please bear in mind that 50 mm quantum of rains tends to paralyse civic life in the City.
  - (3) **Wind.** Winds up to 25-30 knots (46 -64 kmh) is (are) expected.
  - (4) **Note.** Scenario 2 equates with a heavy rainfall situation in the City for which a workable response mechanism exists and is being further improved upon by CDGK and PDMA.
- b. **Triggers**
- (1) Early Warning by PMD
  - (2) Activation of high intensity rains contingency plan by CDGK and key stakeholders
- c. **End State.** Activation of routine life in Karachi City after dissipation of cyclone and rains impact
- d. **Planning Assumptions.** Corresponds with much practised planning assumptions underlying multiple rain contingency planning for Karachi City.
- e. **Likely relief caseload.** Previous experience indicates it does not exceed 500 -1000 in low lying areas of the City which is well within the capacity of CDGK and local voluntary organisations like Eidhi Trust to manage. In relatively rain high impact situations armed forces are pressed in for emergency / disaster response.

### **Response - Scenario 1**

#### 31. **Planning Assumptions**

- a. There is no history of tropical cyclone land fall in Karachi City, therefore, cyclone impact scenarios on Karachi City have been developed by PMD based on tropical cyclone occurrence pattern in North Arabian Sea.
- b. Relief caseload consistent with humanitarian impact of Scenario 1 is 670,800 and overall affected population stands at 4,667,900.
- c. It is assumed that most vulnerable towns / localities have been partially evacuated prior to the cyclone impact.
- d. Relief caseload is planned for 30 days.
- e. There will be a need to evacuate approximately 1,825,900 population from five worst affected towns of Karachi: Korangi, DHA, Saddar, Kemari and Lyari.
- f. Establishment of hygienically safe camps for evacuees and proper administration having adequate shelters, food and medical facilities.



- g. Cyclone impact on Karachi City would have a wider impact in the neighbouring districts, along the coast and towards North in the shape of rainfall and severe winds, but it is not being factored in the response which remains confined to Karachi City.
  - h. Humanitarian impact of Scenario I is explained at Annex G.
32. **Outline Plan**
- a. **Pre-Response Phase (CDGK and PDMA)**
    - (1) Draft NDMA cyclone contingency plan can form the basis for sensitisation of diverse stakeholders of Karachi City with the aim to facilitate them in making a more elaborate multi-stakeholders situation based contingency plan.
    - (2) Crystallisation of multi-stakeholders cyclone contingency plan for Karachi City by CDGK and PDMA.
    - (3) Contingency planning for vulnerable population evacuation and earmarking spaces for relief camps by CDGK.
    - (4) Preparation of temporary shelters in vulnerable urban and rural locations by CDGK.
  - b. **Response Phase (Led by CDGK and PDMA)**
    - (1) Dissemination of Early Warning.
    - (2) Media utilization to forewarn affected population regarding impending cyclone threat.
    - (3) Affecting evacuation of population from the most vulnerable towns / locations.
    - (4) SAR and relief operation led by armed forces when requisitioned.
    - (5) Establishment of relief camps and temporary shelters.
    - (6) Concurrent restoration of essential services and dewatering of essential routes and low lying areas through PDMA / CDGK / relevant departments of provincial government.
    - (7) Concurrent health response to address emergency health needs and pre-empt outbreak of epidemics by Provincial Health Department and private sector.
    - (8) Disbursement of relief compensation for the dead, injured and shelter less.
  - c. **Early Recovery Phase (CDGK and PDMA)**
    - (1) Dewatering of low lying areas and other necessary measures aimed at pre-empting outbreak of epidemics.
    - (2) Immediate assessment of damages.

- (3) Restoration of essential services and repair of damaged infrastructure particularly relating to restoration of electricity, potable water supply, gas and sewerage.
- (4) Launching of livelihood programmes.
- (5) Provision of semi-permanent housing to the shelter less.
- (6) Support for restoration of government administrative mechanism, both for provincial and City governments.
- (7) Restoration of harbour services, railways, industrial activity to lessen cyclone impact on local / national economy.
- (8) Assessments by Federal Government / donor agencies for long term rehabilitation.
- (9) Resource mobilisation for long term rehabilitation.

### 33. **Pre-Response Phase (Mitigation Measures)**

#### a. **Medium Term Measures**

- (1) NDMA / CDGK / PMD/ PDMA to ensure following:-
  - (a) Computer simulation model based hazard mapping for defining the precise cyclone impact relevant to various scenarios.
  - (b) PMD should be associated with this exercise and appropriate international expertise be sought.
- (2) **Resource Mapping for Response**
  - (a) **CDGK / All Stakeholders**
    - i. Will take stock of food and potable water reserves and ensure maintenance as per contingency planning.
    - ii. Will undertake detailed resource mapping for all types of equipment available with private and public sectors that can facilitate response. Equipment will range from heavy plant, dredgers, heavy duty generators etc to life saving boats, jackets, communication equipment required for response.
    - iii. Availability of transport for affecting pre-cyclone evacuation will also be mapped.
    - iv. Resource inventory will be built up through consultations with multiple stakeholders through a detailed planning process.
  - (b) **All Stakeholders for Response**. Will participate in this exercise.

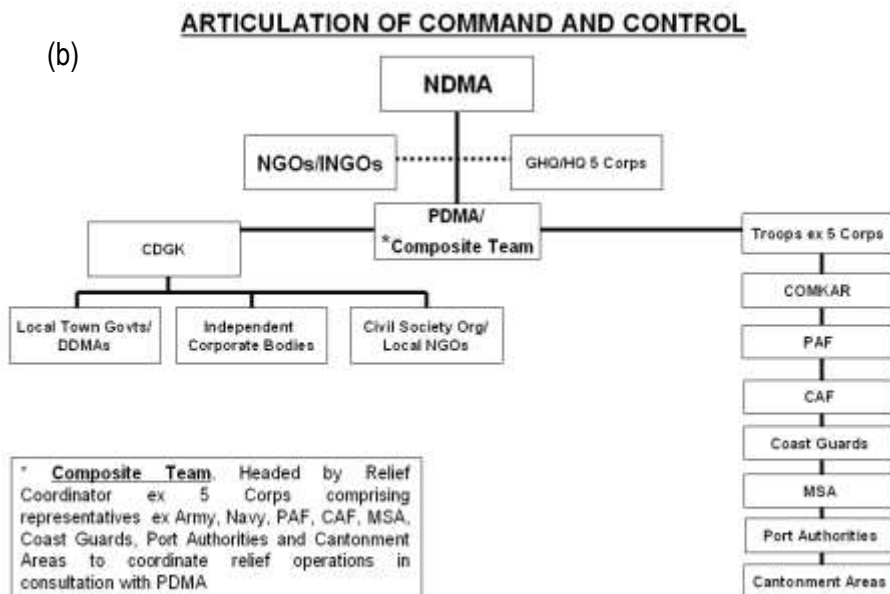
- (3) **Registration of Fishermen Boats and Isolated Coastal Localities for Early Warning and Generating Awareness**
- (a) **MSA / Coast Guards / CDGK / Distt Govt Thatta & Badin.** Undertake registration of isolated fishermen / coastal villages.
- (b) **MSA**
- i. Facilitate provision of VHF communication to all registered fishermen boats for dissemination of Cyclone early warning.
  - ii. Facilitate awareness among fishermen communities with regards to Cyclone warning and response.
- (c) **CDGK / Distt Govt Thatta & Badin.** Establish communications with isolated fishermen / coastal communities for furnishing cyclone early warning and also generate awareness among them with regards to cyclone response.
- (4) **Community Awareness for Early Warning and Response.** All stakeholders will ensure following:-
- (a) Will identify means and methods for inculcating vulnerable communities awareness to cyclone response with regards to its key elements like dissemination of early warning, plans for evacuation and accessing shelters.
- (b) Identify local NGOS which can assist in community awareness and mobilisation for response and involve them in the process.
- (c) Identify volunteers / volunteer organizations which can assist various facets of response like provision of emergency healthcare and relief items.
- (5) **Vulnerable Population Evacuation Plan**
- (a) **CDGK / Cyclone Vulnerable Towns.** Jointly prepare cyclone evacuation plan with alternative options consistent with route layout and various contingencies being considered.
- (b) **Armed Forces.** Will also prepare cyclone evacuation plan relevant to DHA and cantonment areas under cyclone Threat. Plan will be made in coordination with CDGK.

(c) **CDGK / Armed Forces**

- i. The evacuation plan should be prepared and implemented in a flexible manner to avoid traffic congestion and jams to the extent possible.
- ii. Local media to be employed in sensitizing public both on cyclone early warning and on what to do and what to avoid with regards the evacuation plan.
- iii. Contingency plans to be prepared for employment of Rangers / police force / local administration in enforcing evacuation of most critical areas.

(6) **Articulation of Command and Control.** Since search and rescue and immediate relief would entail aerial and water borne operations, therefore, PDMA/CDGK in consultation with HQ 5 Corps will be responsible for these operations. Relief Coordinator ex 5 Corps will head a Composite Team (comprising representatives ex Army, Navy, PAF, CAF, MSA, Coast Guards, Port Authorities and Cantonment Areas) to coordinate relief operations in consultation with PDMA.

(a) Diagrammatic layout is as under:-



- (b) **PDMA/CDGK**. Lead integrated planning for cyclone disaster response for Karachi City.
- (c) **Provincial Government / CDGK**. Responsible for restoration of essential services and dewatering of worst affected areas & major roads.
- (d) **Local Town Govts / Cantonment Areas / Port Authorities / Independent Corporate Bodies**
  - i. Will respond to disaster as per their local response plans but under the overall coordination of PDMA/CDGK.
  - ii. All stakeholders will identify focal person for response and clear responsibilities (with well defined SOP's) for response both of stakeholders and their key / point persons will be spelled out.

b. **Long Term Measures**

(1) **Preparing Cyclone Shelters**

- (a) **CDGK / PMD/ Consultants**. Undertake survey of population likely to be evacuated due to cyclone impact using computer modelling. It will yield need assessments for shelter preparation.
- (b) **CDGK**.
  - i. Plan for absorption of population within relatively unaffected Towns of the City.
  - ii. Identify cyclone shelters within seriously cyclone affected towns to provide local protection
  - iii. Identify locations for making new cyclone shelters along Super Highway, Furqan Trust and Eidhi Village in Malir (locations recommended by City stakeholders)
- (c) **Provincial Govt / CDGK**. Develop shelters as per need assessments. However, it is strongly recommended that international / regional best practices regarding storm shelter preparation should be studied before undertaking this capital intensive assignment.

- (2) **Improving Cyclone Protection Works along the City Coast**
- (a) CDGK / DHA. A master plan to be developed under expert supervision to improve upon the existing tidal wave / cyclone protection works along the City coast.
  - (b) CDGK / DHA / affected Towns. Consequently improve upon the City coastal region protection work for affording / improving defence against a tropical storm surge as part of coastal development plans.
  - (c) Relevant Stakeholders. International / regional best practices in developing cyclone protective works to safeguard mega cities to be studied before undertaking this exercise.
- (3) **Dredging of Storm Water Channels and improving upon water outflow.**  
 CDGK and Townships will ensure following:-
- (a) Dredging regular storm water drains and keeping their flow channels open as part of disaster risk reduction efforts.
  - (b) Ensure that storm water channels outflow is not impeded as a consequence of town planning.

34. **Response Phase**

- a. **Provision of Early Warning.** PDMA/CDGK should streamline responsibilities for dissemination of early warning so that none among the vulnerable segments of the City are missed out in disseminating early warning. Details are as under:-
- (1) **NDMA.** Early warns through dissemination of cyclone situation reports to key Federal, Provincial and local stakeholders.
  - (2) **PMD in close coordination with NDMA and CDGK**
    - (a) Provides Cyclone alert (3-4 days in advance).
    - (b) Provides cyclone watch as it nears its destination.
    - (c) Provides cyclone advisories 4-6 hours earlier than impact (Cyclone warning).
    - (d) Cyclone advisories are disseminated through website/media and by telephone / fax to relevant stakeholders.
  - (3) **PDMA**
    - (a) Disseminates early warning to CDGK, neighboring districts and isolated localities and fishermen organizations.

- (b) Coordinate evacuation of vulnerable communities and establishment of Relief Camps in consultation with CDGK and other stakeholders.
  - (4) **CDGK.** Early warns all towns in Karachi City, industrial areas like SITE, Pakistan Steel Mills and Port Authorities.
  - (5) **Town Administrations.** Disseminate early warning to local residents
  - (6) **Armed Forces.** Inform all ground, aerial and sea based elements (formation) to allow time for taking preventive measures to minimize loss.
  - (7) **MSA.** Informs fishermen at sea for return to port / adoption of preventive measures to minimize loss.
  - (8) **Coast Guards.** Informs fishermen and vessels at sea for return to port / adopting preventive measures.
  - (9) **KPT.** Provides early warning to Minora and Bhit and Baba islands.
- b. **Execution** (Armed forces are involved only after requisitioning)
- (1) **Sindh Govt/ PDMA Sindh.** PDMA Sindh will coordinate Federal and provincial support to CDGK and Provincial line departments will reinforce their counterpart agencies within CDGK.
  - (2) **Armed Forces, Sindh Rangers, MSA and Coast Guards.** Will be working in consultation with PDMA / CDGK to undertake following operations:-
    - (a) SAR.
    - (b) Immediate relief to include provision of food and potable water.
    - (c) Emergency medical support.
  - (3) **CDGK.** Operating under overall coordination of PDMA, CDGK will undertake following tasks while working in concert with affected Town / DHA Administration:-
    - (a) Dewatering of routes / roads critical for response.
    - (b) Dewatering of vulnerable low lying areas.
    - (c) Assist in disposal of the dead.
  - (4) **KESC.** Provide essential electricity required to support relief operations.
  - (5) **KSWB.** KSWB to accord priority to restoration of potable water in priority worst hit areas.
  - (6) **CAA**
    - (a) Secure airplanes and key facilities at the Karachi Airport from cyclone impact.

- (b) Restore normal operations of Karachi airport within 12-18 hours to reinforce support of relief operations.
  - (c) Operationalise Hyderabad as an alternative airport for supporting relief operations in Karachi (would depend on cyclone impact on Hyderabad).
  - (d) Operationalise emergency response plan.
  - (7) **Pakistan Steel Mills**. Take all precautionary measures to minimize damage to essential infrastructure and restore normal operations with minimum loss of time.
  - (8) **Pakistan Railways**. Restore operations in Landhi, Cantonment and City Railway stations with minimum loss of time to support relief operations.
  - (9) **Sui Southern Gas Company**
    - (a) Restore gas supply to worst affected regions within 12-18 hours.
    - (b) Enact local emergency response plan.
    - (c) Support overall relief operations as per defined priority.
  - (10) **DHA**. Ensure evacuation / occupation of cyclone shelters as per local plans.
  - (11) **Sindh Rangers and Local Police**
    - (a) Participate in relief operations in concert with PDMA/CDGK and HQ 5 Corps.
    - (b) Reinforce law and order in the City.
  - (12) **KPT and PQA**
    - (a) Take requisite measures to safeguard infrastructure on port and ensure exit of ships before Cyclone impact as per SOP.
    - (b) Ensure securing of containers to avoid collateral damage to port premises.
  - (13) **Media Management**. To be overseen by Ministry (department) of Information Govt of Sind, who will be provided inputs by PDMA CDGK and other key agencies responsible for relief operations.
- c. **Health Response (Provincial Health Department)**
- (1) Besides providing emergency health care to the affected population the health response to cover risk of spread of epidemic prone diseases like acute watery diarrhoea, typhoid fever, malaria and measles, relapsing of fever and acute respiratory illness.



- (2) Articulation of health response will be coordinated by DG Health Sindh. It should be based on mass casualty management plan, after mapping all available health facilities.
- (3) Preparedness of health response would entail:-
  - (a) Coordination under DG Health Sindh
  - (b) Setting / reinforcing disease surveillance system for Karachi City
  - (c) Human resource data base should be created
  - (d) 100% EPI coverage should be ensured
- (4) Response activities will include:-
  - (a) PHC service delivery and referral
  - (b) Disease surveillance and case management
  - (c) Immunisation
  - (d) Vector Control
  - (e) Health Education and Hygiene promotion
  - (f) Health service delivery monitoring

**Note.** Major hospitals of Karachi city are reflected at Annexure H.

### 35. **Coordination Aspects**

- a. **NDMA.** Plan, coordinate and monitor national response and post cyclone recovery in Karachi City (if required).
- b. **Armed Forces (On requisitioning)**
  - (1) **Pakistan Army.** Reinforce army assets, if required, for execution of relief operations while according priority to aviation support, water borne relief delivery capacity building, provision of emergency shelter, emergency healthcare and camp management.
  - (2) **Pakistan Navy.** Reinforce capacity for aviation support, water borne relief capacity in urban areas and deep sea SAR capacity.
  - (3) **PAF**
    - (a) Provide strategic relief assistance through air assets.
    - (b) Ensure early post cyclone operationalization of Faisal Air Base and mobilise satellite bases in close proximity of Karachi to reinforce relief operations.
    - (c) Reinforce heliborne urban / deep sea relief capacity.

- c. **Civil Armed Forces.**
    - (1) Participate in relief operations in concert with PDMA/CDGK and HQ 5 Corps.
    - (2) Reinforce law and order in the City.
  - d. **Ministry of Health.** Lead and coordinate health response through Provincial Health Department.
  - e. **WAPDA.** Provide need based support to KESC for restoration of electric supply particularly to reinforce the critical relief phase of the operation.
  - f. **UN Agencies and INGOs.** (On request from NDMA and through Disaster Management setups at local level)
    - (1) Support preparatory measures.
    - (2) Support of response / early recovery.
- Note.** Resource persons are included at Annexure J.

Annex A**BASIC TERMS & DEFINITIONS ASSOCIATED WITH CYCLONE OCCURRENCE**

**Depression:** A cyclonic disturbance in which the maximum sustained surface wind speed is between 17 and 33 knots (31 and 61 km/h). If the maximum sustained wind speed lies in the range 28 knots (52 km/h) to 33 knots (61 km/h) the system may be called a "deep depression".\* A cyclonic disturbance in which the maximum sustained surface wind speed is between 22 and 33 knots (41 and 61 km/h). If the maximum sustained wind speed lies in the range 28 knots (52 km/h) to 33 knots (61 km/h) the system may be called a "deep depression".

**Low or Low Pressure Area:** An area enclosed by a closed isobar with minimum pressure inside when mean surface wind is less than 17 knots (31 km/h).

**Pre Cyclone Watch:** This bulletin contains early warning about likely development of a cyclonic storm and an indication of the coastal belt likely to experience adverse weather.

**Severe Cyclonic Storm:** A cyclonic disturbance in which the maximum average surface wind speed is in the range of 48 to 63 knots (89 to 118 km/h).

**Severe Cyclonic Storm with a Core of Hurricane Winds:** A cyclonic disturbance in which the average surface wind speed is 64 knots (119 km/h) or more.

**Squally Wind:** When sudden increases of wind speed occur in squalls with the increased speed reaching a minimum of 22 knots (40 km/h) and persist for at least one minute.

**Storm Season:** The periods April to May and October to December during which most of the cyclonic storms occur in the Bay of Bengal and Arabian Sea. The periods April to May and October to mid-December during which most of the cyclonic storms occur in the Bay of Bengal and Arabian Sea.

**Storm Surge:** The difference between the actual water level under the influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (i.e. astronomical tide).  
(Storm surge results mainly from the shoreward movement of water under the action of wind stress. A minor contribution is also made by the hydrostatic rise of water resulting from the lowered barometric pressure).

**Storm Tide:** The actual water level as influenced by a weather disturbance. The storm tide consists of the normal astronomical tide and the storm surge.

**Super Cyclone:** A cyclonic disturbance in which maximum wind speed is 120 knots and above (222 km/h and above).

**Tropical Cyclone:** Generic term for a non-frontal synoptic scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation. The term is also used for a storm in the South-West Indian Ocean in which the maximum of sustained

wind speed\* is estimated to be in the range of 64 to 90 knots and in the South Pacific and South-East Indian Ocean with the maximum of the sustained wind speed over 33 knots. (Note: \*Maximum sustained wind speed: Average period of one, three, or ten minutes depending upon the regional practices.)

**Eye of the Tropical Cyclone:** The relatively clear and calm area inside the circular wall of convective clouds, the geometric centre of which is the centre of the tropical cyclone.

**Gale Force Wind:** Average surface wind speed of 34 to 47 knots (62 to 88 km/h).

**Tropical Cyclone Advisory:** A priority message for exchanging information, internationally, on tropical cyclones in the Bay of Bengal and the Arabian Sea.

**Speed of movement of the Tropical Cyclone:** Speed of movement of the centre of the tropical cyclone.

**Classification of Tropical Cyclone Systems in the Region:** Existing classification of low pressure systems (cyclonic disturbances) in the Panel countries are given below together with the WMO classifications.

<u>Country</u>	<u>Type of Disturbance</u>	<u>Corresponding Wind Speed</u>
<b>Bangladesh</b>	- Low pressure area	Less than 17 knots (31 km/h)
	- Well marked low	17-21 knots (31-40 km/h)
	- Depression	22-27 knots (51-51 km/h)
	- Deep depression	28-33 knots (52-61 km/h)
	- Cyclonic storm	34-47 knots (62-88 km/h)
	- Severe cyclonic storm	48-63 knots (8-118 km/h)
	- Severe cyclonic storm with a core of hurricane wind	64-119 knots (119-221 km/h)
- Super cyclonic storm	120 knots (222 kph) and above	
<b>India</b>	- Low pressure area	Less than 17 knots (31 km/h)
	- Depression	17-27 knots
	- Deep depression	28-33 knots
	- Cyclonic storm	34-47 knots
	- Severe cyclonic storm	48-63 knots
	- Very severe cyclonic storm	64-119 knots
- Super cyclonic storm	120 knots and above	
<b>Maldives</b>	- Low pressure area	Less than 17 knots
	- Depression	17-27 knots
	- Deep depression	28-33 knots
	- Cyclonic storm	34-47 knots
	- Severe cyclonic storm	48-63 knots
	- Very severe cyclonic storm	64-119 knots
	- Super cyclonic storm	120 knots and above

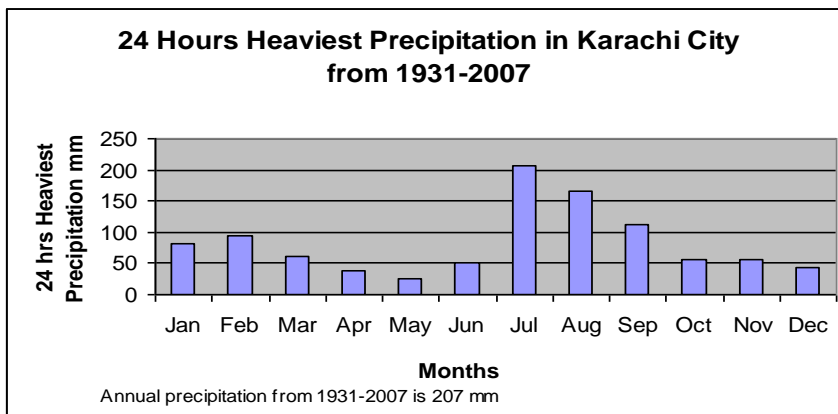
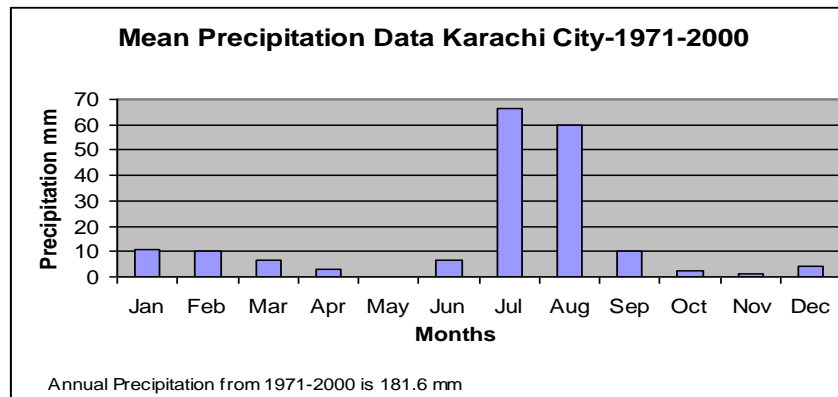
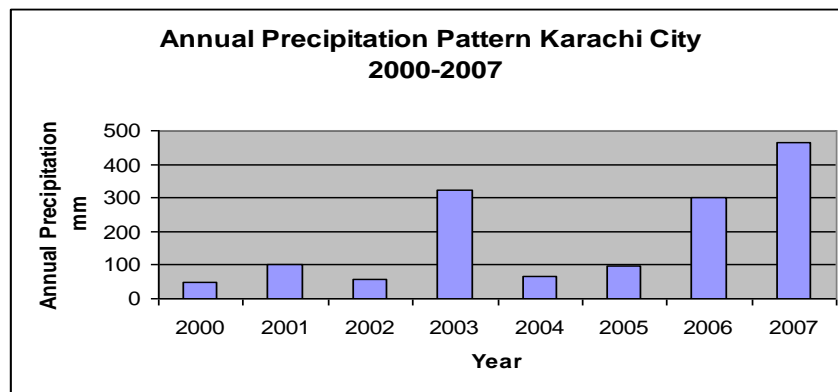
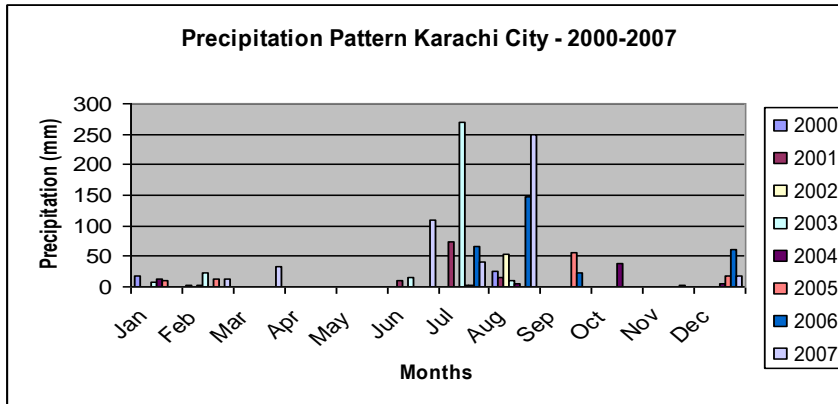
<u>Country</u>	<u>Type of Disturbance</u>	<u>Corresponding Wind Speed</u>
<b>Myanmar</b>	- Low or low pressure area	Less than 17 knots
	- Depression	17-33 knots
	- Cyclonic Storm	34-63 knots
	- Severe cyclonic storm	64 knots or more
<b>Oman</b>	- Low	Less than 17 knots
	- Depression	17-28 knots
	- Deep depression	28-33 knots
	- Cyclonic storm	34-47 knots
	- Severe cyclonic storm	48-63 knots
	- Severe cyclonic storm of Hurricane intensity	64 knots or more
<b>Pakistan</b>	- Depression	22-27 knots
	- Deep Depression	28-33 knots
	- Cyclonic storm	34-47 knots
	- Severe cyclonic storm	48-63 knots
	- Severe cyclonic storm of Hurricane intensity	64 knots or more
<b>Sri Lanka</b>	- Low pressure area	Less than 17 knots
	- Depression	17-27 knots
	- Deep Depression	28-33 knots
	- Cyclonic storm	34-47 knots
	- Severe cyclonic storm	48-63 knots
	- Very severe cyclonic storm	64-119 knots
- Super cyclonic storm	120 knots and above	
<b>Thailand</b>	- Tropical depression	Up to 33 knots
	- Tropical storm or Cyclonic storm	34-63 knots
	- Typhoon or cyclone	64 knots or more
<b>WMO</b>	- Tropical depression	Winds up to 34 knot
	- Moderate tropical storm	Winds 34-47 knots
	- Severe tropical storm	Winds 48-63 knots
	- Hurricane (or local synonym)	Winds 64 knots and more
	- Tropical disturbance of Unknown intensity	Wind speed uncertain

Annex BHISTORY OF CYCLONES – PAKISTAN

<b>Name / Year</b>	<b>Impact</b>	<b>Losses</b>	<b>Response</b>
<b>Yemyin (June 2007)</b>	<b>Sindh &amp; Balochistan coastal and adjoining regions</b>	<b>2.5 million affected. 7 districts of Balochistan and 2 of Sindh severely affected</b>	<b>Required National Response</b>
Gonu 15 June 2007	Rains along Sindh coast and impacted in Oman	Nil	Mild
Tropical cyclone 04-A "Mukda" 21-24 Sep 2006	formed over east central and adjoining north Arabian Sea	Nil	Nil
<b>Onil Oct 2004</b>	<b>Sindh – Thatta and Badin</b>	<b>Local. Cyclone impacted with a reduced impact resulting in heavy local precipitation</b>	<b>Local response</b>
Cyclonic storms formed in during first fortnight of May 2004	Southeast Arabian Sea	Nil	Nil
Severe cyclonic storm formed in May 2001	East central Arabian sea	Nil	Nil
<b>Cyclone of May 1999</b>	<b>Seriously impacted Sindh coast and Districts of Thatta and Badin</b>	<b>202 died, Houses fully / partially damaged 138,719</b>	<b>Major multi agency relief operation was launched</b>
Cyclone storm June 1996	East Central Arabian Sea	Nil	Nil
Tropical storm 2 <sup>nd</sup> fortnight October 1996	Southeast Arabian Sea	Did not impact Pakistan coast	
Cyclone storm June 1996	East Central Arabian sea	Nil	Nil
Tropical cyclone Nov 1993	North Arabian Sea	Nil	Nil
15 Dec 1965	Karachi and Thatta	10,000 affected	Severe

Source: Pakistan Metrological Department, Karachi

**PRECIPITATION DATA OF KARACHI CITY**



**CDGK RAIN & FLOOD EMERGENCY PLAN 2008****Average Rainfall**

July	85.5 MM
August	67.5 MM
September	19.9 MM
Total	172.8 MM

**Main Factors Causing Rain Floods**

- Heavy Rainfall received in a relatively short span of time.
- Synchronization of the peak flood with high tide in the sea.

**Impact of the Rain/Flood**

Great disruption to the routine City Life:

- The Traffic System ceased to work.
- Failure of electric power.
- Flights & Train Schedule badly affected.
- Telephone/Communication Network went out of order.
- Sewerage System collapsed turning roads & Street into big pool of water.
- Road Infrastructure destroyed.
- Advertisement Boards/fall of trees – causing havoc & loss of precious lives.
- Katchi Abadis submerged and
- Inundation of main roads including Shahrah-e-Faisal.
- Significant increase in epidemic diseases like Gastroenteritis, Cholera, Malaria, Skin diseases and Conjunctivitis

**Causes of Deaths during Rain**

- Electrocutation from fallen down wires.
- Drowning in storm water drains and nullahs.
- Caving in of the houses.
- Failing of roofs of kutchha houses.
- Building collapse.
- Failing of walls.
- Failing of Sign boards/Hoardings, particularly of heavy steel structure.
- Contamination of drinking water.

**Objectives**

- In view of the previous experiences, it became imperative to introduced updated Rain Emergency Plan with a systematic approach for the safety of property & lives of Karachiites and provision of better relief to them.
- To counter flood like situation in Lyari river, Gujro Nallah, Malir Nadi and their link nullahs during heavy rain fall.
- For awareness of concerned agencies/TMAs, where there are unauthorized settlements and their inhabitants living in dangerous environments of River Beds.
- A coordinated/comprehensive/update Rain Emergency Plan is very much needed to prevent & manage the pre & post rain situation.



### **An Overview of Storm Water Drainage System**

- Malir River System.
  - Chakora Nullah.
  - Thado Dam.
- Lyari River System
  - Gujjar
  - Orangi

### **Streams Discharging Rain Water Directly in Sea**

- Nehar – e – Khayam.
- Frere Nallah.
- Pitcher Nallah.
- Kalri Nallah.
- Railway Nallah.
- Soldier Bazar Nallah.
- Manzoor Colony.

### **Existing Situation**

- Most of the drains are:
  - Heavily encroached
  - Choked with silt and garbage.
- Their water carrying capacity is at minimum level.

### **Identified Low Lying Areas in Karachi**

- Otram Road.
- Talpur Road from I.I. Chundrigar Road to Wallace Road Railway Crossing.
- Dr. Ziauddin Ahmed Road from S.M. Law College Chowrangi to Mitharam Hostel.
- Shah-e-Liaquat (Arambagh).
- I.I. Chundrigar Road opposite GOP and from Uni-Tower to Cotton Exchange Building.
- Lilly Road Traffic signal to Cantt Plaza Hotel.
- Opposite Avari Hotel.
- Opposite Taj Mehal light Signal at Shahrah-e-Faisal.
- Refique Shaheed Road Opposite Cardio Vascular JPMC and Pir Bukhari turning.
- Khayaban-e-Iqbal.
- Boat Basin.
- Opposite Ideal Bakery to Roomi Matkiwala Street.
- Sunset Boulevard Road to Akhter colony (Korangi).
- M.A. Jinnah Road Opposite Tibbat Center, Saeed Manzil and Agha Khan Chowk.
- Agha Khan road Opposite Makki Masjid.
- Nishter Road.
- Agha Khan Road near Bambino Cinema.
- Shahrah-e-Faisal opposite FTC & Sindhi Muslim Society.
- Korangi Road near Kalapul.
- Aiwan-e-Saddar Road near Khajor Chowk.
- Club Road Crossing.
- Dr. Ziauddin Ahmed Road opposite Karachi Club.
- Near Clifton Bridge.
- Abdullah Haroon Road, Hotel Metropole, Hasho Chowk & Sindh Club Chowk.

- Near Clifton Bridge.
- Khayaban-e-Iqbal (Three Sword Light Signal).
- Ch. Khaliq-uz-Zaman Chowrangi.
- Dr. Dawood Pota Road (Saddar Area).
- Rashid Minhas road Johar Chowrangi, NIPA Chowrangi at Ramp.
- Abul Hasan Isphani road near Sui Gas Company.
- Zia Colony.
- University Road Hasan Square Chowrangi.
- University Road Opposite Urdu Science College.
- Love lane Traffic Signal Nishter Road.
- Business Recorder Road from Gurumondir to Lasbela.
- Business Recorder Road at Fatmid cut.
- M.A. Jinnah Road at Numaish light signal and Capri signal
- New M.A. Jinnah Road.
- Both the side of Lasbella Bridge.
- Siddique Wahab Road at KMC out, Farooqi Masjid and Chowrangi.
- Jehangir Road at various places from Gurumandir to Teen Hatti.
- Surjani Town road.
- University Road opposite Old Sabzimandi, Jail Chowrangi and Edhi Center.
- Sh-e-Faisal from Sh-e-Quideen upto Bridge opposite Pir Bukhari Karsaz and Military Gate, Traffic light signal both the sides.
- From Qayyumabad Chowrangi upto express way.
- Sir Shah Suleman Road at various places from Stadium Road to Hasan Square.
- Stadium Road opposite Traffic Light Signal.
- National Highway from Kala Board to Malir # 15 and on the upper side of Malir Bridge.
- Landhi from 3 ½ to Korangi # 5.
- Dawood Chowrangi towards Gulberg.
- M.T. Khan Road from Tyre Wali Gali upto Mai Kolachi Traffic Signal
- Bunder Road (Ghas Bunder).
- At Jinnah Bridge
- Mauripur Road from ICI Bridge to Mirza Adam Khan Road intersection.
- At Kalri Nallah.
- Estate Avenue Road at Gulbai Chowk, Paracha Chowk and Sher Shah Chowk.
- Dockyard Road.
- Mauripur Road from PAF Base Masroor to Truck Stand.
- Chakiwara Road.
- Mewa Shah Road.
- Faqir Muhammad Bura Road.
- Fakharuddin Valika Road.
- Banarus Bridge.
- Banaras Chowk.
- Mangopir Road from Banarus Chowk to toward Manghopir.
- Road in Orangi Town # 9

#### **Last Year Experience.**

- **Last year water accumulated at following places:**
  - Nursery at Sh-e-Faisal.
  - Falak Naz Appartment (Sh-e-Faisal)

- Lea Market.
- Manzoor Colony.
- NIPA Roundabout.
- Old Sabzi Mandi at University Road.
- Marvick Road (Nishter Road).
- Empress market.

#### **Action Required**

- De-silting of Storm Water Drains.
- Repair, maintenance and procurement of dewatering pump/suction pumps.
- Covering of Open Manholes and repairing of damaged Nallahs.
- Repair of Roads and filling of Deep Trenches.
- Identification of Troubled Areas.
- Activation of early Warning System.
- Prevention of deaths due to wire snapping/electrocution.
- Provision of Rescue teams.
- Establishment of Relief Camps.
- Dewatering of accumulated water.
- Prevention of infectious diseases/epidemics.
- Fumigation/Aerial Spray of affected Areas/River Beds.
- Cleanliness of water channels along the road sides for the smooth drainage of rain water.
- Provision of First aid & Medical Facilities.
- Monitoring of pre-defined areas through Mobile Teams.

#### **Action Taken by CDGK**

- The City Nazim Karachi conducted various meetings to review the arrangements being made to face any eventuality.
- The DCO is holding frequent meetings with concerned departments i.e. Municipal Services, W&S, Health, Master Plan, KBCA, KW&SB.
- The important utility agencies i.e. KESC, SSGC, PTCL have been advised to make the required arrangements to face any eventuality.
- CDGK is in close contact with Additional Relief Commissioner and Met Office, warnings have already been issued to all department concerned including all TMAs, UCs etc.
- All EDOs and TMOs have been instructed to activate their control rooms round the clock during Moonsoon season.
- Pre-rain flood arrangements i.e. desilting of storm water drain started since March 2008. Priority being given to low lying areas and vital infrastructure.
- As special monitoring and coordination cell to deal with rain flood has already been established in DCO Camp Office located at Club Road, Karachi, which shall remain operative round the clock.
- Storm water drain constructed in Clifton and Gulshan-e-Faisal (Bath Island).
- All newly constructed Roads, Underpasses and Flyovers have been provided with storm water drainage facility.
- 36 dewatering pumps have been provided to 18 TMAs.
- Rain Emergency Centers established in all 18 TMAs.
- Arrangements of portable generators and heavy machineries.
- New machinery worth 750 million have been purchased.
 

- Truck (Payload not less than 5 tons)	20 Nos.
- Excavator Wheel Mounted with Grab Crane	05 Nos.
- Grab Crane Mounted Truck	04 Nos.
- Scopic End Type Dump Truck for slug carrier	21 Nos.
- Wheel Loader	10 Nos.
- Tractor (4x4) with front end loader.	20 Nos.

**Development Carried Out**

1. Gulshan-e-Faisal (Bath Island).
2. Three Sword Clifton.
3. I.I. Chundrigar Road.
4. North Nazimabad.

**De-silting of Storm Water is Underway**

<b>Name of Town</b>	<b>Name of Nallah</b>
Landhi Town	6000 Rd, Awami colony 362 Rd, near Zaman Town
Orangi Town	Urdu Chowk to Sabri Chowk Bukhari Colony to Banaras Chowk via Aligar Colony. MPR Colony/Miran Compound & Baloch Colony Nallah. TMA Office to Islam Nagar Shah Waliullah Nagar Nallah. Main Orangi Town Disco More to Metro Cinema via Baloch Goth & Banarsi Market.
North Nazimabad	From Ziauddin Hospital to KDA Chowrangi. From KDA Chowrangi to Pahar Ganj Chowrangi. From Fun to Learn School blk-B to Hamara medical Center. From Abdullah College to Intermediate Board Office Sh-e-Noor Jehan. From Haidry Sweet to HBL on sh-e-Faizy Blk-C. Piala Hotel to Peoples Chowrangi. Nusrat Bhutto Colony to Mian Wali. Back Side old DC Office (Central) Sector 15-A-I. From Peshawary Ice Cream to Temuri Masjid in between Block-G & H.
Jamshed Town	Soldier Bazar Nallah. Karachi A. Nallah. Manzoor Colony Nallah near Bismillah. Murtaza Ground.
Lyari Town	Kulri Nallah. Picture Nallah Haji Peer Nallah Atma Ram.
Saddar Town	Nehr-e-Khayyam (100% completed) Picture Nallah (Saddar) Akber Road Nallah near Frere Market. Soldier Bazar Nallah (Saddar)
Korangi Town	12000 Road Nallah 34/1 & II Nallah
Gulshan Town	Dividing Road Blk- 6 & 7 Gulistan-e-Jauhar near Coconut Bagh. Darul Sahat Blk- 14 & 15 Gulistan-e-Jauhar. Rabia City Pahelwan Goth.
North Karachi	2000 Road Gabol Town to Godra More. 7000 Road Godra More to Bismillah Stop. 4400 Road from D-more to 2 minute Chowrangi.

SITE Town	Orangi Nallah Darul Salam Frontier Colony UC-6 Pirabad Nallah/Muslimabad Qalandria Nallah Nusrat Bhutto colony. Haroonabad Nallah. Mominabad Nallah.
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### Rehabilitation Plan

#### Long Term Plan.

- Removal of encroachment to retrieve the original width.
- Channelization to restore the water carrying capacity.
- Construction of service road on both side of the river/nullah.

### Traffic Arrangements

- For smooth flow of traffic , the Transport Department, CDGK has arranged:
  1. Detours.
  2. Yellow Tapes.
  3. Cones.

### Health and Hygiene

- Arrangements of Fumigation/Aerial spray of the affected areas.
- Health Group of Offices have been asked to procure sufficient medicine.
- Health Group of Offices have also been asked to designate Mobile Medical Team.
- Activation of Emergency Response Center located at Hawks Bay.
- Activation of 134 Helpline.
- Activation of 16 Fire Brigade Department.
- Activation of wireless system to be more vigilant during rain.
- Deployment of staff from relevant department in 134 Helpline.
- Cancellation of leave of all the Emergency Staff.
- Deployment of Community Police Personal, in case of any eventuality.

### Establishment of Emergency Centers

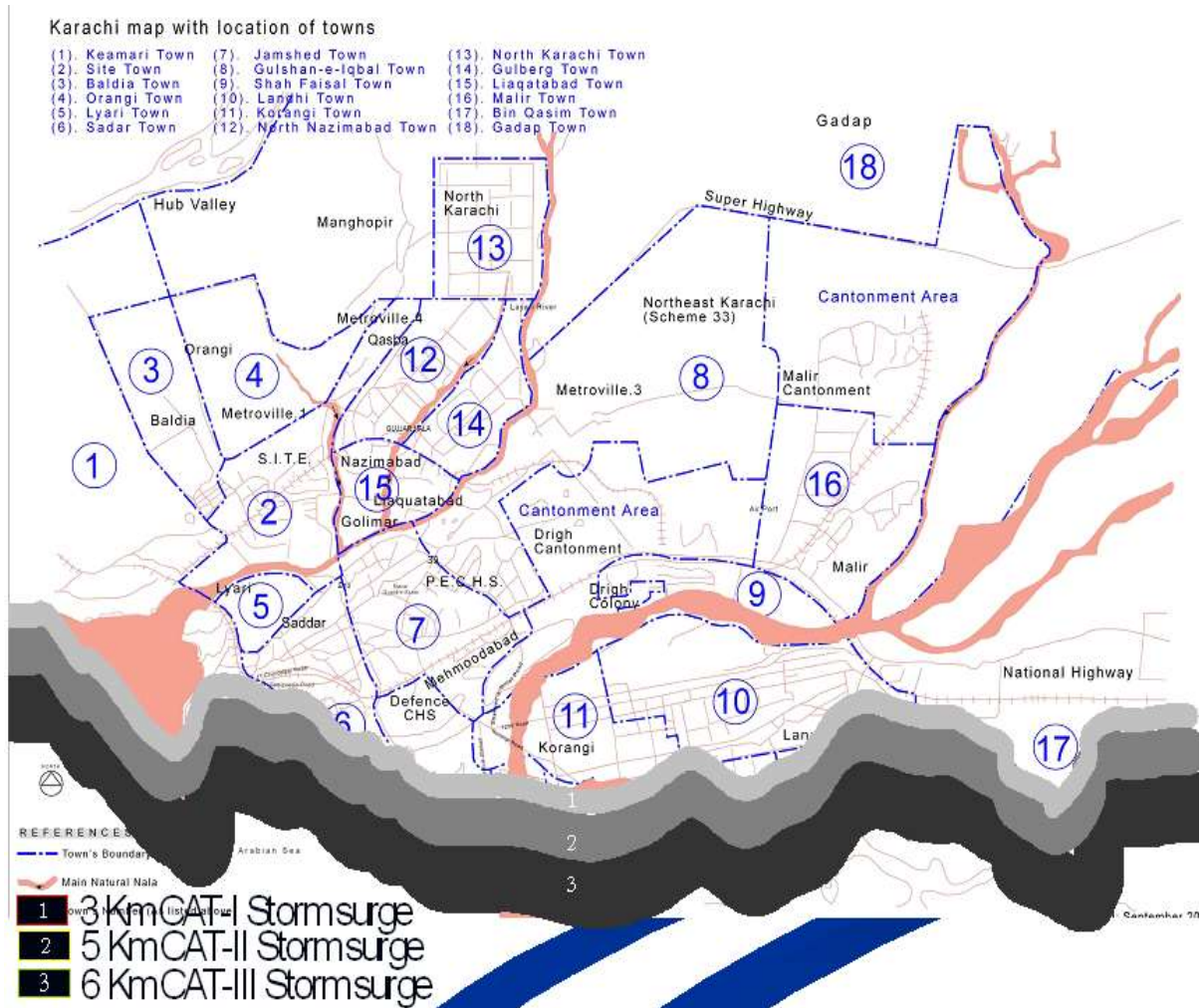
District Coordination Officer (Control Room)	9205605/9205639/9203443 Fax # 021-9205634
134 Helpline (Control Room)	9230060 9230062 134 (five lines)
16 Control Room	9232455 16 (five lines)
Fire Head Quarter Control Room	9215007-08
Gulistan-e-Mustafa Fire Station	9246268/9246316
Landhi Fire Station	5015988/5015888
Lyari Fire Station	2527572/2528090
Focal Person Fire Brigade	0321-2945486/0333-2275615

Annex EDETAILS OF AVAILABLE ASSETS WITH ARMY, COMKAR AND MSA

	<u>Boats</u>	<u>OBMs</u>	<u>Life Jackets</u>	<u>Remarks</u>
Army (5 Corps)	142	125	1335	
COMKAR	40	30		
MSA	50*			* Various categories rescue boats
<b>Total</b>	<b>232</b>	<b>155</b>	<b>1335</b>	

**GRAPHIC ILLUSTRATION OF SCENARIOS**

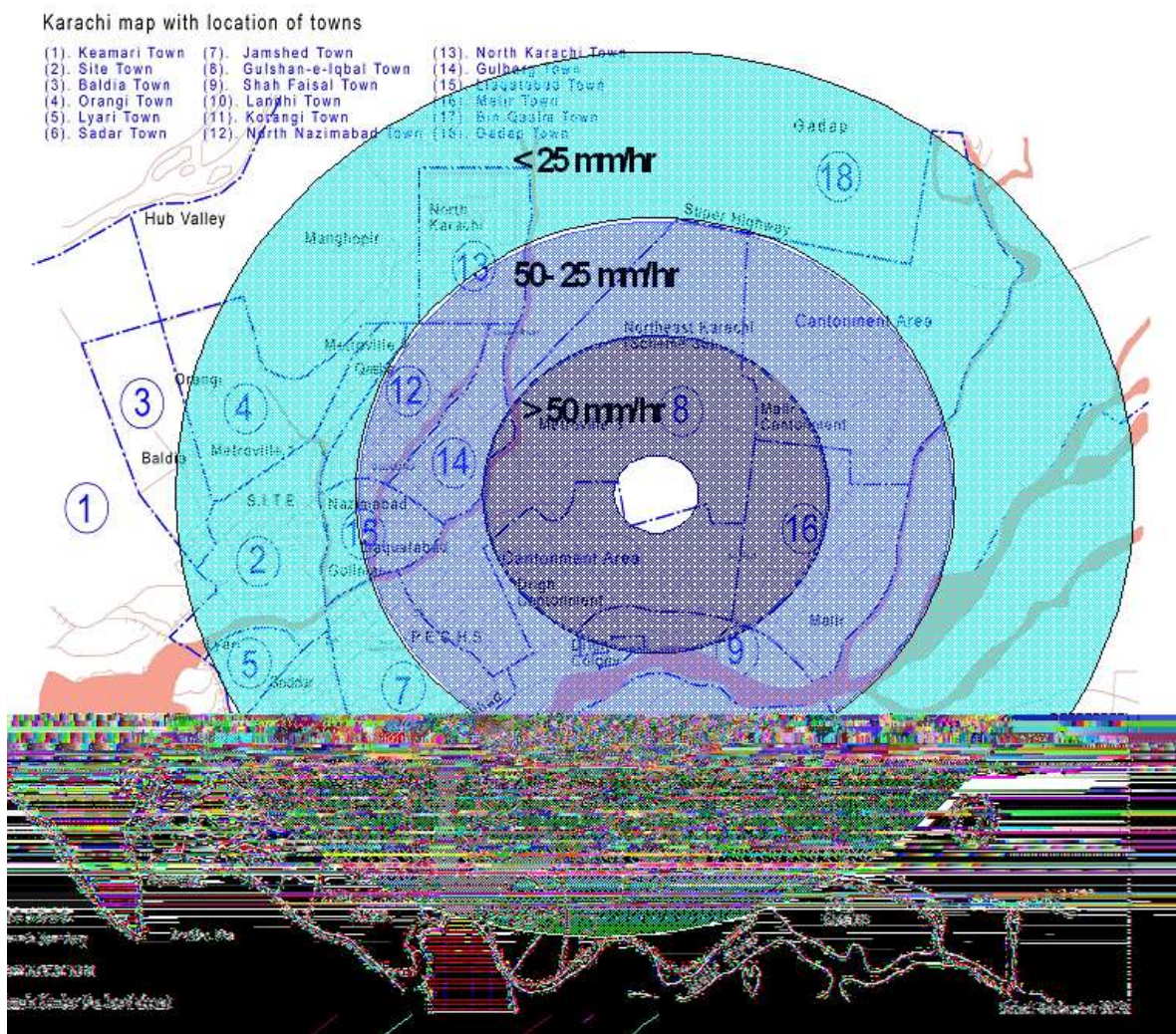
**Extent of Cyclone Surge Scenario I**





## GRAPHIC ILLUSTRATION OF SCENARIOS (Continues)

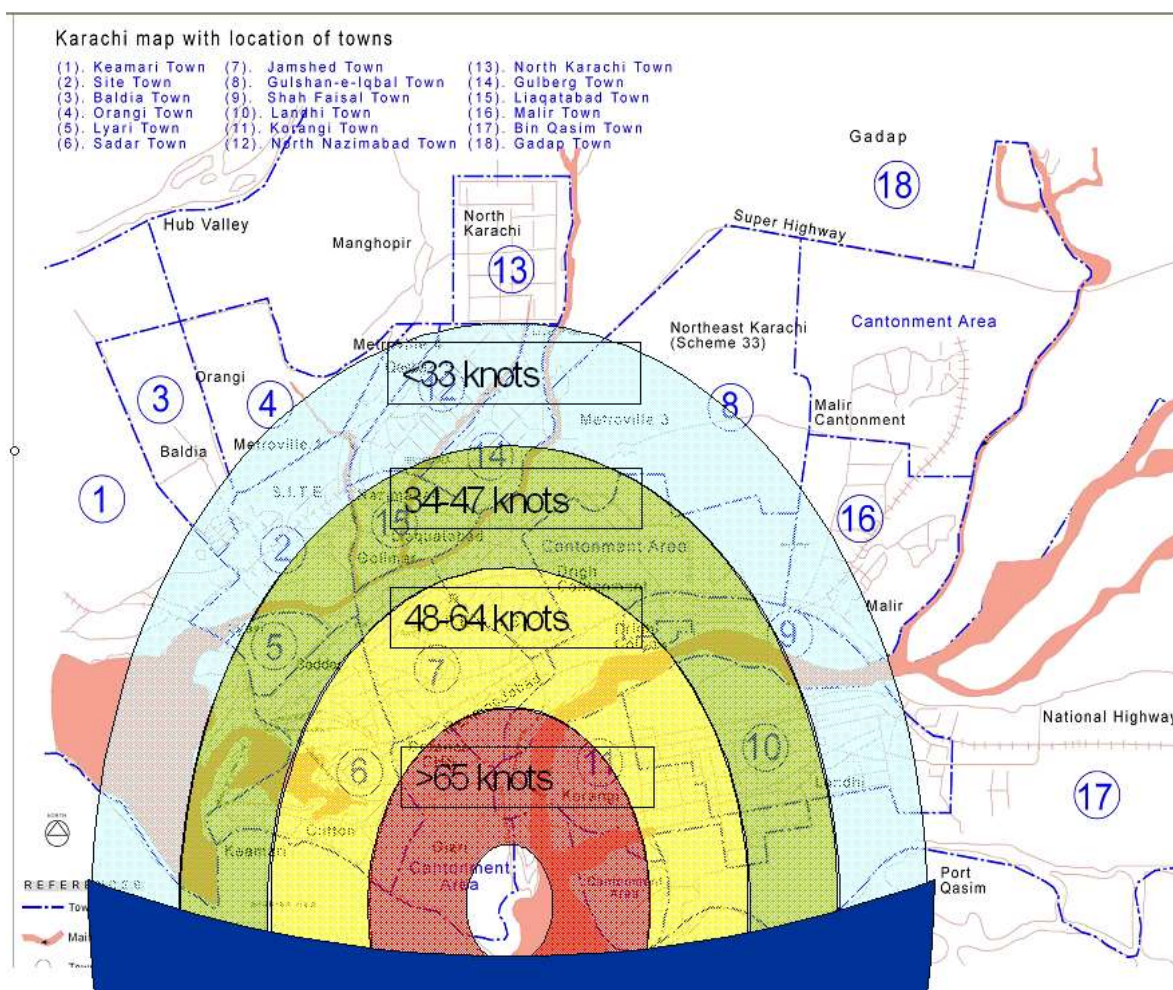
### Precipitation Impact in Cyclone Scenario I





## GRAPHIC ILLUSTRATION OF SCENARIOS (Continues)

### Strong Winds Impact in Cyclone Scenario I

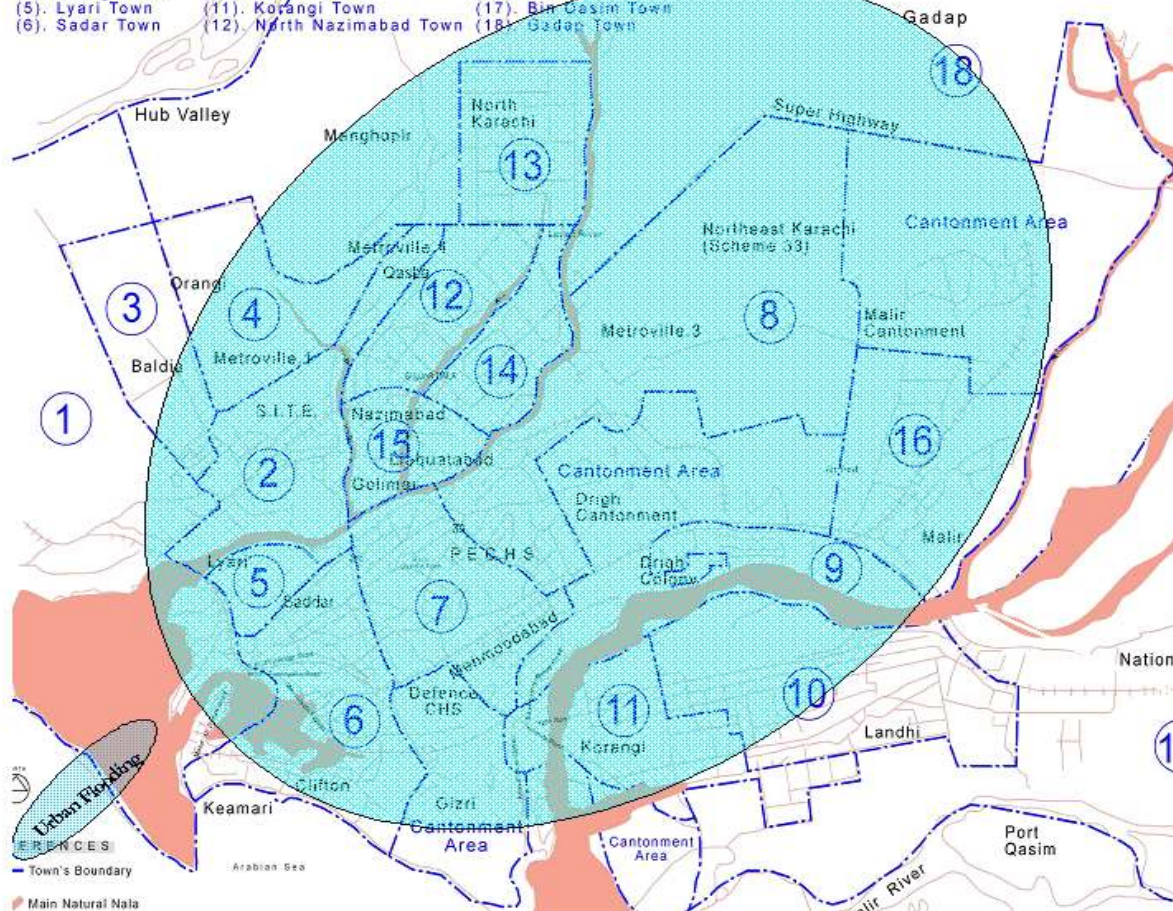


## GRAPHIC ILLUSTRATION OF SCENARIOS (Continues)

### Potential Threats of Urban Flooding Scenario I

Karachi map with location of towns

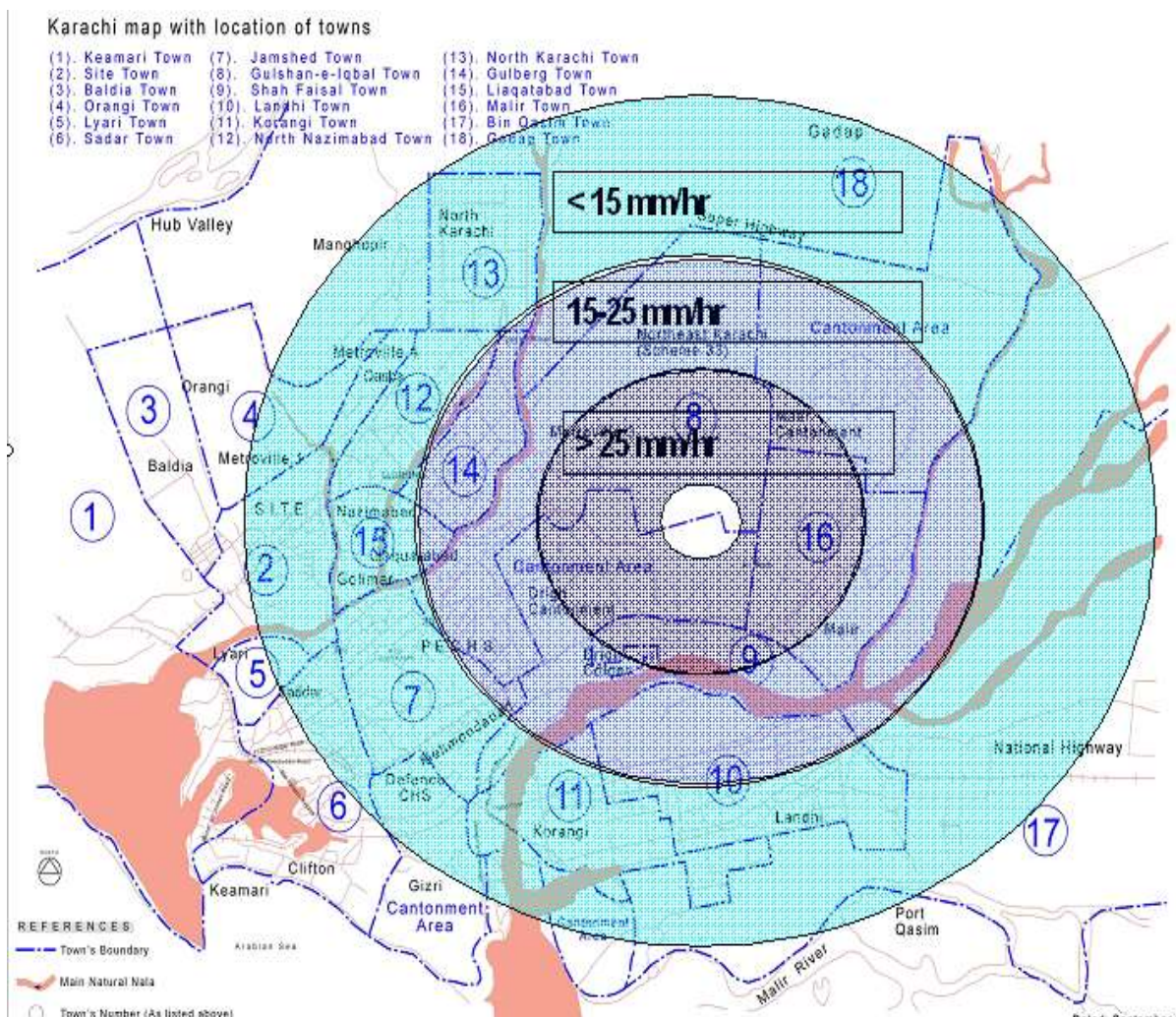
- |                   |                            |                          |
|-------------------|----------------------------|--------------------------|
| (1). Keamari Town | (7). Jamshed Town          | (13). North Karachi Town |
| (2). Site Town    | (8). Gulshan-e-Iqbal Town  | (14). Gulberg Town       |
| (3). Baldia Town  | (9). Shah Faisal Town      | (15). Liaqatabad Town    |
| (4). Orangi Town  | (10). Landhi Town          | (16). Malir Town         |
| (5). Lyari Town   | (11). Korangi Town         | (17). Bin Qasim Town     |
| (6). Sadar Town   | (12). North Nazimabad Town | (18). Gadap Town         |





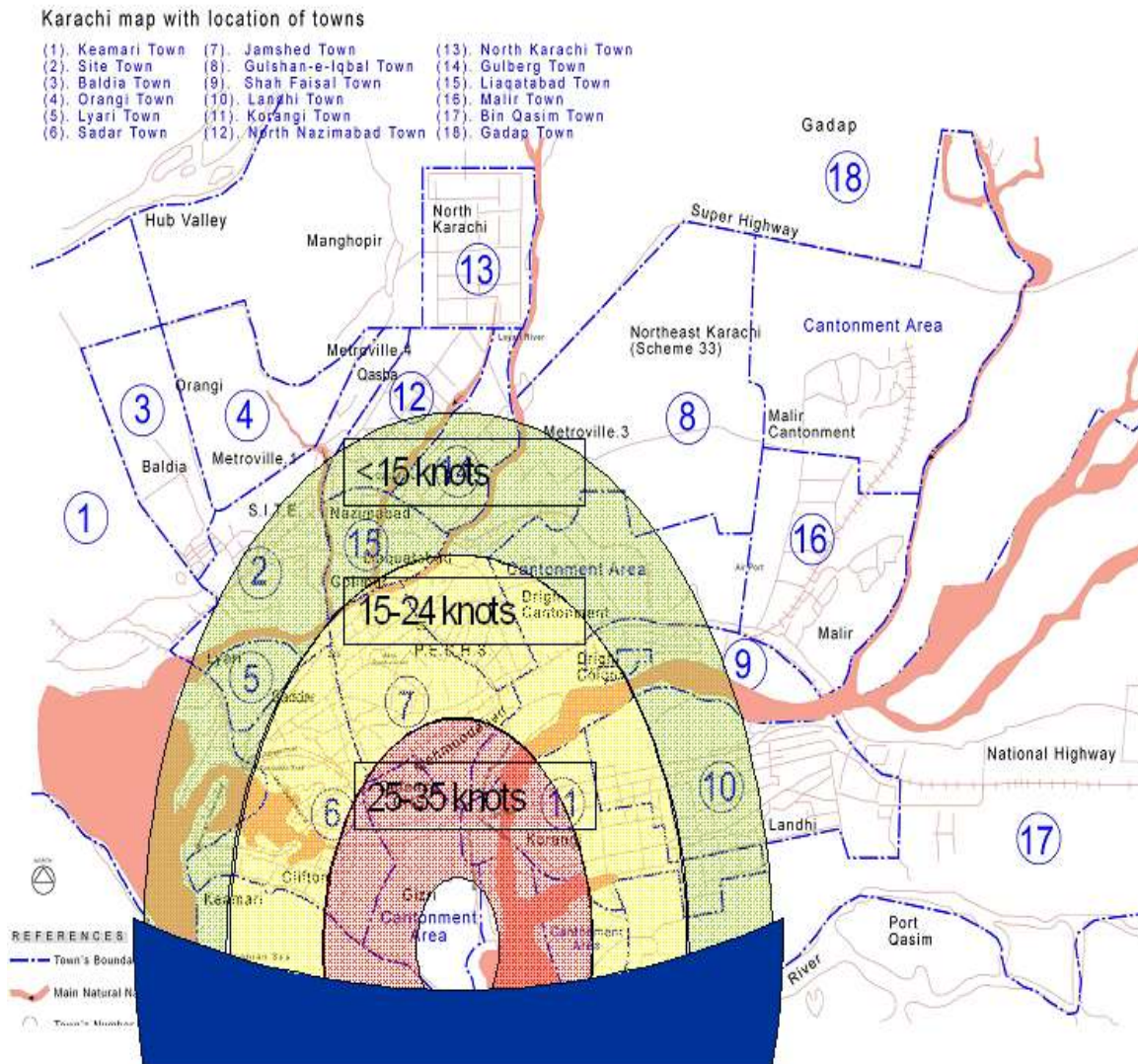
## GRAPHIC ILLUSTRATION OF SCENARIOS (Continues)

### Precipitation Impact in Scenario II



## GRAPHIC ILLUSTRATION OF SCENARIOS (Continues)

### Strong Winds Impact in Scenario II



**LIKELY HUMANITARIAN IMPACT OF CYCLONE IN KARACHI (SCENARIO 1)****Summary of Affected Population / Relief Caseload**

	Population	Affected Population	Possible Relief Caseload
Worst Affected Towns (5 Towns)	3,651,791	2,395,368	479,075
Moderately Affected Towns (2 Towns)	1,730,957	407,864	61,181
Towns Affected by Rains and Winds (13 Towns)	9,737,082	1,864,641	130,532
<b>Grand Total</b>	<b>15,119,830</b>	<b>4,667,873</b>	<b>670,788</b>

**Affected Pop / Relief Caseload in Worst Affected Towns due to Storm Surge, Rain & Wind Impact**

Town	Population	Affected Population		Possible Relief Caseload 20% of Affected Population
		%	Population	
Korangi	829,813	75	622,360	124,472
DHA	379,596	80	303,677	60,736
Saddar	935,566	70	654,897	130,980
Kemari	583,640	100	583,640	116,728
Lyari	923,176	25	230,794	46,159
<b>Total</b>	<b>3,651,791</b>		<b>2,395,368</b>	<b>479,075</b>

**Affected Pop / Relief Caseload in Moderately Affected Towns due to Storm Surge, Rain & Wind Impact**

Town	Population	Affected Population		Possible Relief Caseload 15% of Affected Population
		%	Population	
Jamshed Town	1,114,235	20	222,847	33,428
Baldia	616,722	30	185,017	27,753
<b>Total</b>	<b>1,730,957</b>		<b>407,864</b>	<b>61,181</b>

**Affected Pop / Relief Caseload Towns Affected by Rains and Winds Only**

Town	Population	Affected Population		Possible Relief Caseload 7% of Affected Population
		%	Population	
Shah Faisal	509,915	50	254,958	17,848
SITE	709,944	30	212,984	14,909
Nazimabad	753,423	20	150,687	10,549
Gadap	439,674	5	21,984	1,539
Gulshan Iqbal	949,351	10	94,936	6,645
Landhi	1,012,391	20	202,479	14,174
New Karachi	1,038,865	15	155,830	10,909
Orangi	1,098,859	25	274,715	19,231
Bin Qasim	480,854	5	24,043	1,684
Gulberg	688,580	25	172,145	12,051
Liaquatabad	985,581	25	246,396	17,248
Malir	604,763	5	30,239	2,117
Cantonment	464,882	5	23,245	1,628
<b>Total</b>	<b>9,737,082</b>		<b>1,864,641</b>	<b>130,532</b>

**Population to be Evacuated (Worst Affected Towns)**

Town	Population	50% of Total Population
Korangi	829,813	414,907
DHA	379,596	189,798
Saddar	935,566	467,783
Kemari	583,640	291,820
Lyari	923,176	461,588
<b>Total</b>	<b>3,651,791</b>	<b>1,825,896</b>



Annex HLIST OF HOSPITALS IN KARACHI

<b>Name of Hospital</b>	<b>Location</b>
<b>Administered by Federal Government / Armed Forces</b>	
Combined Military Hospital	Malir
Jinnah Postgraduate Medical Centre (1,185 beds)	Rafique Shaheed Road
National Institute of Cardiovascular diseases (360 beds)	Rafique Shaheed Road
National Institute of Child Health	Rafique Shaheed Road
PNS Rahat	Shah Faisal
PNS Shifa	DHA
Shoukat Omer Memorial Hospital	Shah Faisal
<b>Administered by Sindh Government</b>	
Civil Hospital	Babe Urdu Road
Kulsum Bai Valika Social Security Hospital	SITE
Nazimabad Chest Clinic	Nazimabad
Ojah Institute of Chest Diseases,	University Road
Police Hospital (50 bed)	Garden
Sindh Government Children Hospital	
Sindh Government Hospital	Korangi
Sindh Government Hospital	Liaquatabad
Sindh Government Hospital	Lyari
Sindh Government Hospital	New Karachi
Sindh Government Qatar Hospital	Orangi
Sindh Government Hospital	Saudabad
Sindh Government Hospital	Bin Qasim, Ibrahim Hydri
Sindh Services Hospital	M.A.Jinnah Road
Sindh Institute of Skin Diseases (50 bed)	Regal Chowk
Sindh Institute of Urology and Transplantation	Babe Urdu Road
Skin & Social Hygiene Centre	Saddar
Social Security Hospital	Landhi
<b>Administered by CDGK</b>	
Abbasi Shaheed Hospital	Nazimabad
Institute of Infection Diseases	Gadap
Karachi Institute of Heart Diseases (120 beds)	Gulberg
Karachi Institute of Radiotherapy and Nuclear Medicine	KDA Scheme 33
Spencer Eye Hospital	Lee Market
Sobhraj Maternity Home	Urdu Bazar
<b>Private Hospitals</b>	
Aga Khan University Hospital (542 beds)	Stadium Road
Bismillah Taquee Institute of Health Sciences & Blood Diseases Centre	Gulshan e Iqbal
Burhani Hospital	Saddar
Baqai University Hospital	Nazimabad
Chiniot General hospital	Korangi
Darul Sehat Hospital	Gulistan e Johar
Darul Shifa Imam Khomeini Hospital	Malir
Hamdard University Hospital	M.A. Jinnah Road
Ibne Sina Hospital Complex	Gulshan e Iqbal
Jinnah Medical College Hospital	Shaheed e Millat Road

Karachi National Hospital	M.A.Jinnah Road
Kharadar General Hospital	Kharadar
Layton Rahmatulla Benevolent Trust Eye Hospital (L.R.B.T.),	DHA
Liaquat National Hospital	Stadium Road
Nazimabad Hospital	Nazimabad
Nihal Hospital	Malir
National Medical Centre	DHA
Universal Medical Training Centre & Hospital	Nazimabad
Zainab Panjwani Memorial Hospital	Numaish
Dr. Zia Ud Din Hospital	Nazimabad, North Nazimabad, Clifton, Kemari



Annex JRESOURCE PERSONS

<b>Name</b>	<b>Sector</b>	<b>Contact No.</b>
Dr. Qamar Uz Zaman	PMD, Isb	051-9250367
Dr. Ghulam Rasool	PMD, Isb	051-9250369
Vice Admiral Tayyab Ali Dogar	Pak Navy (MSA)	021-9214619, 48508941
Commodore Ifthikhar Ahmad	Pak Navy (COMKAR)	
Brig. Akhtar Rao	HQ Engrs 5 Corps	021-560-2350
Mr. Muhamad Suleman Chandio	Water & Sewerage	
Lt. Col Talat Janjua	Pak Rangers	021-9205255
Mr. Muhammad Tauseef Alam	PMD	051-9250360-63
Mr. Arshad Ifthikhar	WAPDA	
Mr. Anwar Ali	WAPDA	
Mr. Noor Mohammad Baloch	Fisheries Forum	
Mr. Mir Muhammad Khaskheli	Railways	051-9203068
Mr. Saindad Tunio	Board of Revenue	
Mr. Abid Arifeen	Fisheries	
Wing Commander Syed Naseem Ahmad	CAA	
Commodore Qaiser Aziz	Pak Navy (MSA)	021-9214619, 48508941
Commodore Adnan Abdullah	Pak Navy (MSA)	021-9214619, 48508941
Commodore Khalid Pervez	Pak Navy HQ COMKAR	
Major Shahid Javaid	Pak Coast Guard	
Lt. Col ( R ) Pervez Anwar Gill	SSGC	
Capt. (R) M. Arif	SSGC	
Lt. Comdr ( R ) Ghulam Hussain Shah	KPT	
Commodore Munir Hussain	KSEW	
Major Adil Muhammad	NDMA	051-9213083
Mr. Amir Mohiuddin	NDMA	051-9008447
Lt. Col. Mumtaz	HQ Engrs 5 Corps	021-560-2350
Brig. (R) Abdul Qayyum	Pakistan Steel Mills	
Mr. Imam Baksh Baloch	KPT	
Mr. Barkat Ali Jatoi	Sindh Industrial Trading Estate (SITE)	
Mr. Munir A. Memon	Relief Department Sindh	
Mr. Khuda Baksh	Municipal Services (CDGK)	

**KARACHI CITY MAP**

