

MHVRA

INFORMED DISASTER MANAGEMENT PLAN

2023-2032

DISTRICT SUJAWAL



DEVELOPED BY
PDMA SINDH



THROUGH
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PREFACE

Multi-Hazard Vulnerability Risk Assessment (MHVRA) and resultant database are the foundation for evidence-based disaster management plan. Such databases are also an integral part of the implementation of disaster risk reduction and disaster risk management strategies. The MHVRA study of the Sujawal district has been conducted successfully using high-resolution satellite imagery and its products like digital elevation models, historical disaster datasets, hydro-meteorological data, pertinent socio-economic data, and various other essential datasets. The hazard, vulnerability, and risk maps at Union Council (UC) level have been prepared and compiled as atlases. Using disaster risk information obtained through MHVRA, the disaster management plan of district Sujawal is prepared and being presented to disaster management practitioners, executors, and prominent stakeholders. Before the MHVRA study, the district-level disaster and contingency plans were prepared using conventional methods and human knowledge. In contrast, the MHVRA based disaster management plans are realistic, based on modern techniques and multiple data sources, therefore, are more authentic and reliable for planning and management of disasters in the district.

The disaster management plans are based on MHVRA study carried out to understand the hazard vulnerability and risk at UC levels. The multi-criteria approach used in this disaster management plan offers comprehensive understanding of vulnerable communities at UC levels, while offering concerned authorities with viable and best practices to minimize the hazard impacts to the communities. Also, cost-benefit analysis for recommended mitigation efforts provides clear actionable insights for relevant authorities to take necessary measures.

District-wise disaster management plans will be revised after 10 years on updation of the MHVRA study. The disaster management plan of Sujawal is comprehensive and covers guidelines on the complete spectrum of disaster management and standard operating procedures to efficiently cope with disasters and emergencies in the district.

The disaster management plan is duly approved by Provincial Disaster Management Board and demands its proactive implementation in true letter and spirit. The proactive implementation of the plan will ensure reduced disaster losses and damages in the district.

ACKNOWLEDGEMENTS

Multi-Hazard Vulnerability Risk Assessment (MHVRA) based Informed Disaster Management Plan (IDMP) for Sindh Province will help to strengthen the institutional and community level capacity to plan and implement natural hazard risk preparedness, recovery, and reduction in the province through capacity building, public education, and awareness by undertaking steps to reinforce physical, environmental and economic elements, as well as psychosocial wellbeing of communities.

SUPARCO appreciates and acknowledges the efforts of the project officials and professionals' team in preparing this comprehensive IDMP. We would also like to extend special thanks to the Project Director and Project Coordinator, Sindh Resilience Project (SRP), for their valuable inputs and necessary support required during the execution of different project activities.

- - Disclaimer - -

The Informed Disaster Management Plan (IDMP), the product of “Multi-Hazard Vulnerability Risk Assessment (MHVRA) Study” developed for Provincial Disaster Management Authority (PDMA) Sindh under Sindh Resilience Project (PDMA Component) by Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) is based on results of MHVRA 2022 study, satellite imagery, data and information obtained from concerned departments and verifiable online sources. Every effort has been made to make this plan practical and free of errors, however, PDMA Sindh or SUPARCO are not liable for any discrepancy in data obtained from various departments. The Informed Disaster Management Plan or any part of it is not to be used for legal or litigation matters and commercial use. However, the information contained in the IDMP or any part of the IDMP can be used without prior permission of PDMA Sindh with proper citation and acknowledgements.

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INTRODUCTION TO DISASTER MANAGEMENT PLAN OF DISTRICT SUJAWAL

INTRODUCTION

As per the declaration of National Disaster Management Act 2010, the districts are required to develop disaster management plans to effectively cope with disasters and emergencies at district level. The objective of district wise disaster management plan is to adopt a proactive approach in managing disaster risk by building capacity and strengthening institutional mechanisms. The plan is aimed to provide direction and guidelines to district governments and other stakeholders, in a paradigm shift from reactive to a proactive approach, and to layout the standard operating procedures to be followed in the complete cycle of disaster management.

Multi-Hazard Vulnerability and Risk Assessment (MHVRA) is integral for proactive risk management, hence under Sindh Resilience Project (PDMA Component), MHVRA has been conducted at the Provincial level. MHVRA is a multi-disciplinary process involving the quantification of the frequency and intensity of possible hazard(s), the assessment of the elements that can be destroyed or damaged from possible disasters, and the degree of the damage each element can sustain when affected by certain disasters of various intensities. The assessment of hazard, exposure, vulnerability and capacity leads to the risk assessment, which indicates the anticipated damages in case of a possible disaster. Disaster risk assessment is normally the first step in planning for disaster management activities. It provides an evidence-based estimation of the risk so that effective risk reduction measures can be employed appropriately and cost-effectively.

The development of MHVRA informed disaster management plan is based on diversified information sources including satellite remote sensing, Digital Elevation Model (DEM), and pertinent information collected from concerned departments. The outcomes for MHVRA study are depicted in atlas including; landuse / landcover, critical infrastructure, hazard, exposure, vulnerability, and risk maps of cyclone and storm surge, drought, earthquake, flood, heatwave, and tsunami at UC level.

The MHVRA Informed Disaster Management Plan is a significant step towards disaster resilient Sindh because the foundation of disaster management plan is laid on realistic disaster risk identification and efficient need-based disaster preparedness and response measures. UC-level multi-disaster risk identification will not only enable active and effective disaster preparedness but also help in disaster risk reduction at the grass-root level. In addition, the plan is intended to strengthen the district disaster management system and provide guidance on pre-disaster preparedness, coordinated response and recovery through implementable agenda.

VISION

Vision of MHVRA Informed Disaster Management Plan is;

- To identify underlying UC level multi-disaster risks in administrative districts of Sindh province.
- To develop realistic Disaster Management Plan for proactive disaster management.
- To ensure prioritization of disaster risk reduction measures at UC level.
- To enforce better coordination for disaster response.
- To improve rehabilitation plans for restoration of livelihood, and organizational capacities of affected communities.

OBJECTIVES

The plan is intended to meet following objectives in 10 years;

1. Building disaster resilience capacity at UC level to minimize the loss of lives, livelihood, assets and environment.
2. Improved understanding of disaster risk, hazard and vulnerabilities to strengthen disaster governance from local level to provincial level.
3. Enhanced preparedness to improve disaster response at grass-root level.
4. Promote and facilitate Disaster Risk Reduction (DRR) in planning and implementation of development projects to increase resilience.
5. Provide clarity on roles and responsibilities of various departments and stakeholders involved in different aspects of disaster management.
6. Promote "Build Back Better" principle in recovery, rehabilitation and reconstruction.
7. Promote social inclusion and communities as partners to reduce and manage disaster risk.
8. Promote disaster prevention and mitigation culture at local level.

REVIEW OF MHVRA INFORMED DISASTER MANAGEMENT PLAN

The MHVRA Informed Disaster Management Plan is planned to be effective for 10 years starting from January 2023 to December 2032 and requires review before completion of 10 years. Periodic review is essential because of following reasons;

1. During 10 years, there will be likely chances of new development in the district hence, vulnerability, exposure, and risk assessment will require updation.

1. Planning is a dynamic process, therefore, disaster management plan must be reviewed periodically to incorporate changes according to the emergence of new eminent disasters and situations.
2. Climate is a dynamic driver of changing hazard risks, therefore, it is important to review disaster management plan in changing disaster scenarios.

Additionally, it is also recommended to review the plan after the occurrence of each disaster event to measure its effectiveness. Necessary adjustment may be carried out in the plan accordingly.

Foregoing in view, it is recommended to formulate a committee to review the disaster management plan. A review of the plan shall be carried out by the concerned DDMA under the supervisory role of PDMA Sindh. Recommended composition of the plan review committee is as follows;

Table 1: Recommended Committee for Reviewing Disaster Management Plan

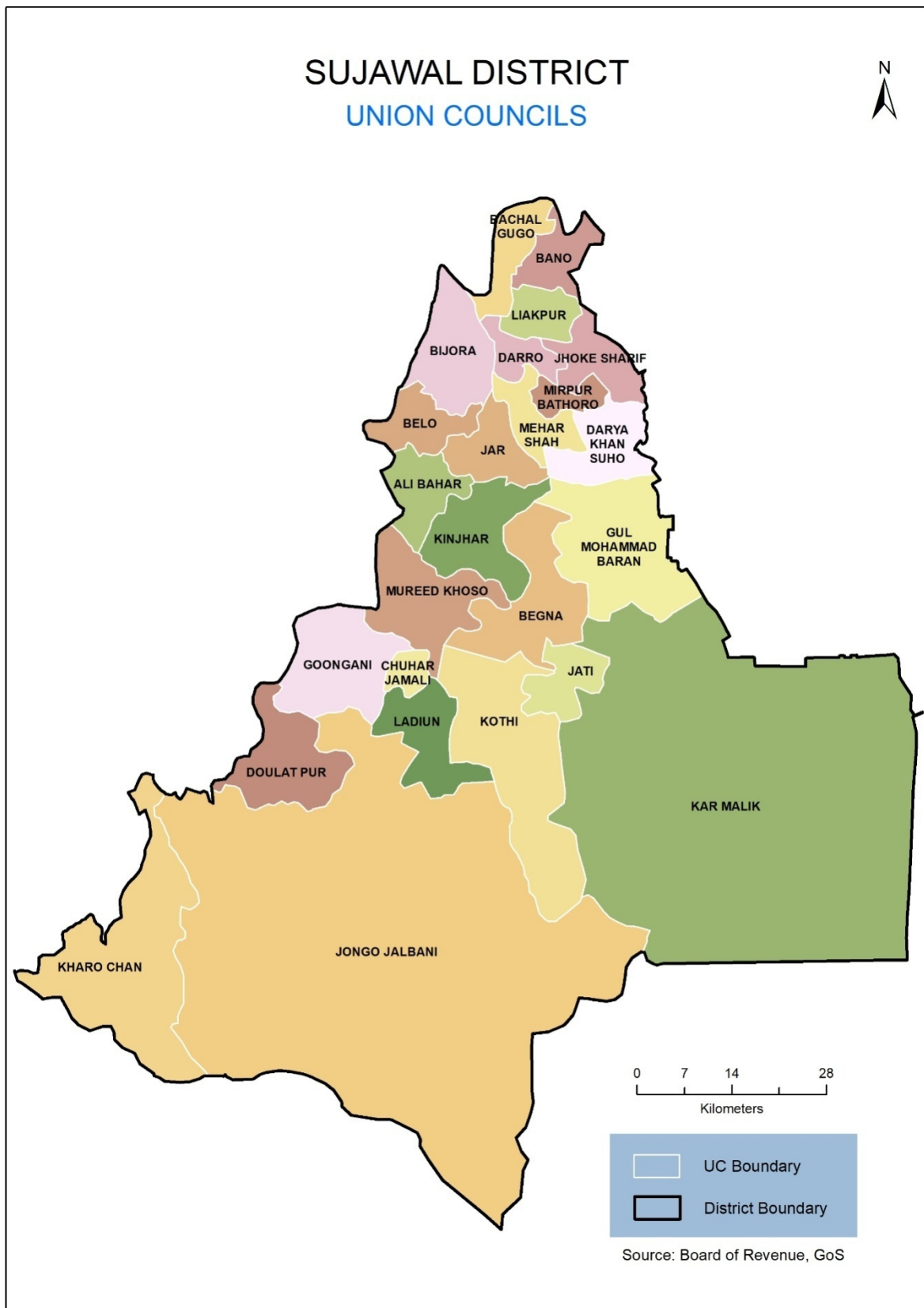
Committee Representative	Role
DG, PDMA Sindh / Dir Ops PDMA	Chairman
Concerned DC or representative officer	Member
Concerned officer from local government	Member
Elected representative of the concerned district	Member
Representatives from disaster affected communities	Member (s)
Representative from SUPARCO	Member
Representative from research / academia experienced in disaster management field	Member (s)
Representative from UN Organization on disaster related domains in Pakistan, especially in Sindh	Member
Representative from reputed NGO working on disaster related domains especially in Sindh	Member

MODES OF REVIEW

Preferred modes of review of plan are;

- a. For a post-disaster review of the plan, PDMA shall conduct a questionnaire-based survey covering pertinent questions to identify gaps or issues in the plan. A questionnaire-based survey can be conducted through online survey services or organizing online meetings. Once issues have been identified by the committee, necessary changes be incorporated in the plan and the revised plan be approved by review committee.
- b. For review before the expiry of the validity of the plan, necessary updation in baseline mapping i.e., hazard, exposure, vulnerability, and risk assessment be carried out to incorporate new developments and disaster situations. Once, baseline mapping is updated, plan is to be updated accordingly. The review committee shall vet the updation of the plan in the light of experience and recommendations. Upon approval from the review committee, the plan shall be effective for next 10-years.

DISASTER RISK PROFILE OF DISTRICT SUJAWAL



GEOGRAPHY

District area in Sq. Km	8,826	
Coordinates	Longitude 68° 1' 38" to 68° 45' 28" East Latitude 23° 58' 17" to 24° 49' 56" North	
Surrounding Districts	Thatta in the West Badin in East Arabian Sea and Indus Deltaic Region in the South Tando M. Khan in the North	
Climate Conditions	Warm and Semi-Arid	
Coldest Month	January	
Hottest Month	May	
Seasonal Temperatures	Max Mean (°C)	Min Mean (°C)
Spring (March and April)	35.77	21.52
Dry Summer (May and June)	37.98	27.48
Wet Summer (July to September)	34.73	26.66
Autumn (October to November)	34.45	21.08
Winter (December to February)	28.13	14.23
Average Rainfall	178.84 mm/year	
Physiographic Features	Arabian sea on the south with Indus deltaic region Indus river flows along the western boundary of the district	

DEMOGRAPHY

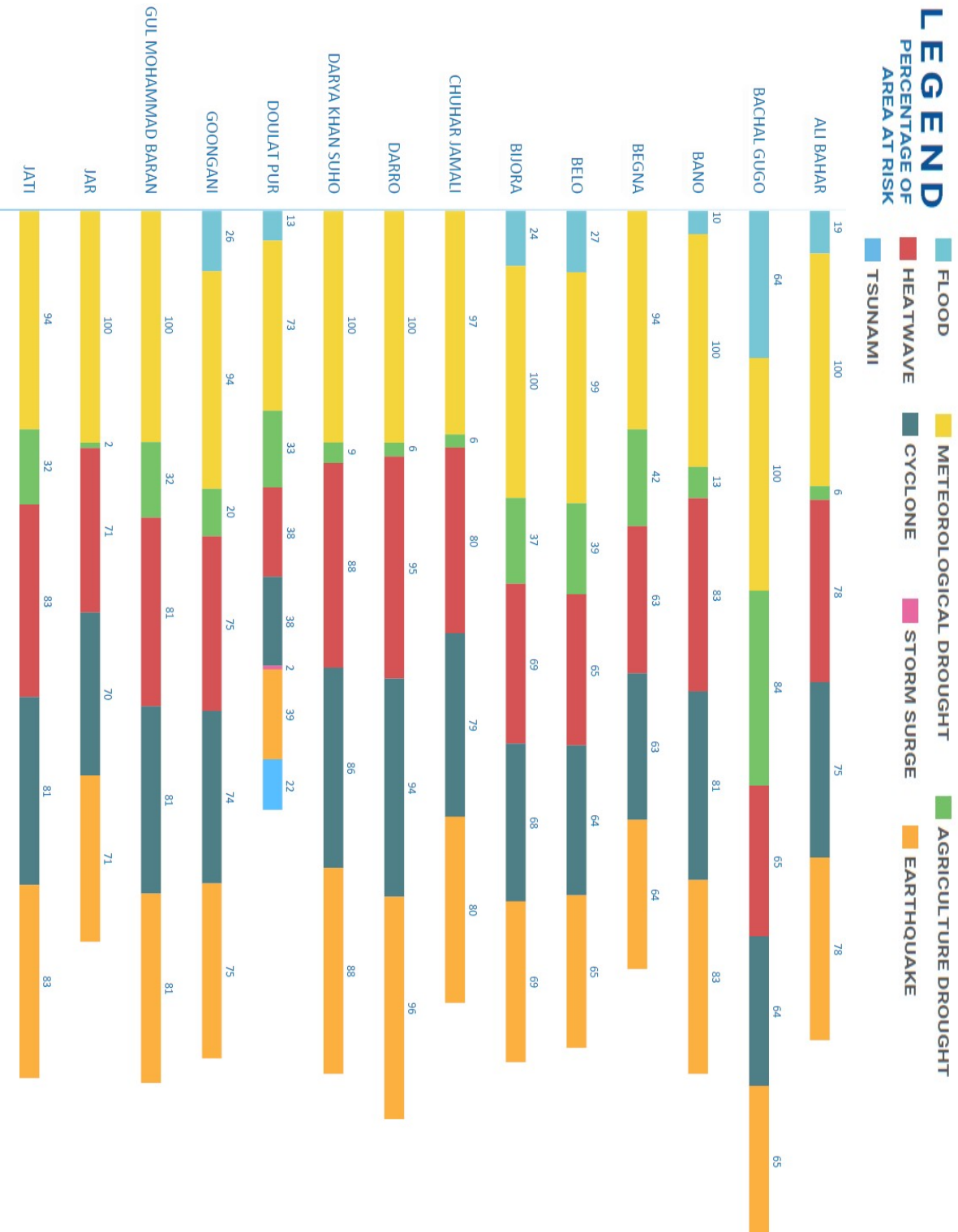
	Year-1998	Year-2017
Population	513,702	779,062
Urban	61,035	85,496
Rural	452,667	693,566
No. of Household	-	153,018
Average Annual Growth Rate 1998-2017	2.21 %	

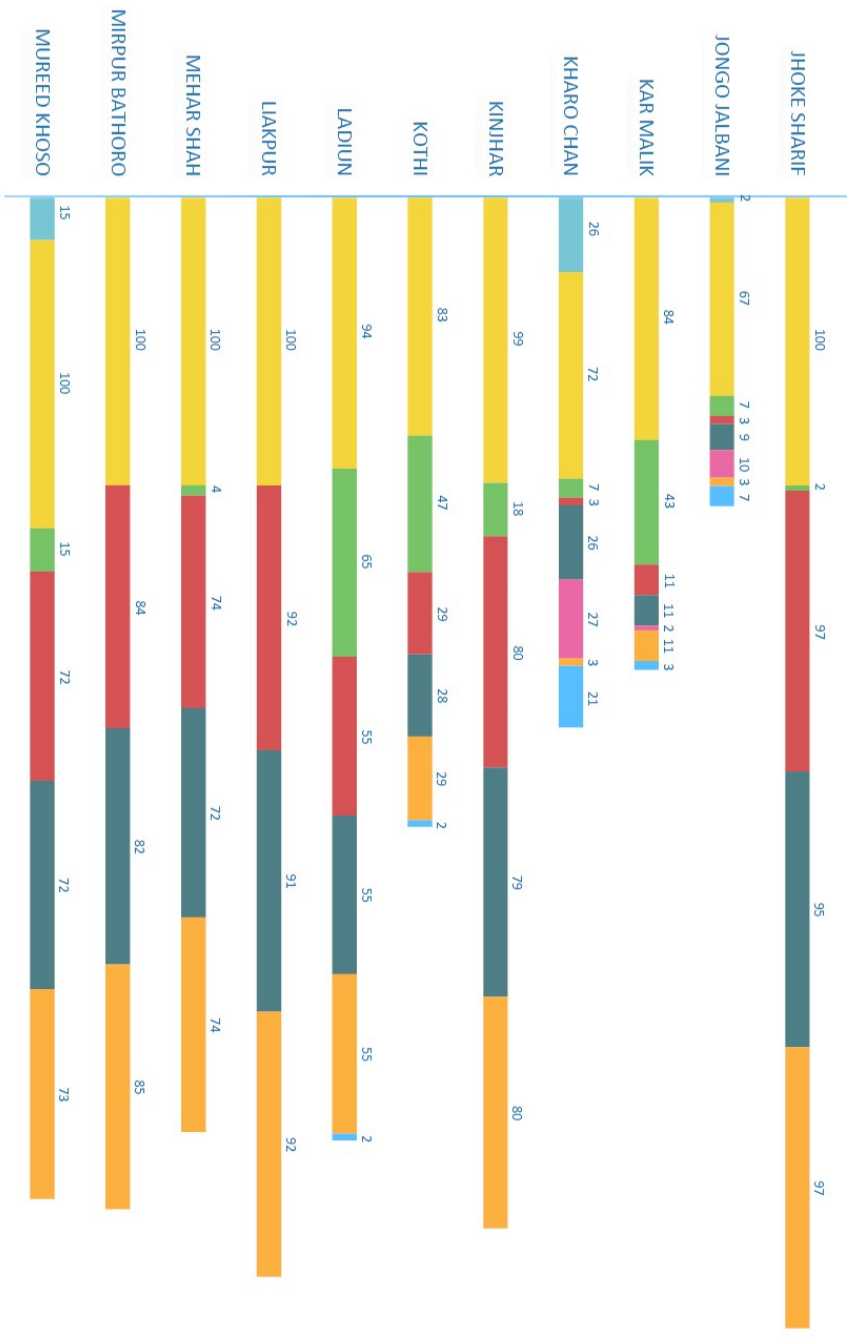
ECONOMY

Industries	Agriculture and fisheries are two major sources
Agriculture	Production in M.tons as per (2016-17)
Major Crops	
Rice	2,002,364
Wheat	233,979
Sugarcane	23,608
Cotton	54,185
Minor Crops	
Bajra	26
Jowar	123
Maize	1,108
Barley	1,279

TALUKA NAMES	UC NAMES
<ol style="list-style-type: none"> 1. Jati Taluka 2. Kharo Chan Taluka 3. Mirpur Bathoro Taluka 4. Shah Bunder Taluka 5. Sujawal Taluka 	<ol style="list-style-type: none"> 1. Ali Bahar 2. Bachal Gugo 3. Bano 4. Begna 5. Belo 6. Bijora 7. Chuhar Jamali 8. Darro 9. Darya Khan Suho 10. Doulat Pur 11. Goongani 12. Gul Mohammad Baran 13. Jar 14. Jati 15. Jhoke Sharif 16. Jongo Jalbani 17. Kar Malik 18. Kharo Chan 19. Kinjhar 20. Kothi 21. Ladiun 22. Liakpur 23. Mehar Shah 24. Mirpur Bathoro 25. Mureed Khoso

SUJAWAL DISTRICT MULTI-HAZARD RISK PROFILES





Ali Bahar			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	80.764 sq km
		Forest Area	0.047 sq km
		Natural Vegetation in Wet Areas	0.083 sq km
		Pakka Unplanned Area	3.533 sq km
		Range Land	0.104 sq km
		Ambulance Services	1
		Bridges	7
		Bus Stops	1
		Education Facilities	13
		Health Facilities	11
		Industries	1
		Mobile Towers	7
		Petrol Pumps	10
		Police Stations	2
		Post Offices	1
		Settlements	31
		Irrigation and Drainage Network	62.649 km
		Road Network	121.783 km
Population	72061		
Household	14205		
Meteorological Drought	Medium - Extreme	Settlements	31
		Agriculture Area	81.056 sq km
		Forest Area	0.478 sq km
		Natural Vegetation in Wet Areas	9.361 sq km
		Range Land	1.955 sq km
		Water Body	2.891 sq km
		Wet Area	4.889 sq km
		Population	60001
		Household	11828
Agricultural Drought	Low - Medium	Agriculture Area	4.051 sq km
		Forest Area	0.186 sq km
		Natural Vegetation in Wet Areas	2.387 sq km
		Range Land	0.825 sq km
		Water Body	0.188 sq km
		Wet Area	0.017 sq km

		Population	80
		Household	16
Heatwave	Low - Extreme	Settlements	31
		Population	59659
		Household	11761
		Agriculture Area	80.673 sq km
		Pakka Unplanned Area	3.536 sq km
Cyclone	Low	Agriculture Area	80.717 sq km
		Forest Area	0.019 sq km
		Natural Vegetation in Wet Areas	0.067 sq km
		Pakka Unplanned Area	0.456 sq km
		Range Land	0.052 sq km
		Bridges	7
		Education Facilities	4
		Health Facilities	2
		Industries	1
		Petrol Pumps	7
		Settlements	31
		Irrigation and Drainage Network	56.593 km
		Road Network	107.764 km
		Population	10297
		Household	2025
Riverine Flood	Low - Extreme	Agriculture Area	13.633 sq km
		Natural Vegetation in Wet Areas	6.314 sq km
		Pakka Unplanned Area	0.076 sq km
		Range Land	0.001 sq km
		Settlements	2
		Irrigation and Drainage Network	1.5 km
		Road Network	5.742 km
		Population	2107
		Household	412
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	

Bachal Gugo			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	60.933 sq km
		Forest Area	0.007 sq km
		Natural Vegetation in Wet Areas	0.324 sq km
		Pakka Unplanned Area	0.593 sq km
		Range Land	0.014 sq km
		Education Facilities	3
		Health Facilities	2
		Settlements	10
		Irrigation and Drainage Network	14.314 km
		Road Network	29.638 km
		Population	11495
		Household	2236
Meteorological Drought	Medium - Extreme	Settlements	10
		Agriculture Area	61.246 sq km
		Forest Area	0.318 sq km
		Natural Vegetation in Wet Areas	30.867 sq km
		Range Land	0.214 sq km
		Wet Area	0.737 sq km
		Population	9556
		Household	1859
Agricultural Drought	Low - High	Settlements	2
		Agriculture Area	58.971 sq km
		Forest Area	0.385 sq km
		Natural Vegetation in Wet Areas	37.482 sq km
		Range Land	0.259 sq km
		Wet Area	0.007 sq km
		Population	532
		Household	104
Heatwave	Low - Extreme	Settlements	9
		Population	9506
		Household	1847
		Agriculture Area	60.86 sq km
		Pakka Unplanned Area	0.595 sq km
Cyclone	Low	Agriculture Area	60.917 sq km
		Forest Area	0.007 sq km
		Natural Vegetation in Wet Areas	0.278 sq km

		Pakka Unplanned Area	0.075 sq km
		Range Land	0.013 sq km
		Settlements	10
		Irrigation and Drainage Network	13.921 km
		Road Network	24.902 km
		Population	1460
		Household	284
Riverine Flood	Low - Extreme	Agriculture Area	42.378 sq km
		Natural Vegetation in Wet Areas	18.37 sq km
		Pakka Unplanned Area	0.007 sq km
		Irrigation and Drainage Network	4.451 km
		Road Network	0.336 km
		Population	145
		Household	28
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	

Bano			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	69.989 sq km
		Forest Area	0.004 sq km
		Natural Vegetation in Wet Areas	0.11 sq km
		Pakka Unplanned Area	2.041 sq km
		Range Land	0.052 sq km
		Bridges	1
		Education Facilities	4
		Police Stations	1
		Settlements	58
		Irrigation and Drainage Network	55.728 km
		Road Network	96.017 km
		Population	39602
Household	7695		
Meteorological Drought	Medium – Extreme	Settlements	58
		Agriculture Area	70.211 sq km
		Forest Area	0.13 sq km
		Natural Vegetation in Wet Areas	3.918 sq km

		Range Land	0.668 sq km
		Wet Area	9.257 sq km
		Population	33030
		Household	6419
Agricultural Drought	Low - Medium	Settlements	1
		Agriculture Area	8.886 sq km
		Forest Area	0.157 sq km
		Natural Vegetation in Wet Areas	4.582 sq km
		Range Land	0.614 sq km
		Wet Area	0.031 sq km
		Population	449
		Household	86
Heatwave	Low - Extreme	Settlements	56
		Population	32744
		Household	6363
		Agriculture Area	69.907 sq km
		Pakka Unplanned Area	2.05 sq km
Cyclone	Low	Agriculture Area	69.928 sq km
		Forest Area	0.004 sq km
		Natural Vegetation in Wet Areas	0.031 sq km
		Pakka Unplanned Area	0.428 sq km
		Range Land	0.015 sq km
		Bridges	1
		Settlements	58
		Irrigation and Drainage Network	49.103 km
		Road Network	83.431 km
		Population	8301
Household	1614		
Riverine Flood	Low - Extreme	Agriculture Area	5.616 sq km
		Forest Area	0.092 sq km
		Natural Vegetation in Wet Areas	3.34 sq km
		Pakka Unplanned Area	0.003 sq km
		Range Land	0.001 sq km
		Irrigation and Drainage Network	1.105 km
		Road Network	1.031 km
		Population	62
Household	12		

Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge

Begna			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	148.046 sq km
		Kachcha Area	0.083 sq km
		Natural Vegetation in Wet Areas	0.099 sq km
		Pakka Unplanned Area	0.875 sq km
		Range Land	0.636 sq km
		Bridges	2
		Education Facilities	1
		Health Facilities	2
		Petrol Pumps	1
		Settlements	56
		Irrigation and Drainage Network	130.313 km
		Road Network	201.61 km
		Population	26270
		Household	5143
Meteorological Drought	Medium - Extreme	Settlements	55
		Agriculture Area	148.896 sq km
		Natural Vegetation in Wet Areas	5.966 sq km
		Range Land	12.335 sq km
		Water Body	2.986 sq km
		Wet Area	51.754 sq km
		Population	22093
		Household	4327
Agricultural Drought	Low - High	Settlements	12
		Agriculture Area	65.571 sq km
		Natural Vegetation in Wet Areas	7.138 sq km
		Range Land	11.639 sq km
		Water Body	3.35 sq km
		Wet Area	30.881 sq km
		Population	907
		Household	178
Heatwave	Low - Extreme	Settlements	46
		Population	21827

		Household	4274
		Agriculture Area	147.718 sq km
		Kachcha Area	0.083 sq km
		Pakka Unplanned Area	0.876 sq km
Cyclone	Low	Agriculture Area	147.993 sq km
		Kachcha Area	0.083 sq km
		Natural Vegetation in Wet Areas	0.025 sq km
		Pakka Unplanned Area	0.112 sq km
		Range Land	0.249 sq km
		Bridges	2
		Settlements	56
		Irrigation and Drainage Network	83.611 km
		Road Network	137.816 km
		Population	5337
		Household	1044
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Belo			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	62.707 sq km
		Forest Area	0.01 sq km
		Natural Vegetation in Wet Areas	0.324 sq km
		Pakka Unplanned Area	0.633 sq km
		Range Land	0.101 sq km
		Bridges	1
		Bus Stops	1
		Mobile Towers	1
		Petrol Pumps	1
		Settlements	27
		Irrigation and Drainage Network	31.811 km
		Road Network	76.578 km
		Population	15921
		Household	3137
Meteorological	Medium - Extreme	Settlements	27

Drought		Agriculture Area	62.99 sq km
		Forest Area	0.575 sq km
		Natural Vegetation in Wet Areas	14.067 sq km
		Range Land	1.539 sq km
		Water Body	3.209 sq km
		Wet Area	12.864 sq km
		Population	13301
		Household	2621
Agricultural Drought	Low - High	Settlements	2
		Agriculture Area	26.804 sq km
		Forest Area	0.689 sq km
		Natural Vegetation in Wet Areas	16.638 sq km
		Range Land	0.231 sq km
		Water Body	1.857 sq km
		Wet Area	0.076 sq km
		Population	914
		Household	181
Heatwave	Low - Extreme	Settlements	27
		Population	13203
		Household	2601
		Agriculture Area	62.601 sq km
		Pakka Unplanned Area	0.636 sq km
Cyclone	Low	Agriculture Area	62.677 sq km
		Forest Area	0.008 sq km
		Natural Vegetation in Wet Areas	0.15 sq km
		Pakka Unplanned Area	0.152 sq km
		Range Land	0.013 sq km
		Mobile Towers	1
		Settlements	27
		Irrigation and Drainage Network	23.118 km
		Road Network	54.112 km
		Population	3822
		Household	755
Riverine Flood	Low - Extreme	Agriculture Area	19.193 sq km
		Natural Vegetation in Wet Areas	6.847 sq km
		Pakka Unplanned Area	0.16 sq km
		Range Land	0.001 sq km
		Bridges	1

		Settlements	3
		Irrigation and Drainage Network	0.004 km
		Road Network	4.806 km
		Population	4033
		Household	796
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	

Bijora			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	116.289 sq km
		Forest Area	0.089 sq km
		Kachcha Area	0.042 sq km
		Natural Vegetation in Wet Areas	0.413 sq km
		Pakka Unplanned Area	1.928 sq km
		Range Land	0.038 sq km
		Bridges	1
		Education Facilities	1
		Health Facilities	2
		Settlements	56
		Irrigation and Drainage Network	51.385 km
		Road Network	130.401 km
		Population	49532
Household	9753		
Meteorological Drought	Medium - Extreme	Settlements	56
		Agriculture Area	116.88 sq km
		Forest Area	9.296 sq km
		Natural Vegetation in Wet Areas	25.696 sq km
		Range Land	1.084 sq km
		Water Body	3.081 sq km
		Wet Area	12.673 sq km
		Population	41377
Household	8144		
Agricultural Drought	Low - Medium	Settlements	6
		Agriculture Area	43.362 sq km
		Forest Area	8.906 sq km
		Natural Vegetation in Wet Areas	23.501 sq km

		Water Body	0.194 sq km
		Wet Area	0.931 sq km
		Population	5029
		Household	988
Heatwave	Low - Extreme	Settlements	56
		Population	41032
		Household	8082
		Agriculture Area	116.092 sq km
		Kachcha Area	0.042 sq km
		Pakka Unplanned Area	1.936 sq km
Cyclone	Low	Agriculture Area	116.213 sq km
		Forest Area	0.08 sq km
		Kachcha Area	0.042 sq km
		Natural Vegetation in Wet Areas	0.255 sq km
		Pakka Unplanned Area	0.456 sq km
		Range Land	0.023 sq km
		Bridges	1
		Health Facilities	2
		Settlements	56
		Irrigation and Drainage Network	44.29 km
		Road Network	100.13 km
		Population	12524
		Household	2469
Riverine Flood	Low - Extreme	Agriculture Area	24.781 sq km
		Kachcha Area	0.042 sq km
		Natural Vegetation in Wet Areas	16.663 sq km
		Pakka Unplanned Area	0.026 sq km
		Settlements	2
		Irrigation and Drainage Network	1.222 km
		Road Network	5.347 km
		Population	1705
Household	336		
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	

Chuhar Jamali			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	27.426 sq km
		Natural Vegetation in Wet Areas	0.007 sq km
		Pakka Unplanned Area	0.372 sq km
		Range Land	0.067 sq km
		Bridges	1
		Bus Stops	1
		Education Facilities	1
		Petrol Pumps	1
		Settlements	9
		Tourist Places	1
		Irrigation and Drainage Network	6.496 km
		Road Network	34.353 km
		Population	14141
Household	2779		
Meteorological Drought	Medium - Extreme	Settlements	9
		Agriculture Area	27.49 sq km
		Forest Area	0.059 sq km
		Natural Vegetation in Wet Areas	0.831 sq km
		Range Land	3.661 sq km
		Water Body	0.147 sq km
		Wet Area	1.114 sq km
		Population	11838
		Household	2326
Agricultural Drought	Low - Medium	Agriculture Area	0.019 sq km
		Forest Area	0.036 sq km
		Natural Vegetation in Wet Areas	0.339 sq km
		Range Land	1.401 sq km
		Wet Area	0.557 sq km
Heatwave	Low - Extreme	Settlements	9
		Population	11769
		Household	2313
		Agriculture Area	27.401 sq km
		Pakka Unplanned Area	0.373 sq km
Cyclone	Low	Agriculture Area	27.419 sq km
		Natural Vegetation in Wet Areas	0.007 sq km
		Pakka Unplanned Area	0.061 sq km

		Range Land	0.047 sq km
		Bridges	1
		Education Facilities	1
		Petrol Pumps	1
		Settlements	9
		Tourist Places	1
		Irrigation and Drainage Network	6.461 km
		Road Network	32.36 km
		Population	2314
		Household	454
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Darro			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	56.624 sq km
		Pakka Unplanned Area	1.189 sq km
		Range Land	0.015 sq km
		Bridges	1
		Education Facilities	9
		Health Facilities	5
		Mobile Towers	7
		Petrol Pumps	2
		Police Stations	1
		Settlements	34
		Irrigation and Drainage Network	51.156 km
		Road Network	69.222 km
		Population	23448
Household	4533		
Meteorological Drought	Medium - Extreme	Settlements	34
		Agriculture Area	56.703 sq km
		Range Land	0.169 sq km
		Water Body	0.016 sq km
		Wet Area	2.539 sq km
		Population	19541
Household	3778		

Agricultural Drought	Low	Agriculture Area	4.358 sq km
		Wet Area	0.007 sq km
		Population	13
		Household	2
Heatwave	Low - Extreme	Settlements	34
		Population	19432
		Household	3756
		Agriculture Area	56.593 sq km
		Pakka Unplanned Area	1.195 sq km
Cyclone	Low	Agriculture Area	56.603 sq km
		Pakka Unplanned Area	0.165 sq km
		Range Land	0.005 sq km
		Bridges	1
		Education Facilities	4
		Mobile Towers	2
		Petrol Pumps	1
		Settlements	34
		Irrigation and Drainage Network	48.226 km
		Road Network	62.592 km
		Population	3503
Household	683		
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Darya Khan Suho			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	114.199 sq km
		Forest Area	0.007 sq km
		Natural Vegetation in Wet Areas	0.021 sq km
		Pakka Planned Area	1.184 sq km
		Pakka Unplanned Area	1.857 sq km
		Range Land	0.009 sq km
		Bridges	5
		Bus Stops	2
		Education Facilities	2
Health Facilities	2		

		Industries	1
		Mobile Towers	1
		Petrol Pumps	4
		Settlements	83
		Irrigation and Drainage Network	83.587 km
		Road Network	89.238 km
		Population	36031
		Household	7001
Meteorological Drought	Medium - Extreme	Settlements	83
		Agriculture Area	114.495 sq km
		Forest Area	0.153 sq km
		Natural Vegetation in Wet Areas	1.08 sq km
		Range Land	0.586 sq km
		Water Body	0.428 sq km
		Wet Area	13.475 sq km
		Population	30123
		Household	5847
Agricultural Drought	Low - Medium	Settlements	2
		Agriculture Area	12.401 sq km
		Forest Area	0.136 sq km
		Natural Vegetation in Wet Areas	0.772 sq km
		Range Land	0.203 sq km
		Water Body	0.02 sq km
		Wet Area	0.712 sq km
		Population	814
		Household	158
Heatwave	Low - Extreme	Settlements	82
		Population	29853
		Household	5800
		Agriculture Area	114.072 sq km
		Pakka Planned Area	1.186 sq km
		Pakka Unplanned Area	1.862 sq km
Cyclone	Low	Agriculture Area	114.126 sq km
		Forest Area	0.001 sq km
		Natural Vegetation in Wet Areas	0.02 sq km
		Pakka Planned Area	0.025 sq km
		Pakka Unplanned Area	0.483 sq km
		Range Land	0.009 sq km

		Bridges	2
		Education Facilities	1
		Health Facilities	2
		Mobile Towers	1
		Settlements	83
		Irrigation and Drainage Network	70.359 km
		Road Network	68.735 km
		Population	9366
		Household	1817
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Doulat Pur			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	72.517 sq km
		Forest Area	0.112 sq km
		Kachcha Area	0.128 sq km
		Natural Vegetation in Wet Areas	0.28 sq km
		Pakka Unplanned Area	0.276 sq km
		Range Land	0.349 sq km
		Health Facilities	1
		Settlements	20
		Tourist Places	1
		Irrigation and Drainage Network	30.041 km
		Road Network	70.584 km
		Population	15330
		Household	3010
Meteorological Drought	Medium - Extreme	Settlements	20
		Agriculture Area	73.06 sq km
		Forest Area	2.327 sq km
		Natural Vegetation in Wet Areas	16.652 sq km
		Range Land	15.404 sq km
		Water Body	2.029 sq km
		Wet Area	27.138 sq km
		Population	13029
		Household	2560

Agricultural Drought	Low- Extreme	Settlements	1
		Agriculture Area	42.557 sq km
		Forest Area	1.531 sq km
		Natural Vegetation in Wet Areas	8.32 sq km
		Range Land	16.613 sq km
		Water Body	0.865 sq km
		Wet Area	5.709 sq km
		Population	452
		Household	89
Heatwave	Low - Extreme	Settlements	17
		Population	12775
		Household	2509
		Agriculture Area	72.292 sq km
		Kachcha Area	0.128 sq km
		Pakka Unplanned Area	0.276 sq km
Cyclone	Low	Agriculture Area	72.498 sq km
		Forest Area	0.058 sq km
		Kachcha Area	0.128 sq km
		Natural Vegetation in Wet Areas	0.2 sq km
		Pakka Unplanned Area	0.041 sq km
		Range Land	0.238 sq km
		Settlements	20
		Tourist Places	1
		Irrigation and Drainage Network	20.472 km
		Road Network	45.973 km
		Population	6412
		Household	1260
Tsunami	Low - High	Agriculture Area	27.726 sq km
		Forest Area	0.856 sq km
		Natural Vegetation in Wet Areas	4.042 sq km
		Pakka Unplanned Area	0.126 sq km
		Range Land	8.387 sq km
		Settlements	9
		Tourist Places	1
		Irrigation and Drainage Network	6.366 km
		Road Network	29.382 km
		Population	4803
		Household	942

Storm Surge	Low - Extreme	Agriculture Area	1.728 sq km
		Forest Area	0.035 sq km
		Natural Vegetation in Wet Areas	0.855 sq km
		Range Land	0.293 sq km
		Settlements	1
		Irrigation and Drainage Network	0.942 km
		Road Network	0.94 km
Riverine Flood	Low - Extreme	Agriculture Area	16.954 sq km
		Kachcha Area	0.128 sq km
		Natural Vegetation in Wet Areas	8.012 sq km
		Pakka Unplanned Area	0.003 sq km
		Range Land	0.00034 sq km
		Settlements	5
		Road Network	0.889 km
		Population	4960
		Household	973

Goongani			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	164.666 sq km
		Kachcha Area	0.068 sq km
		Natural Vegetation in Wet Areas	0.357 sq km
		Pakka Planned Area	0.021 sq km
		Pakka Unplanned Area	2.528 sq km
		Range Land	0.202 sq km
		Bridges	5
		Education Facilities	8
		Grain Mandi	1
		Health Facilities	6
		Mobile Towers	1
		Petrol Pumps	1
		Settlements	58
		Irrigation and Drainage Network	63.709 km
		Road Network	146.937 km
Population	81099		
Household	15656		
Meteorological Drought	Medium - Extreme	Settlements	58
		Agriculture Area	165.14 sq km

		Natural Vegetation in Wet Areas	20.478 sq km
		Range Land	14.485 sq km
		Water Body	1.185 sq km
		Wet Area	2.843 sq km
		Population	67840
		Household	13100
Agricultural Drought	Low - Extreme	Agriculture Area	30.088 sq km
		Natural Vegetation in Wet Areas	7.545 sq km
		Range Land	16.321 sq km
		Water Body	0.166 sq km
		Wet Area	0.462 sq km
		Population	112
		Household	22
Heatwave	Low - Extreme	Settlements	56
		Population	67494
		Household	13034
		Agriculture Area	164.472 sq km
		Kachcha Area	0.069 sq km
		Pakka Planned Area	0.021 sq km
		Pakka Unplanned Area	2.533 sq km
Cyclone	Low	Agriculture Area	164.614 sq km
		Kachcha Area	0.068 sq km
		Natural Vegetation in Wet Areas	0.216 sq km
		Pakka Planned Area	0.02 sq km
		Pakka Unplanned Area	0.37 sq km
		Range Land	0.153 sq km
		Bridges	5
		Education Facilities	3
		Health Facilities	2
		Petrol Pumps	1
		Settlements	58
		Irrigation and Drainage Network	55.397 km
		Road Network	131.706 km
		Population	14780
Household	2875		
Riverine Flood	Low - Extreme	Agriculture Area	47.871 sq km
		Kachcha Area	0.068 sq km
		Natural Vegetation in Wet Areas	9.652 sq km

		Pakka Unplanned Area	1.101 sq km
		Range Land	0.005 sq km
		Settlements	17
		Irrigation and Drainage Network	1.041 km
		Road Network	3.321 km
		Population	44409
		Household	8724
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	

Gul Mohammad Baran			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	260.177 sq km
		Forest Area	0.006 sq km
		Kachcha Area	0.163 sq km
		Natural Vegetation in Wet Areas	0.105 sq km
		Pakka Planned Area	0.086 sq km
		Pakka Unplanned Area	2.342 sq km
		Range Land	0.193 sq km
		Bridges	7
		Education Facilities	1
		Health Facilities	1
		Mobile Towers	1
		Petrol Pumps	1
		Settlements	90
		Irrigation and Drainage Network	125.114 km
		Road Network	300.978 km
Population	66508		
Household	13004		
Meteorological Drought	Medium - Extreme	Settlements	89
		Agriculture Area	260.856 sq km
		Forest Area	0.877 sq km
		Natural Vegetation in Wet Areas	9.785 sq km
		Range Land	4.451 sq km
		Water Body	1.811 sq km
		Wet Area	43.055 sq km
		Population	55780
		Household	10905

Agricultural Drought	Low - Extreme	Settlements	10
		Agriculture Area	85.276 sq km
		Forest Area	1.058 sq km
		Natural Vegetation in Wet Areas	9.861 sq km
		Range Land	5.022 sq km
		Water Body	0.804 sq km
		Wet Area	24.591 sq km
		Population	13355
		Household	2612
Heatwave	Low - Extreme	Settlements	86
		Population	55337
		Household	10816
		Agriculture Area	259.943 sq km
		Kachcha Area	0.164 sq km
		Pakka Planned Area	0.087 sq km
		Pakka Unplanned Area	2.352 sq km
Cyclone	Low	Agriculture Area	260.092 sq km
		Forest Area	0.006 sq km
		Kachcha Area	0.163 sq km
		Natural Vegetation in Wet Areas	0.036 sq km
		Pakka Planned Area	0.003 sq km
		Pakka Unplanned Area	0.554 sq km
		Range Land	0.104 sq km
		Bridges	7
		Mobile Towers	1
		Settlements	90
		Irrigation and Drainage Network	112.156 km
		Road Network	263.533 km
		Population	19262
Household	3767		
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Jar			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	76.302 sq km
		Pakka Unplanned Area	0.818 sq km
		Range Land	0.05 sq km
		Bridges	2
		Bus Stops	2
		Education Facilities	1
		Grid Stations	1
		Health Facilities	1
		Post Offices	1
		Power Plants	1
		Settlements	45
		Irrigation and Drainage Network	87.652 km
		Road Network	92.954 km
		Population	20568
Household	4051		
Meteorological Drought	Medium - Extreme	Settlements	45
		Agriculture Area	76.689 sq km
		Range Land	1.737 sq km
		Water Body	7.566 sq km
		Wet Area	22.842 sq km
		Population	17198
		Household	3388
Agricultural Drought	Low	Agriculture Area	1.964 sq km
		Range Land	0.152 sq km
		Water Body	0.925 sq km
		Wet Area	0.016 sq km
Heatwave	Low - Extreme	Settlements	45
		Population	17077
		Household	3365
		Agriculture Area	76.183 sq km
		Pakka Unplanned Area	0.822 sq km
Cyclone	Low	Agriculture Area	76.268 sq km
		Pakka Unplanned Area	0.21 sq km
		Range Land	0.034 sq km
		Bridges	1
		Bus Stops	2
		Education Facilities	1
Grid Stations	1		

		Health Facilities	1
		Post Offices	1
		Power Plants	1
		Settlements	45
		Irrigation and Drainage Network	62.412 km
		Road Network	68.695 km
		Population	5286
		Household	1039
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Jati			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	75.065 sq km
		Forest Area	0.004 sq km
		Kachcha Area	0.009 sq km
		Natural Vegetation in Wet Areas	0.001 sq km
		Pakka Unplanned Area	1.888 sq km
		Range Land	0.139 sq km
		Bridges	2
		Health Facilities	1
		Mobile Towers	5
		Petrol Pumps	1
		Settlements	36
		Irrigation and Drainage Network	45.412 km
		Road Network	102.087 km
		Population	38194
Household	7391		
Meteorological Drought	Medium - Extreme	Settlements	35
		Agriculture Area	75.239 sq km
		Forest Area	0.176 sq km
		Natural Vegetation in Wet Areas	0.015 sq km
		Range Land	4.578 sq km
		Water Body	0.287 sq km
		Wet Area	4.917 sq km
		Population	32049

		Household	6199
Agricultural Drought	Low - High	Settlements	10
		Agriculture Area	29.506 sq km
		Forest Area	0.212 sq km
		Natural Vegetation in Wet Areas	0.018 sq km
		Range Land	5.47 sq km
		Water Body	0.336 sq km
		Wet Area	0.742 sq km
		Population	424
		Household	82
Heatwave	Low - Extreme	Settlements	31
		Population	31777
		Household	6150
		Agriculture Area	75.001 sq km
		Kachcha Area	0.009 sq km
		Pakka Unplanned Area	1.891 sq km
Cyclone	Low	Agriculture Area	75.04 sq km
		Forest Area	0.004 sq km
		Kachcha Area	0.009 sq km
		Natural Vegetation in Wet Areas	0.001 sq km
		Pakka Unplanned Area	0.172 sq km
		Range Land	0.086 sq km
		Bridges	2
		Petrol Pumps	1
		Settlements	36
		Irrigation and Drainage Network	42.004 km
		Road Network	83.398 km
		Population	4560
		Household	890
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Jhoke Sharif			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	97.254 sq km
		Forest Area	0.009 sq km
		Natural Vegetation in Wet Areas	0.007 sq km
		Pakka Unplanned Area	2.326 sq km
		Range Land	0.004 sq km
		Bridges	3
		Bus Stops	4
		Education Facilities	13
		Health Facilities	1
		Mobile Towers	3
		Petrol Pumps	3
		Settlements	92
		Irrigation and Drainage Network	50.879 km
		Road Network	155.053 km
		Population	42835
Household	8402		
Meteorological Drought	Medium - Extreme	Settlements	92
		Agriculture Area	97.386 sq km
		Forest Area	0.03 sq km
		Natural Vegetation in Wet Areas	0.4 sq km
		Range Land	0.053 sq km
		Wet Area	1.974 sq km
		Population	35789
		Household	7021
Agricultural Drought	Low	Settlements	1
		Agriculture Area	1.789 sq km
		Forest Area	0.001 sq km
		Natural Vegetation in Wet Areas	0.479 sq km
		Wet Area	0.005 sq km
		Population	433
		Household	83
Heatwave	Low - Extreme	Settlements	91
		Population	35463
		Household	6951
		Agriculture Area	97.21 sq km
		Pakka Unplanned Area	2.333 sq km

Cyclone	Low	Agriculture Area	97.192 sq km
		Forest Area	0.002 sq km
		Natural Vegetation in Wet Areas	0.007 sq km
		Pakka Unplanned Area	0.634 sq km
		Range Land	0.004 sq km
		Bridges	2
		Bus Stops	3
		Education Facilities	6
		Mobile Towers	1
		Petrol Pumps	3
		Settlements	92
		Irrigation and Drainage Network	48.481 km
		Road Network	148.108 km
		Population	12077
Household	2357		
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Jongo Jalbani			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	78.097 sq km
		Forest Area	0.169 sq km
		Kachcha Area	0.153 sq km
		Natural Vegetation in Wet Areas	0.203 sq km
		Pakka Unplanned Area	0.204 sq km
		Range Land	0.496 sq km
		Health Facilities	1
		Mobile Towers	1
		Settlements	26
		Irrigation and Drainage Network	42.955 km
		Road Network	72.619 km
		Population	12640
		Household	2488
Meteorological Drought	Medium - Extreme	Settlements	25
		Agriculture Area	78.7 sq km
		Forest Area	256.365 sq km

		Natural Vegetation in Wet Areas	60.08 sq km
		Range Land	23.564 sq km
		Water Body	2.094 sq km
		Wet Area	1449.823 sq km
		Population	10610
		Household	2089
Agricultural Drought	Low - Extreme	Settlements	4
		Agriculture Area	48.245 sq km
		Forest Area	7.501 sq km
		Natural Vegetation in Wet Areas	46.537 sq km
		Range Land	25.114 sq km
		Water Body	0.717 sq km
		Wet Area	104.057 sq km
		Population	62
		Household	12
Heatwave	Low - Extreme	Settlements	23
		Population	10512
		Household	2070
		Agriculture Area	77.872 sq km
		Kachcha Area	0.153 sq km
		Pakka Unplanned Area	0.203 sq km
Cyclone	Low	Agriculture Area	78.087 sq km
		Forest Area	170.271 sq km
		Kachcha Area	0.153 sq km
		Natural Vegetation in Wet Areas	0.168 sq km
		Pakka Unplanned Area	0.05 sq km
		Range Land	0.573 sq km
		Health Facilities	1
		Mobile Towers	1
		Settlements	26
		Irrigation and Drainage Network	29.182 km
		Road Network	54.226 km
		Population	7345
		Household	1445
Tsunami	Low – High	Agriculture Area	21.983 sq km
		Forest Area	125.89 sq km
		Kachcha Area	0.119 sq km
		Natural Vegetation in Wet Areas	32.025 sq km

		Pakka Unplanned Area	0.068 sq km
		Range Land	9.575 sq km
		Settlements	6
		Irrigation and Drainage Network	6.802 km
		Road Network	12.269 km
		Population	6221
		Household	1228
Storm Surge	Low - Extreme	Agriculture Area	19.525 sq km
		Forest Area	220.795 sq km
		Natural Vegetation in Wet Areas	15.466 sq km
		Pakka Unplanned Area	0.037 sq km
		Range Land	5.032 sq km
		Settlements	5
		Irrigation and Drainage Network	3.311 km
		Road Network	4.705 km
		Population	910
		Household	181
Riverine Flood	Low - Extreme	Agriculture Area	2.774 sq km
		Forest Area	35.391 sq km
		Natural Vegetation in Wet Areas	18.244 sq km
		Pakka Unplanned Area	0.038 sq km
		Settlements	3
		Population	528
		Household	109

Kar Malik			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	239.311 sq km
		Forest Area	0.078 sq km
		Kachcha Area	1.021 sq km
		Natural Vegetation in Wet Areas	0.037 sq km
		Pakka Planned Area	0.041 sq km
		Pakka Unplanned Area	0.651 sq km
		Range Land	0.647 sq km
		Education Facilities	1
		Health Facilities	1
		Settlements	55
		Irrigation and Drainage Network	112.659 km

		Road Network	194.036 km
		Population	47385
		Household	9268
Meteorological Drought	Medium - Extreme	Settlements	55
		Agriculture Area	240.499 sq km
		Forest Area	14.615 sq km
		Natural Vegetation in Wet Areas	41.064 sq km
		Range Land	32.136 sq km
		Wet Area	1595.454 sq km
		Population	39903
		Household	7808
Agricultural Drought	Low - Extreme	Settlements	41
		Agriculture Area	226.006 sq km
		Forest Area	4.614 sq km
		Natural Vegetation in Wet Areas	14.457 sq km
		Range Land	38.627 sq km
		Wet Area	899.098 sq km
		Population	29877
		Household	5846
Heatwave	Low - Extreme	Settlements	53
		Population	39508
		Household	7729
		Agriculture Area	238.931 sq km
		Kachcha Area	1.024 sq km
		Pakka Planned Area	0.041 sq km
		Pakka Unplanned Area	0.655 sq km
Cyclone	Low	Agriculture Area	239.284 sq km
		Forest Area	0.712 sq km
		Kachcha Area	1.021 sq km
		Natural Vegetation in Wet Areas	0.022 sq km
		Pakka Planned Area	0.008 sq km
		Pakka Unplanned Area	0.168 sq km
		Range Land	0.329 sq km
		Settlements	55
		Irrigation and Drainage Network	72.051 km
		Road Network	107.71 km
		Population	33085
		Household	6470

Tsunami	Low - High	Agriculture Area	19.071 sq km
		Forest Area	6.066 sq km
		Kachcha Area	0.152 sq km
		Natural Vegetation in Wet Areas	33.391 sq km
		Pakka Planned Area	0.011 sq km
		Pakka Unplanned Area	0.024 sq km
		Range Land	7.765 sq km
		Settlements	2
		Irrigation and Drainage Network	5.63 km
		Road Network	18.164 km
		Population	5189
Household	1015		
Storm Surge	Low - High	Forest Area	9.185 sq km
		Natural Vegetation in Wet Areas	27.081 sq km
Riverine Flood	Nil	The Left Bank Outfall Drain (LBOD) passes through the UC and has potential to produce flooding during monsoon / heavy rains. In case of excessive water in LBOD system, overtopping / breaching and consequent residual risk of flooding cannot be ruled out for UC.	

Khara Chan			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	11.56 sq km
		Forest Area	0 sq km
		Kachcha Area	0.047 sq km
		Natural Vegetation in Wet Areas	0.118 sq km
		Pakka Unplanned Area	0.637 sq km
		Range Land	0.051 sq km
		Settlements	14
		Irrigation and Drainage Network	2.396 km
		Road Network	2.459 km
		Population	9592
		Household	1974
Meteorological Drought	Medium - Extreme	Settlements	14
		Agriculture Area	11.662 sq km
		Forest Area	92.712 sq km
		Natural Vegetation in Wet Areas	29.342 sq km

		Range Land	6.963 sq km
		Water Body	0.151 sq km
		Wet Area	195.178 sq km
		Population	7803
		Household	1607
Agricultural Drought	Low - Extreme	Settlements	1
		Agriculture Area	6.585 sq km
		Forest Area	0.058 sq km
		Natural Vegetation in Wet Areas	9.953 sq km
		Range Land	7.82 sq km
		Water Body	0.025 sq km
		Wet Area	13.725 sq km
		Population	16
		Household	3
Heatwave	Low - Extreme	Settlements	12
		Population	7976
		Household	1642
		Agriculture Area	11.534 sq km
		Kachcha Area	0.047 sq km
		Pakka Unplanned Area	0.635 sq km
Cyclone	Low - Medium	Agriculture Area	11.565 sq km
		Forest Area	91.443 sq km
		Kachcha Area	0.047 sq km
		Natural Vegetation in Wet Areas	15.616 sq km
		Pakka Unplanned Area	0.1 sq km
		Range Land	3.822 sq km
		Settlements	14
		Irrigation and Drainage Network	2.396 km
		Road Network	2.459 km
		Population	2070
		Household	426
Tsunami	Low-high	Agriculture Area	8.715 sq km
		Forest Area	61.209 sq km
		Kachcha Area	0.011 sq km
		Natural Vegetation in Wet Areas	24.752 sq km
		Pakka Unplanned Area	0.495 sq km
		Range Land	6.436 sq km
		Settlements	9

		Irrigation and Drainage Network	0.364 km
		Road Network	0.45 km
		Population	7093
		Household	1460
Storm Surge	Low – Extreme	Agriculture Area	9.568 sq km
		Forest Area	89.663 sq km
		Kachcha Area	0.026 sq km
		Natural Vegetation in Wet Areas	24.101 sq km
		Pakka Unplanned Area	0.427 sq km
		Range Land	6.438 sq km
		Settlements	8
		Irrigation and Drainage Network	1.185 km
		Road Network	1.464 km
		Population	6352
		Household	1310
Riverine Flood	Low - Extreme	Agriculture Area	6.069 sq km
		Forest Area	91.156 sq km
		Kachcha Area	0.007 sq km
		Natural Vegetation in Wet Areas	26.886 sq km
		Pakka Unplanned Area	0.375 sq km
		Range Land	0.052 sq km
		Settlements	8
		Irrigation and Drainage Network	0.647 km
		Road Network	0.111 km
		Population	5366
		Household	1105

Kinjhar			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	144.441 sq km
		Natural Vegetation in Wet Areas	0.027 sq km
		Pakka Planned Area	0.459 sq km
		Pakka Unplanned Area	0.799 sq km
		Range Land	0.118 sq km
		Bridges	6
		Education Facilities	6
		Health Facilities	4
		Industries	1

		Mobile Towers	1
		Settlements	49
		Irrigation and Drainage Network	117.719 km
		Road Network	138.035 km
		Population	20096
		Household	3958
Meteorological Drought	Medium - Extreme	Settlements	49
		Agriculture Area	144.954 sq km
		Natural Vegetation in Wet Areas	2.301 sq km
		Range Land	3.11 sq km
		Water Body	3.523 sq km
		Wet Area	26.052 sq km
		Population	16804
		Household	3308
Agricultural Drought	Low - Medium	Settlements	4
		Agriculture Area	35.505 sq km
		Natural Vegetation in Wet Areas	0.555 sq km
		Range Land	2.787 sq km
		Water Body	0.736 sq km
		Wet Area	1.111 sq km
		Population	1806
		Household	355
Heatwave	Low - Extreme	Settlements	47
		Population	16695
		Household	3287
		Agriculture Area	144.306 sq km
		Pakka Planned Area	0.459 sq km
		Pakka Unplanned Area	0.802 sq km
Cyclone	Low	Agriculture Area	144.409 sq km
		Natural Vegetation in Wet Areas	0.02 sq km
		Pakka Planned Area	0.006 sq km
		Pakka Unplanned Area	0.218 sq km
		Range Land	0.057 sq km
		Bridges	6
		Education Facilities	6
		Health Facilities	4
		Mobile Towers	1
		Settlements	49

		Irrigation and Drainage Network	107.34 km
		Road Network	130.496 km
		Population	5484
		Household	1077
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Kothi			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	117.505 sq km
		Forest Area	0.116 sq km
		Kachcha Area	0.36 sq km
		Natural Vegetation in Wet Areas	0.005 sq km
		Pakka Unplanned Area	0.328 sq km
		Range Land	1.228 sq km
		Bridges	4
		Education Facilities	1
		Health Facilities	1
		Settlements	37
		Irrigation and Drainage Network	87.686 km
		Road Network	164.217 km
		Population	23194
Household	4552		
Meteorological Drought	Medium - Extreme	Settlements	35
		Agriculture Area	118.161 sq km
		Forest Area	5.036 sq km
		Natural Vegetation in Wet Areas	10.377 sq km
		Range Land	61.446 sq km
		Water Body	0.275 sq km
		Wet Area	148.588 sq km
		Population	19464
Household	3818		
Agricultural Drought	Low - Extreme	Settlements	24
		Agriculture Area	80.648 sq km
		Forest Area	5.123 sq km

		Natural Vegetation in Wet Areas	11.149 sq km
		Range Land	73.093 sq km
		Water Body	0.329 sq km
		Wet Area	64.811 sq km
		Population	10774
		Household	2113
Heatwave	Low - Extreme	Settlements	27
		Population	19353
		Household	3796
		Agriculture Area	117.198 sq km
		Kachcha Area	0.362 sq km
		Pakka Unplanned Area	0.329 sq km
Cyclone	Low	Agriculture Area	117.474 sq km
		Forest Area	0.066 sq km
		Kachcha Area	0.36 sq km
		Natural Vegetation in Wet Areas	0.003 sq km
		Pakka Unplanned Area	0.045 sq km
		Range Land	0.42 sq km
		Bridges	2
		Settlements	37
		Irrigation and Drainage Network	47.705 km
		Road Network	97.63 km
		Population	13707
		Household	2689
Tsunami	Low - High	Agriculture Area	1.753 sq km
		Forest Area	0.424 sq km
		Kachcha Area	0.054 sq km
		Natural Vegetation in Wet Areas	5.071 sq km
		Range Land	1.676 sq km
		Settlements	1
		Irrigation and Drainage Network	0.956 km
		Road Network	6.341 km
		Population	1889
		Household	371
Storm Surge	Low - High	Forest Area	0.682 sq km
		Natural Vegetation in Wet Areas	2.444 sq km

Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood
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Ladiun			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	80.705 sq km
		Forest Area	0.06 sq km
		Kachcha Area	0.034 sq km
		Natural Vegetation in Wet Areas	0.039 sq km
		Pakka Unplanned Area	0.387 sq km
		Range Land	0.324 sq km
		Bridges	3
		Education Facilities	1
		Health Facilities	2
		Settlements	31
		Irrigation and Drainage Network	34.008 km
		Road Network	70.667 km
		Population	15989
		Household	3140
Meteorological Drought	Medium - Extreme	Settlements	31
		Agriculture Area	81.014 sq km
		Forest Area	0.689 sq km
		Natural Vegetation in Wet Areas	11.751 sq km
		Range Land	25.652 sq km
		Water Body	3.05 sq km
		Wet Area	16.774 sq km
		Population	13428
		Household	2638
Agricultural Drought	Low - Extreme	Settlements	10
		Agriculture Area	55.013 sq km
		Forest Area	0.823 sq km
		Natural Vegetation in Wet Areas	14.05 sq km
		Range Land	30.511 sq km
		Water Body	3.659 sq km
		Wet Area	11.324 sq km
		Population	1931
		Household	378
Heatwave	Low - Extreme	Settlements	26

		Population	13307
		Household	2615
		Agriculture Area	80.599 sq km
		Kachcha Area	0.033 sq km
		Pakka Unplanned Area	0.388 sq km
Cyclone	Low	Agriculture Area	80.69 sq km
		Forest Area	0.034 sq km
		Kachcha Area	0.034 sq km
		Natural Vegetation in Wet Areas	0.034 sq km
		Pakka Unplanned Area	0.059 sq km
		Range Land	0.222 sq km
		Bridges	3
		Health Facilities	1
		Settlements	31
		Irrigation and Drainage Network	30.562 km
		Road Network	61.444 km
		Population	3532
		Household	694
Tsunami	Low - High	Agriculture Area	1.379 sq km
		Kachcha Area	0.002 sq km
		Natural Vegetation in Wet Areas	0.533 sq km
		Range Land	1.437 sq km
		Irrigation and Drainage Network	0.275 km
		Road Network	0.804 km
		Population	93
		Household	18
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Liakpur			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	66.883 sq km
		Natural Vegetation in Wet Areas	0.034 sq km
		Pakka Unplanned Area	0.934 sq km
		Range Land	0.008 sq km
		Bridges	2
		Health Facilities	2

		Settlements	45
		Irrigation and Drainage Network	52.07 km
		Road Network	88.725 km
		Population	18127
		Household	3519
Meteorological Drought	Medium - Extreme	Settlements	45
		Agriculture Area	67.042 sq km
		Natural Vegetation in Wet Areas	0.795 sq km
		Range Land	0.144 sq km
		Water Body	0.023 sq km
		Wet Area	5.224 sq km
		Population	15151
		Household	2941
Agricultural Drought	Low	Agriculture Area	0.083 sq km
		Population	19
		Household	4
Heatwave	Low - Extreme	Settlements	45
		Population	15004
		Household	2912
		Agriculture Area	66.823 sq km
		Pakka Unplanned Area	0.938 sq km
Cyclone	Low	Agriculture Area	66.853 sq km
		Natural Vegetation in Wet Areas	0.018 sq km
		Pakka Unplanned Area	0.221 sq km
		Range Land	0.003 sq km
		Bridges	2
		Settlements	45
		Irrigation and Drainage Network	49.307 km
		Road Network	81.999 km
		Population	4285
		Household	832
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	

Mehar Shah			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	62.832 sq km
		Natural Vegetation in Wet Areas	0.018 sq km
		Pakka Unplanned Area	1.317 sq km
		Range Land	0.012 sq km
		Bridges	1
		Education Facilities	2
		Health Facilities	1
		Settlements	56
		Irrigation and Drainage Network	76.321 km
		Road Network	72.243 km
		Population	28874
		Household	5649
Meteorological Drought	Medium - Extreme	Settlements	56
		Agriculture Area	63.146 sq km
		Natural Vegetation in Wet Areas	1.743 sq km
		Range Land	1.092 sq km
		Water Body	1.796 sq km
		Wet Area	18.3 sq km
		Population	24120
		Household	4720
Agricultural Drought	Low	Agriculture Area	1.628 sq km
		Natural Vegetation in Wet Areas	2.08 sq km
		Range Land	0.005 sq km
		Wet Area	0.034 sq km
		Population	29
		Household	5
Heatwave	Low - Extreme	Settlements	56
		Population	23941
		Household	4685
		Agriculture Area	62.696 sq km
		Pakka Unplanned Area	1.323 sq km
Cyclone	Low	Agriculture Area	62.773 sq km
		Natural Vegetation in Wet Areas	0.01 sq km
		Pakka Unplanned Area	0.302 sq km
		Range Land	0.01 sq km
		Bridges	1

		Education Facilities	2
		Settlements	56
		Irrigation and Drainage Network	58.309 km
		Road Network	59.417 km
		Population	6520
		Household	1272
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Mirpur Bathoro			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	36.452 sq km
		Forest Area	0.003 sq km
		Pakka Planned Area	0.046 sq km
		Pakka Unplanned Area	1.309 sq km
		Bridges	2
		Bus Stops	2
		Education Facilities	11
		Health Facilities	3
		Mobile Towers	4
		Petrol Pumps	2
		Police Stations	2
		Post Offices	1
		Settlements	35
		Irrigation and Drainage Network	28.785 km
		Road Network	52.839 km
Population	21915		
Household	4375		
Meteorological Drought	Medium - Extreme	Settlements	35
		Agriculture Area	36.616 sq km
		Forest Area	0.009 sq km
		Wet Area	6.668 sq km
		Population	18284
		Household	3647
Agricultural Drought	Low	Agriculture Area	0.029 sq km
		Wet Area	0.001 sq km

		Population	1
		Household	0
Heatwave	Low - Extreme	Settlements	35
		Population	18132
		Household	3619
		Agriculture Area	36.386 sq km
		Pakka Planned Area	0.046 sq km
		Pakka Unplanned Area	1.312 sq km
Cyclone	Low	Agriculture Area	36.415 sq km
		Forest Area	0 sq km
		Pakka Planned Area	0.007 sq km
		Pakka Unplanned Area	0.238 sq km
		Bridges	1
		Bus Stops	1
		Education Facilities	5
		Petrol Pumps	1
		Settlements	35
		Irrigation and Drainage Network	22.551 km
		Road Network	41.776 km
		Population	4454
		Household	865
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	
Riverine Flood	Nil	The UC falls out of vulnerable zone for Riverine Flood	

Mureed Khoso			
Hazard Type	Risk	Elements at Risk	
Earthquake	Low	Agriculture Area	149.661 sq km
		Forest Area	0.001 sq km
		Kachcha Area	0.102 sq km
		Natural Vegetation in Wet Areas	0.247 sq km
		Pakka Unplanned Area	0.655 sq km
		Range Land	0.473 sq km
		Health Facilities	2
		Petrol Pumps	1
		Settlements	62
		Irrigation and Drainage Network	86.542 km

		Road Network	133.982 km
		Population	22050
		Household	4317
Meteorological Drought	Medium - Extreme	Settlements	62
		Agriculture Area	150.315 sq km
		Forest Area	0.019 sq km
		Natural Vegetation in Wet Areas	12.449 sq km
		Range Land	18.941 sq km
		Water Body	1.468 sq km
		Wet Area	23.144 sq km
		Population	18510
		Household	3624
Agricultural Drought	Low - Medium	Settlements	3
		Agriculture Area	17.833 sq km
		Forest Area	0.022 sq km
		Natural Vegetation in Wet Areas	7.184 sq km
		Range Land	12.109 sq km
		Water Body	0.266 sq km
		Wet Area	0.1 sq km
		Population	103
		Household	19
Heatwave	Low - Extreme	Settlements	57
		Population	18363
		Household	3595
		Agriculture Area	149.425 sq km
		Kachcha Area	0.102 sq km
		Pakka Unplanned Area	0.658 sq km
Cyclone	Low	Agriculture Area	149.624 sq km
		Forest Area	0.001 sq km
		Kachcha Area	0.102 sq km
		Natural Vegetation in Wet Areas	0.151 sq km
		Pakka Unplanned Area	0.12 sq km
		Range Land	0.279 sq km
		Health Facilities	2
		Petrol Pumps	1
		Settlements	62
		Irrigation and Drainage Network	69.87 km
		Road Network	121.228 km

		Population	6241
		Household	1220
Riverine Flood	Low- Extreme	Agriculture Area	28.108 sq km
		Natural Vegetation in Wet Areas	3.162 sq km
		Pakka Unplanned Area	0.084 sq km
		Range Land	0.001 sq km
		Settlements	5
		Road Network	2.572 km
		Population	2333
		Household	456
Tsunami	Nil	The UC falls out of vulnerable zone for Tsunami	
Storm Surge	Nil	The UC falls out of vulnerable zone for Storm Surge	

ORGANIZATION STRUCTURE FOR DISASTER MANAGEMENT AT DISTRICT LEVEL

INTRODUCTION

Each year natural disasters kill thousands of people and inflict billions of dollars in economic losses. No nation or community is immune to the damage of disasters and certainly, the province of Sindh is no exception. Almost every year, a major or minor natural disaster disrupts the life and economy of people living in the province, especially those with high economic vulnerability or the poor strata of the population. Unless action is taken to reduce the toll of natural disasters, the damages and losses of disasters can only be expected to rise. The scientific and technological advances of today's world provide unprecedented opportunities for responding to the urgent need to mitigate the impacts of natural hazards.

It is a globally recognized fact that natural hazards do not kill but poor planning does. Better disaster management and disaster risk reduction can only be achieved through collective efforts in integrating hazard reduction policy and practice throughout the province. It is a need of the time and opportunity to reassess the approach to natural hazards and to develop strategies for reducing losses by prevention and preparedness.

Disaster management can be achieved through the collective effort of all segments of life. A central authority, like Provincial Disaster Management Authority, can oversee, plan, manage and coordinate for disaster management at the provincial scale, however, it is the responsibility of concerned departments and authorities to implement and execute disaster management measures at the grass-root level. For effective disaster management, it is also imperative to take onboard and empower communities at high disaster risk as first responders. The disaster management plan will be effective once the roles and responsibilities of each individual and department are well understood and disaster management measures are implemented.

Keeping in view the importance of disaster management at all levels i.e., from the Provincial level to UC or village level, different disaster management committees have been recommended to be constituted. These committees are District Disaster Management Authority (DDMA), Taluka Disaster Management Committee (TDMC), and Union Council Disaster Management Committee (UCDMC). The recommended composition of each committee is given in Table-2 to 4.

Table 2: District Disaster Management Authority

Sr.#	Committee Representative	Role
1.	Deputy Commissioner	Chairperson
2.	Additional Deputy Commissioner	DDMO
3.	Senior Superintendent of Police	Member
4.	Assistant Director Local Government	Member
5.	District Information Officer	Member
6.	Cantonment Officer (Where Applicable)	Member
7.	District Health Officer	Member
8.	District Education Officer	Member

9.	District Food Controller	Member
10.	Deputy Director Civil Defense	Member
11.	District Officer Social Welfare	Member
12.	District Officer Livestock	Member
13.	District Chairman Zakat	Member
14.	Executive Engineer (Works and Services)	Member
15.	Executive Engineer Irrigation	Member
16.	Executive Engineer Public Health	Member
17.	Municipal Commissioners / CMOs / TMOs	Member(s)
18.	Representative Officer of Armed Forces	Member
19.	Two Elected Representatives nominated by the chair	Members
20.	Two Representatives of NGOs/Civil Society	Members
21.	Two Representatives of Business Community	Members
22.	Representative of Agriculture and Livestock Department	Member
23.	Representative of NHA	Member
24.	Representative of Electric Supply Corporation	Member
25.	Representative of SSGC	Member
26.	Representative of Red Crescent	Member
27.	Representative of Sindh Scouts	Member
28.	Representation of Volunteers from Communities at Risk	Member(s)

Table 3: TDMC Taluka Disaster Management Committee

Sr.#	Committee Representative	Role
1.	Assistant Commissioner	Chairperson
2.	Mukhtiarkar	Secretary
3.	Town Municipal Officer (TMO)	Member(s)
4.	Sub Divisional Police Officer	Member
5.	Taluka Education Officer	Member
6.	Medical Superintendent Taluka Level Medical Facility	Member
7.	Representative from Civil Defense	Member
8.	Representative from Social Welfare Department	Member
9.	Representative from Livestock Department	Member
10.	Assistant Engineer (Works and Services)	Member
11.	Assistant Engineer Irrigation	Member
12.	Assistant Engineer Public Health	Member
13.	Two Representatives of NGOs/Civil Society	Members
14.	Two Representatives of Business Community	Members
15.	Representative of Agriculture and Livestock Department	Member
16.	Representative of Electric Supply Corporation	Member
17.	Representative of SSGC	Member
18.	Representative of Red Crescent	Member
19.	Representative of Sindh Scouts	Member
20.	Representation of Volunteers from Communities at Risk	Member

Table 4: UCDMC Union Council Disaster Management Committee

Sr.#	Committee Representative	Role
1.	UC Administrator	Chairperson
2.	Secretary UC	Secretary
3.	Station House Officer (Police) – Concerned	Member
4.	Two Representatives of NGOs/Civil Society	Members
5.	Representation of Volunteers from Communities at Risk	Members
6.	Representation of Renowned Persons	Members

RESPONSIBILITY OF DISTRICT DISASTER MANAGEMENT AUTHORITY

- The DDMA shall work as a coordinating body of all government agencies and non-government organizations operating in the district and act as a focal authority in the conduction and implementation of plan and actions on disaster management
- Additional Deputy Commissioner who is proposed as Disaster Management Officer shall also work as Secretary DDMA and will provide administrative support to DDMA
- The DDMA shall ensure to take all possible disaster management measures in the district in accordance with the guidelines laid down by PDMA or NDMA
- The DDMA shall provide leadership by taking initiative to achieve MHVRA Informed Disaster Management Plan goals and objectives
- The DDMA shall coordinate with PDMA Sindh in disaster preparedness, response and recovery
- The DDMA shall provide guidance and support for the implementation of district response plans including management of the District Emergency Operation Centre

FUNCTION OF DDMA

- To review district disaster management plan, including district response plan in-line with Provincial and National disaster management plans and policies
- To ensure that risk maps are developed and updated and disaster-prone areas have been identified and prioritized in the district
- To coordinate the efforts for prevention and mitigation measures that are undertaken by the government and local authorities in the identified vulnerable areas of the district
- To organize and coordinate specialized disaster management training programs for different levels of officers, employees, and volunteer rescue workers in the district

- To facilitate community training and awareness programs with the support of local authorities, government and non-government organizations
- To set up, maintain, review and upgrade the mechanism for early warning and dissemination of accurate information to concerned authorities and the general public
- To review development plans prepared by the government departments, statutory or local authorities with a view that disaster management plan has been integrated into the development activities and projects
- To coordinate with, and give guidelines to, local authorities in the district to ensure that pre-disaster and post-disaster management activities in the district are carried out promptly and effectively
- To prepare, review and update district level response and contingency plans.
- To identify buildings and places which could, in the event of disaster situation be, used as relief centers and camps and make arrangements for water supply and sanitation in such buildings or places
- To distribute relief and facilitate rescue or ensure disaster preparedness and response
- To ensure operationalization of District Emergency Operation Centre (DEOC) equipped with all necessary gadgets
- To activate the District Emergency Operations Centre (DEOC) and ensure its uninterrupted operation during and after disaster events
- To carry out rapid damage and needs assessment and develop a report for assisting PDMA and other relevant stakeholders
- To coordinate and monitor early recovery and rehabilitation activities with the support of PDMA or relevant local and international stakeholders
- To prepare and continuously update databases of external agency projects, future priority areas, funding framework, available resources, areas of operations/expertise etc.
- To perform other functions as deemed necessary by the provincial government or provincial authority for disaster management in the district

RESPONSIBILITY OF TALUKA DISASTER MANAGEMENT COMMITTEE

- The TDMC shall work as front-line body for disaster management in the district and shall ensure implementation of disaster management measures set by DDMA and PDMA
- The TDMC shall interact directly with communities at risk in disaster preparedness, disaster risk reduction and response
- The TDMC shall Bridge between government and communities in disaster response
- The TDMC shall coordinate between DDMA, PDMA and all stakeholders working at grass-root level in pre, during and post disaster events

FUNCTION OF TALUKA DISASTER MANAGEMENT COMMITTEE

- Identification and updation of all hazards in their respective locations and conduct of risk and vulnerability analysis and communicate with DDMA and subsequently with PDMA
- Ensure that the officers and employees are trained in disaster management
- Ensure that resources relating to disaster management are maintained and readily available for use in the event of any threatening disaster situation or disaster
- To coordinate and monitor disaster management plan mainstreaming operations in the district and over all disaster management initiatives
- Land use planning and zoning within the municipality by preparing master plans while keeping the multi hazard of the municipality and Taluka in context
- To ensure the implementation of bylaws related to encroachment at hazardous places, building codes, land use planning and zonation etc.
- To identify evacuation/shelter places to face any disaster/emergency
- To monitor the disaster management activities of NGOs, UCDCMs and private sectors
- To share initial damage and needs assessment reports to DDMA and subsequently to PDMA
- To carry out relief, rehabilitation and reconstruction activities in the affected areas in accordance with the DDMA and PDMA

RESPONSIBILITY OF UNION COUNCIL DISASTER MANAGEMENT COMMITTEE

1. UCDMC shall work as front-line, first responder body at village, mohalla and ward level.
2. Shall assist TDMC, DDMA and PDMA especially in disaster response.
3. Shall encourage and keep record of volunteers in Union Council.
4. Shall formulate different groups to respond disaster and emergency events such as evacuation group, camp management group etc. and share this record with TDMC, DDMA and PDMA.
5. Shall prepare awareness and capacity development proposals and training programs and follow-up with TDMC, DDMA and PDMA for arranging such events at grass root level.

FUNCTION OF UCDMC

1. Identification and updation of all hazards in their respective locations and conduct of risk and vulnerability analysis and communicate with TDMC, DDMA and subsequently with PDMA.
2. To prepare/update UC level disaster management plan for emergent hazards or new hazards caused by any disaster event.
3. To make an analysis of disaster risk and to prepare a list of vulnerable villages and areas of the concerned union councils.
4. To mobilize community for maintaining public ways, public streets, culverts, Bridges and public buildings, de-silting of canals and other development activities.
5. To coordinate with the village and neighborhood UCs in case of emergency in order to get quick information about the severity and extent of a disaster impact and report it to the TDMC and DDMA.
6. To report cases of handicapped, destitute and socially excluded groups to TDMC, DDMA and PDMA in order to streamline their special needs in relief and response operation.
7. Mobilizing and coordinating work of volunteers and ensuring community participation.
8. Conduct of search and rescue operations in coordination with the rescue teams and Police.
9. To provide assistance to other agencies for mobility/transport of staff, including rescue parties, relief personnel and relief materials. To communicate with the TDMC, DDMA or PDMA for required additional resources.

10. To monitor NGO activities and provide necessary support to ensure community participation by establishing coordination mechanisms among NGOs and local communities.

ESTABLISHMENT OF EMERGENCY OPERATION CENTERS

PROVINCIAL EMERGENCY OPERATION CENTER (PEOC)

As envisioned by PDMA Sindh, PEOC is established at HQ of PDMA Sindh. The center is equipped with modern tools and techniques for management and operation activities in pre, during and post disaster events. The center works under the management of PDMA with 24/7 operation.

The functions of PEOC are summarized below;

- Coordinating node for planning, management and operations of disaster management activities
- Inventory management and goods distribution.
- Assets and vehicles management and monitoring
- Monitoring of extreme weather and disasters
- Issuance of early warnings
- Disposal and monitoring of man and material resources during disaster events
- Coordination with community based associations, volunteers, NGOs and other relevant institutions involved in disaster management
- Assessment of disaster risk and elements at risk and dissemination of information to concerned departments
- Coordination for evacuation, medical, search, rescue and relief
- Preparation and collection of damage assessment reports
- Coordination with all management tiers
- Daily briefings on disaster events, search and rescue operations, damages and losses, recovery and rehabilitation
- Hosting of online meetings
- Damage data collection through imaging drones

DISTRICT EMERGENCY OPERATION CENTER (DEOC)

The PEOC established at PDMA HQ is connected with districts through DEOC. The DEOC is supposed to work as field arm of PEOC for execution and implementation of instructions passed on by PEOC. The center is equipped with modern tools and techniques for management and operation activities in pre, during and post disaster events. The center works under the management of DDMA with 24/7 operation during disasters.

FUNCTION OF DEOC

The functions of DEOC are appended below;

- Receive information and instructions from PEOC regarding implementation and execution of action plans
- Monitor the situation and put everything ready and functional in the DEOC
- Dissemination of early warnings issued from PEOC to stakeholders and communities
- To coordinate with PEOC, PDMA, concerned departments and other stakeholders
- To monitor emergency operations and make efforts for preventing secondary hazards
- To conduct rapid assessment of the relief needs by collecting information from affected areas and circulate to PDMA and other concerned departments and stakeholders
- To deploy evacuation, medical, search and rescue teams in the affected areas
- To provide relief assistance in terms of relief camps, medical and sanitation facilities and temporary shelter to the affected population in the district
- To establish a liaison with concerned departments and stakeholders engaged in emergency response by anticipating resource inventory
- To collect information for daily briefings on disaster situation for PEOC, media, general public and other stakeholders
- Record keeping and preparation of consolidated reports and response plans and projects.
- Coordination and mobilization of community based associations, volunteers, NGOs and other relevant institutions involved in disaster management

SECTOR WISE ROLES AND RESPONSIBILITIES OF GOVERNMENT FUNCTIONARIES

AGRICULTURE AND LIVESTOCK DEPARTMENT

Pre-Disaster

- Capacity building of department regarding disaster management and risk reduction and implementation of sector specific disaster risk reduction measures
- Provide recommendation on changing/rescheduling of cropping patterns with respect to changing climate and weather scenarios
- Create Community Seed Bank at Union Council level
- Provide livestock vaccination and de-worming
- Assessment of high prone areas and estimation of possible damage and needs for recovery regarding livestock, crops, irrigation facilities in case of any disaster
- Mass awareness regarding epidemics and diseases to livestock and crops
- Close coordination with PDMA and DDMA

During-Disaster

- Close and regular coordination with DDMA and PDMA
- Immediate transfer of current situation to DDMA and PDMA
- Vaccination of livestock

Post-Disaster

- Facilitation to institutions / NGOs/ INGOs which focus on rehabilitation activities as per guidelines provided by DDMA and PDMA
- Submit report on damages and needs to DDMA and PDMA
- Mass awareness regarding epidemics and diseases to livestock and crops
- Vaccination of livestock
- Upgrade Community Seed Bank (CSB)
- Timely compensation to affected farmers

- Prepare overall report of the department regarding intervention and disseminate to DDMA and PDMA

PROVINCIAL DISASTER MANAGEMENT AUTHORITY (PDMA)

Pre-Disaster

- Close coordination with national and international institutions engaged in disaster forecasting.
- Coordinate meeting and engage DDMA for preparation of anticipated disasters
- Ensure readiness of equipment and inventory
- Disseminate disaster alerts to concerned DDMA with action plans for forecastable disasters
- Ensure availability of relief goods and other relevant stuff before anticipated disaster
- Advise concerned departments on removal of congestion from water ways before monsoon and flooding period
- Aware and sensitize public and private departments on main streaming disaster risk reduction in developing planning
- Ensure availability and functioning of provincial emergency operation center
- Provide and report high risk population and infrastructure in anticipated hazard areas.
- Capacity building of line and stakeholder department on disaster risk reduction and management.

During-Disaster

- Coordination and mobilization of man and material resources
- For rescue and evacuation of people, provide and manage temporary shelter and life restoration equipment in disaster affected regions
- Coordinate with line departments for health and veterinary services in the affected regions and ensure to control outbreak of any communicable diseases
- Coordinate with DDMA and line departments

- Coordinate with individual donors, donor organizations, NGOs and INGOs and ensure distribution of relief among disaster affectees

Post-Disaster

- Coordination with DDMA and line departments for need and damage assessment
- Need and damage assessment reporting to higher management, NGOs, INGOs and other agencies for rehabilitation
- Ensure rehabilitation on build back better principle

DISTRICT DISASTER MANAGEMENT AUTHORITY (DDMA)

Pre-Disaster

- Close coordination with PDMA and other relevant stakeholders
- Risk assessment and identification of disaster-prone areas
- Aware and sensitize public and private departments on main streaming disaster risk reduction in developing planning
- Coordinate meeting and engage TDMC for preparation of anticipated disasters.
- Ensure readiness of equipment and inventory
- Disseminate disaster alerts to concerned TDMC with action plans for forecastable disasters
- Ensure availability of relevant staff before anticipated disaster
- Advise concerned departments on removal of congestion from water ways before monsoon and flooding period
- Ensure availability and functioning of district emergency operation center
- Arrange emergency response exercises and drills along with volunteer groups, social welfare and civil defense on various disaster scenarios

During-Disaster

- Mobilization of man and material resources
- For rescue and evacuation of people, provide and manage temporary shelter and life restoration equipment in disaster affected regions
- Coordinate with TDMC and line departments
- The DDMA shall lead the evacuation of people to safer places with the assistance of PDMA. DDMA shall also ensure safety, security, supply chain, life commodities and management of relief camps
- Only authorized officials of DDMA shall brief media on disaster situation and the response activities.

Post-Disaster

- Coordination with TDMC and line departments for need and damage assessment
- Need and damage assessment reporting to PDMA
- Ensure rehabilitation on Build Back Better principle

CIVIL DEFENSE

Pre-Disaster

- Assign representatives for DDMA to participate in meetings
- Information sharing regarding capacities and needs of Civil Defense department regarding disaster risk management
- Capacity building of Civil Defense department regarding disaster risk management
- Information sharing regarding technical and personnel expertise with DDMA
- Conduct trainings for Volunteers regarding Rescue and other relevant expertise in collaboration with Health department and PDMA
- Create awareness regarding rescue, evacuation and first aid
- Effectively establish, train and systemize volunteers initiatives in collaboration with education department / institutions

During-Disaster

- Fire fighting
- Rescue and evacuation
- Assign volunteers in coordination with PDMA and DDMA
- Communicate to DEOC about details of all activities
- Communicate to DEOC any additional resources required for performing the above tasks
- Facilitate line departments as per demand in disaster response

Post-Disaster

- Assist in rehabilitation process if required

EDUCATION DEPARTMENT

Pre-Disaster

- Assign representatives for DDMA and participate in meetings
- Information sharing regarding capacities and needs of Education department regarding disaster risk management
- Teachers and students are informed about the disaster prone areas of the district
- Teachers and students are informed of their responsibilities to take care of materials and documents to safe places during disaster
- Facilitate and collaborate with PDMA in preparation of disaster management curriculum
- Collaborate with PDMA and DDMA in synergizing volunteers

During-Disaster

- Mobilize human resources for intervention during disaster
- Inform schools situated in high risk areas about hazard and hazard forecast
- Assist in arrangement of relief and shelter camps in educational institutes for the disaster affectees

- Facilitate Health department and other relevant entities in arranging medical camps, blood donations and provision of medical aid during disaster and emergencies
- Coordinate with PDMA and DDMA in assigning volunteers for emergency response

Post-Disaster

- Assessment of damages occurred to educational institutes
- Provide assistance to teachers, students and other staff who are victimized by disasters (lack of food, shelter, etc.)
- Rehabilitation and reconstruction of affected educational facilities
- Facilitate institutions / NGOs / INGOs which focus on rehabilitation of educational facilities
- Prepare overall report of the department regarding intervention and disseminate to PDMA and DDMA

FINANCE DEPARTMENT

Pre-Disaster

- Regular coordination with PDMA
- Allocate budget on contingency basis, to handle any emergency situations
- Facilitate other departments in planning and meeting their financial needs

During-Disaster

- Provide funds to PDMA and other line departments for procurement of material and equipment required for emergency response
- Provide funds to PDMA and other line departments for rescue and relief activities

Post-Disaster

- Get statistical data regarding actual damage and recovery needs from all line departments
- Provide funds for execution of rehabilitation process

HEALTH DEPARTMENT

Pre-Disaster

- Assign representatives for DDMA, and participate in meetings
- Information sharing regarding capacities and needs of Health department regarding disaster risk management
- Build capacity of health department regarding disaster risk management and preventive health care especially in disaster prone areas
- Monitor the general health situation, e.g. monitor outbreak of diseases
- Provide specific information required regarding precautions for epidemics
- Establish a health mobile team in district and taluka headquarter hospital
- Set-up an information Centre to organize sharing of information for public information purposes
- Prepare first aid kits, medicines, water test kits, chloramines and anti-snake venom serum.
- Collaboration with relevant organizations / partner NGOs for participation and support through technical resources
- Up-gradation and smooth functioning of hospitals, BHUs, equipped with required staff, medicines and equipment
- Database and linkages with ambulance services/blood banks
- Health and hygiene awareness and education
- Ensure proper disposal of hospital waste

During-Disaster

- Provide emergency treatment for the seriously injured
- Ensure emergency supplies of medicines and first-aid
- Supervise food, water supplies, sanitation and disposal of waste

- Assess and co-ordinate provision of ambulances and hospitals where they could be sent (public and private);
- Provide special information required regarding precautions for epidemics
- Set-up an information Centre to organize sharing of information for public information purposes
- Conduct disaster impact assessment on health
- Intervene in case of disease outbreak
- Medical camps and vaccination
- Ongoing surveillance with regard to health issues and disease outbreaks

Post-Disaster

- Conduct disaster impact assessment on health situation
- Prepare plan for the following year along with reports and submit to PDMA and concerned department.
- Medical camps and vaccination
- Rehabilitation of health infrastructure affected during disaster
- Preparation of impact assessment surveys covering strengths and weaknesses of interventions and impact on affected victims and dissemination of learning to PDMA and other concerned institutions

IRRIGATION DEPARTMENT

Pre-Disaster

- Inspection and identification of vulnerable embankments
- Monitoring and dissemination of river water levels
- Implementation of SOPs defined by Bund Manual
- Ensure readiness of equipment and machinery before monsoon and flooding season
- Monitor and disseminate flood level information to DDMA and PDMA

- Initiate necessary embankments reinforcing interventions for vulnerable embankments
- Initiate interventions for river training where necessary
- Introduce and ensure water harvesting and modern water management interventions in likely drought affected areas
- Ensure safety and compactness of irrigation channels, canals, branches, etc. before start of monsoon season to avoid breaches in irrigation system during heavy rains
- Ensure removal of congestion from storm water and draining channels before monsoon

During-Disaster

- Ensure 24/7 vigilance of vulnerable embankments
- Measure and report flood water inundation levels to DDMA and PDMA
- Ensure to drain/de-water from agriculture fields and its safe conveyance to minimize losses
- Coordinate with PDMA and DDMA during entire disaster event for execution of on-demand action plans

Post-Disaster

- Conduct assessment of damages and needs and report to PDMA through DEOC
- Restore and repair damaged irrigation systems
- Prepare overall report of the department regarding intervention and disseminate to PDMA and DDMA

INFORMATION DEPARTMENT

Pre-Disaster

- Close coordination and liaison with PDMA and DDMA
- During monsoon, flooding season and forecastable hazards issuance of press releases regarding hazards and preparedness plans of the government
- Issue and publish disaster alerts on appropriate media forums
- Coverage and publication of government initiatives on disaster risk reduction and management

- Ensure media coverage and publication of PDMA and DDMA meetings for pre disaster preparations

During-Disaster

- Coordination with PDMA and DDMA for announcement of warnings and updates on disasters
- Publication of bulletins on government actions, facilities, relief and rescue efforts
- Publication of camp management and relief distribution announcements
- Publication of safety measures during disasters to minimize disaster domino effects
- Communicate voice of affectees to concerned departments

Post-Disaster

- Focus on problems being faced by the people of the affected area
- Publish, broadcast /telecast programs highlighting strengths, weaknesses and scams in disaster response activities
- Publish, broadcast /telecast programs highlighting government initiatives and collective response of NGOs, INGOs and other departments for relief and rehabilitation

PAKISTAN METEOROLOGICAL DEPARTMENT (PMD)

Pre-Disaster

- Update and upgrade forecast equipment
- Timely and authentic forecast of rains, windstorms and other forecastable hazards
- Timely transfer of information regarding abnormal weather conditions to PDMA

During-Disaster

- Monitoring of flood waters, river flows and sharing of information with PDMA
- Forecasting for any confluencing disaster
- Issuance of precautionary measures to avoid domino effects of disaster

Post-Disaster

- Technical assistance in rescue and rehabilitation process

POLICE DEPARTMENT

Pre-Disaster

- Coordinate with the DDMA in the pre-disaster planning
- Participate in DDMA meetings
- Capacity building of Police department regarding disaster risk management
- Information dissemination through 15 helpline service to local residents
- Prepare team for emergency intervention
- Prepare plan for shifting to safer places and early warning system

During-Disaster

- Co-ordinate with DEOC
- Assistance in shifting of rescued/affected people to relief camps and hospitals
- Provide protection and easy access to rescue and relief personnel/vehicles
- Maintain law and order
- Provide warning / instruction to travelers
- Divert traffic on alternate routes as and when necessary
- Ensure security to workers of NGOs and INGOS who perform duties for disaster response
- Ensure safety and security of relief goods and maintain discipline during relief distribution process
- Provide security in Relief Camps

Post-Disaster

- Assist in relief and rehabilitation process

REVENUE DEPARTMENT

Pre-Disaster

- Assign representatives for DDMA, and participate in meetings
- Information sharing regarding capacities and needs of Revenue department regarding disaster risk management
- Capacity building of Revenue department regarding disaster risk management
- Assessment of high prone areas and estimation of possible damage and needs for recovery in case of emergency
- Arrangement of financial resources
- Facilitate getting tax exemptions to institutions/NGOs/INGOs focus on disaster risk management
- Collect and update population data at village level

During-Disaster

- Coordination with the DEOC
- Establish relief distribution centers
- Accept relief donations and relief support
- Timely release of funds

Post-Disaster

- Allocation of funds for recovery and rehabilitation process
- Assessment of damage of industry/business, crops and livestock and settlement of applicable taxes accordingly in coordination with Industry, Agriculture and Irrigation departments

ARMED FORCES

Pre-Disaster

- Coordinate with the DDMA in the pre-disaster planning

- Prepare necessary equipment, labor, transportation and other materials for emergency interventions
- Provide training to soldiers and determine the role of soldiers who are stationed in flood prone areas
- Assist in evacuation of people to safe places

During-Disaster

- Maintain liaison with the DEOC for vital inputs during response
- Collect information and warn appropriate Army units for engagement in safety, rescue and evacuation activities
- Establish communication infrastructure and supplement the civil communication set-up if required
- Coordinate all military activity required by the civil administration
- Provision of medical care with the help of the medical teams, including treatment at the nearest armed forces hospital
- Transportation of relief material
- Provision of logistic back-up (aircrafts, helicopters, boats)
- Assist in establishment of Relief Camps
- Assist in evacuation of people to safe places during the disaster
- Installation of temporary Bridges, Bunds

Post-Disaster

- Cooperate and coordinate with district authorities
- Assist in rehabilitation process if required

SOCIAL WELFARE AND COMMUNITY DEVELOPMENT

Pre-Disaster

- Coordination with NGOs and civil society organizations working for disaster risk management

- Empower the extremely vulnerable people emphasizing women and children through public awareness involving respective departments for various fields such as Education, Health etc.
- Capacity building of community based groups and volunteers engaged in disaster management activities

During-Disaster

- Provide information on the situation of the disaster to the DEOC
- Coordinate all NGOs / INGOs and civil society organizations working during the emergency response
- Monitor progress of relief operations in the affected areas
- In coordination with PDMA, Health, Revenue and other line departments, ensure delivery of relief to most vulnerable segments of society such as children, orphans, widows, destitute
- Assist and facilitate Damage and Needs Assessment teams from NGOs
- Share human resources with DDMA

Post-Disaster

- Monitor and follow up the status of the extremely vulnerable people
- Assist and facilitate Damage and Needs Assessment teams from NGOs
- Conduct impact assessment studies and analysis of strengths and weaknesses of stakeholders and disseminate learning to PDMA, DDMA and other concerned institutions
- Facilitate institutions / NGOs/ INGOs which focus on rehabilitation activities

NGOs / INGOs

Pre-Disaster

- Facilitate PDMA and DDMA for capacity building regarding disaster risk management
- Capacity building of community groups regarding disaster risk management
- Linkages with concerned departments and institutions for providing technical and financial resources regarding diverse sectors related to disaster management

- Resource mobilization at local and international level

During-Disaster

- Collaborate and facilitate in relief operations
- Incorporate local and international expertise in disaster response
- Facilitate establishment of temporary shelters and camps
- Facilitate in overall disaster response in collaboration with concerned departments
- Regular updates and alerts to local and international partners
- Utilization of existing resources and further mobilization at local and international level
- Assessment of losses using sphere standards

Post-Disaster

- Collaborate and facilitate in rehabilitation activities
- Incorporate local and international expertise in rehabilitation activities
- Facilitate overall rehabilitation in collaboration with concerned departments
- Impact assessment studies and sharing findings with PDMA, DDMA, local and international partners
- Linkages with partners for sustainable resources mobilization

DISASTER MANAGEMENT GUIDELINES

INTRODUCTION

Multi-hazard vulnerability Risk Assessment of Sujawal district reveals that the district is prone to multiple natural disasters. The pertinent hazards to district are hydro-meteorological hazards including drought, cyclone, tsunami and riverine flood. The risk of geophysical hazards is low in the district. In modern technological era, hydro-meteorological hazards can be precisely forecasted and action can be taken well in time to minimize damages and losses. In other words, the vulnerabilities and risks are manageable and losses and damages can be minimized through adoption of best management practices and mobilization of resources.

These guidelines introduce best practices which can be adopted to manage risk of natural disasters in the district.

Riverine Flood	<ol style="list-style-type: none">1. River Indus in Sindh can be segmented in three broad reaches Guddu to Hyderabad, Hyderabad to Kotri and Kotri to Arabian Sea. Additionally, during past years, road bridges have been built over river Indus at different location. Though such developments and interventions were essential to bring prosperity in the region, however, have embedded impacts on fluvial geomorphology and natural flood plain of the Indus. Further, extensive human interventions such as use of land for agriculture, road infrastructure, civil embankments, etc. are observed through satellite imagery within the existing flood plain. In such scenario, risk of breaches in flood protective embankments and consequential flooding of adjoining areas have been increased. To minimize this risk, it is essential to restore Indus flood plain in its natural form. This arrangement will significantly reduce riverine flood risk through adoption of ecosystem friendly disaster risk reduction. The arrangement will not only reduce disaster risk but restore and enrich biodiversity in Indus flood plain.2. Though river Indus floodplain is bounded by flood protective embankment, but still some parts of district Sujawal adjoining river Indus are likely to be affected due to breaches in embankments of river Indus.3. It is highly recommended to identify and reinforce sections of vulnerable embankments before flooding season to avoid breaches in embankments and consequential damages.4. As far as riverine floods are concerned, the Sindh province has sufficient time for preparation and reaction. Close monitoring of river discharge level in coordination with irrigation department, the government of
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	<p>Punjab, Federal Flood Commission and Pakistan Meteorological Department (PMD) be conducted.</p> <ol style="list-style-type: none"> 5. Timely alerts be issued to people living in low lying areas within flood plain. 6. In case of high anticipated flows evacuation of people and livestock be carried out. 7. Soaking and compacting of embankments before arrival of flood water. 8. Reinforcement and stone pitching of high-risk embankments. 9. Use alternative eco-friendly options like use of bamboo wood etc. to minimize erosion impact on high-risk embankments. 10. Where necessary and possible, erection of guide embankments and spur before arrival of high flood water. 11. 24/7 vigilance of high-risk embankments by Sindh Irrigation Department. 12. Readily availability of breach filling stock and machinery at high risk embankments. 13. Restoration of natural eco-system within flood plain such as revival of braided/Yazoo channels and natural lakes within flood plain to disperse and distribute flood water across the plain. 14. Removal of possible congestion factors within the flood plain. 15. Public participation comprising local people be encouraged in pre and during flood periods.
<p>Earthquake</p>	<ol style="list-style-type: none"> 1. The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar, Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karoonjhar Mountains, which is famous for Nagar Parkar Granite. District Sujawal falls away from any major fault line and is unlikely to be affected by a massive earthquake. 2. Some of prominent faults situated in Sindh are (a) Karachi-Jati, (b) Surjan-Jhampir, (c) Pab Fault (d) Hub Fault and (e) Allah Bund-Rann of

	<p>Kutch faults.</p> <ol style="list-style-type: none"> 3. Though risk of geophysical hazards in Sujawal district is low but still some actions must be taken to avoid losses in case of minor jolts. It is highly recommended to identify old and weak buildings in the city and other urban settings of the district. Local concerned authorities may decide evacuation or retrofitting of such buildings / structures. 4. It is also recommended that, new housing schemes, societies and infrastructure be built with proper town planning and following Building Codes recommended for the zone in which Sujawal district is situated. 5. Local government departments must be strengthened to manage situation arisen from earthquake jolts. Strengthening must include capacity building to act as first responder in any likely situation.
Heatwave	<ol style="list-style-type: none"> 1. The district has witnessed rapidly increased severity of heatwave in the past five years. The district is moderately populated, which significantly increases the chances of heatwave impacts. 2. Heatwaves are forecastable hazards and actions can be taken well before occurrence of heatwaves. The most suitable action is issuance of warnings and alerts in public for precautions and safety. Suitable media for the purpose is social media and SMS. 3. Scientific studies suggest that, frequency and intensity of heatwaves is increased due to climate change. Though climate change is global phenomena, however, its impacts can be minimized through local interventions. The most efficient and cost-effective solution is tree plantation. Tree plantation must be encouraged at different levels including government functionaries, NGOs, community and individual levels. 4. Additionally, introduction of reduced Urban Heat Islands (UHI) through policies and implementation in infrastructure development will significantly reduce impacts of heatwaves.
Drought	<ol style="list-style-type: none"> 1. Sujawal is a moderately populated district with closely spaced homes in major cities. Climatic condition of the district can be categorized as Warm and Semi-Arid (Climate Classification of Pakistan (Khan et al.,

	<p>2010). Average annual rainfall received during a year across the district is 178.84 mm. Agriculture is practiced in the district which is mainly dependent on canal irrigation.</p> <ol style="list-style-type: none"> 2. Drought is also forecastable hazard and can be predicted well in advance. Though drought does not bring any prominent or famine like conditions in the district, however, it causes reduction in agricultural production and some extent disturb food supply for the animals and livestock. The best practice to manage drought related impacts is storage of food supplies for both humans and animals. 3. The situation of drought may vary in future due to climate change effects, therefore, introduction of drought resilient crops is need of the time. Additionally, efficient use of available water resources and introduction of efficient irrigation systems in agriculture sector is also required.
Cyclone	<ol style="list-style-type: none"> 1. The cyclone hazard threat to district Sujawal is Cat-1 TC to Cat-2 TC. However, the frequency and intensity of cyclone formation in Arabian Sea may further increase due to climate change and global warming. Fortunately, cyclone is forecastable hazard, its intensity, possible landfall, timings etc. can be precisely predicted before landfall. If population to be affected is well aware and already prepared for likely event, then major losses and damages can be minimized. Such example can be seen in regional countries like India, Bangladesh and Philippines etc. 2. It is utmost important to strengthen cyclone detection and warning systems in the coastal belt along entire coast in Sindh. Community based disaster risk management, capacity development of prone communities, establishment of permanent shelters and provision of life support facilities will increase the trust and confidence of communities on government functionaries in early evacuation process.
Tsunami	<ol style="list-style-type: none"> 1. The only known Tsunami which hit some parts of Sindh coast happened to major earthquake in Makran coast in Balochistan which triggered tsunami in the region. This event happened in November 1945. No authentic record is available on damage and losses caused by Tsunami in coastal belt of Sindh. The effects of the Tsunami of December, 2004 caused by

	<p>earthquake in Indonesia were along the coastline of Pakistan in the form of abnormal changes in tide gauge stations placed at Keti Bunder.</p> <p>2. As Tsunami is consequence of major earthquake, hence not forecastable hazard in true sense but once the earthquake is occurred in sea or near coast, special sensors can detect the occurrence of tsunami. Once tsunami is detected little time is left for evacuation. However, installation of tsunami early warning system along the coast may greatly impact losses. The best approaches to tsunami response are;</p> <ul style="list-style-type: none">○ Installation of tsunami early warning and dissemination system in coastal settlements○ Awareness of communities at risk on tsunami precautions and response
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STANDARD OPERATING PROCEDURES

INTRODUCTION

Overall, disaster risk reduction is collective responsibility of concerned departments, associated line departments, private sector and communities. Synergized and coherent efforts are required at each cycle of disaster in order to minimize and avoid disaster losses and damages. The implementation of this disaster management plan would only be possible until roles and responsibilities of every department are defined and well understood.

ACTION PLAN FOR FLOOD

The monsoon and flooding period is well defined and occur almost every year with different intensities and cause losses at different scales. The recommended action plan for monsoon and flooding is tabulated below:

Table 5: Action Plan for Flood Hazard Management

Action	Timelines	Responsibility
Letter to irrigation department for identification of vulnerable embankments and disaster mitigation measures	April-May	PDMA
Inspection, maintenance and ensure readiness of flood fighting equipment available with PDMA	May-June	PDMA
Inspection, maintenance and ensure readiness of flood fighting equipment available with line departments	May-June	Local Government, Irrigation, and other relevant functionaries
Letter to concerned departments for removal of congestions in water ways	May-June	PDMA
Conduct pre monsoon meetings/conference with concerned departments	June-July	PDMA

Organization and conduct of pre monsoon meetings headed by DDMA and chalking out of monsoon contingency and action plans	June-July	PDMA to write letter to concerned departments and organize such meetings through online or other feasible mechanism
Interaction and close liaison with Pakistan MD on weather forecast	June-July	PDMA
Dissemination of severe weather alerts to concerned DDMA and likely population to be affected	Based on forecast	PDMA
Daily monitoring of discharge data and flood inundation levels	During flooding	Sindh Irrigation Department
Deployment of man and material resources and soaking, inspection and monitoring of flood protecting infrastructure	Pre and during flooding	Sindh Irrigation Department

ACTION PLAN FOR FORECASTABLE DISASTERS

Severe weather, heatwave, drought, and cyclone are only forecastable hazards. For such hazards following action plan is recommended

Table 6: Action Plan for Heatwave Hazard Management

Action	Timelines	Responsibility
Interaction with PMD for forecasting and monitoring of heatwave	Based on forecast	PDMA
Dissemination of forecast to	Based on forecast	PDMA

concerned DDMA and local community		
Mobilization of NGOs, INGOs and individuals for arrangement of heat stroke and medical camps within affected areas	During disturbance period	PDMA and DDMA

Table 7: Action Plan for Drought Hazard Management

Action	Timelines	Responsibility
Interaction with PMD for forecasting and monitoring of drought	Based on forecast	PDMA
Dissemination of forecast to concerned DDMA and local community	Based on forecast	PDMA
Mobilization of NGOs, INGOs and individuals for stocking of food and life support items to prevent and mitigate famine conditions depending upon severity and spell of drought	During disturbance period	PDMA and DDMA

Table 8: Action Plan for Cyclone Hazard Management

Action	Timelines	Responsibility
Interaction with PMD for forecasting and monitoring of cyclone and likely landfall.	Based on forecast	PDMA
Dissemination of forecast to concerned DDMA and local community	Based on forecast	PDMA
Evacuation of population likely to	Before forecasted landfall	PDMA and DDMA

be affected to safe places		
Temporary shelter and camp management for affected population and livestock	Before forecasted landfall	PDMA and DDMA
Arrangement of initial relief for affectees	During disturbance period	PDMA and DDMA
Recovery and resettlement of population to native places	Post disaster	PDMA and DDMA

ACTION PLAN FOR UNFORECASTABLE HAZARDS

Earthquake/Tsunami

The earthquake and tsunami are unforecastable hazards and do not provide reaction time to prevent damages. The recommended post disaster action plan are as follows

Table 9: Action Plan for Earthquake/Tsunami Hazard Management

Action	Timelines	Responsibility
Mobilization of man and material resources for rescue and recovery	Post disaster	PDMA and DDMA
Mobilization of NGO, INGO, volunteer groups, scouts and armed services for rescue and recovery	Post disaster	PDMA and DDMA
Coordination and establishment of relief camps, mobile medical camps, life support facilities and provision of relief to affectees	Post disaster	PDMA and DDMA
Coordination and mobilization of rescue teams to search and rescue life in collapsed structures	Post disaster	PDMA and DDMA

Coordination with National Disaster Management Authority (NDMA) for seeking assistance from international agencies (depending on severity of events and damages/losses)	Post disaster	PDMA
Coordination and mobilization of resources on Build Back Better principles	Post disaster	PDMA

SOP FOR PEOC AND DEOCs

- For the smooth operation of the emergency activities the PEOC and District Emergency Response Centre (DEOC) will work under defined Standard Operating Procedures (SOPs). These SOPs are broadly categorized in three sections
 - a. Action on receipt of early warning, safe evacuation, search and rescue, initial assessment, relief distribution, recovery and deactivation of response.
 - b. Coordination and information dissemination
 - c. Contingency planning and response actions
- For localized emergencies, the situation shall be dealt within the regular operating mode of the emergency management services in the district.
- DDMA shall activate the DEOC and take the operational lead for the district government response.
- The DEOC will serve as the center for receiving early warning and issuing information to public at village level, taking measures to evacuate people, updating relevant departments, response agencies, and media etc.
- The DEOC will lead the coordination and management of relief operations in affected areas in the district with the assistance of PEOC.
- DEOC will coordinate with all concerned departments and humanitarian agencies at district level.
- DEOC will coordinate for early recovery with the assistance of PDMA and other concerned departments.

- In standby position, PEOC and DEOC shall be alert and ready to start emergency operations. The PEOC shall coordinate with concerned departments like NDMA, PMD, etc. for regular updates on likely disaster events. Once the threat is established, the PDMA shall approve the alert and activate response mechanism of PEOC and DEOC.
- Once PEOC and DEOC activation is approved or issued, both centers will remain fully operational on 24/7 basis and coordination shall be established with all concerned departments.
- PEOC and DEOC will collect regular updates on disaster situation and after normalization of situation and with mutual consultation shall inform PDMA to issue stand down or disaster deactivation call and final report on emergency operations will be circulated to stakeholders.
- The operationalization of PEOC and DEOC means complete activation of centers during disaster situation. Management of PDMA shall ensure full functionalities of PEOC including stock for emergency food, office supplies, communication system with backup support, electricity generators, computers, screens, multimedia projectors and other necessary equipment. While Deputy Commissioner Sujawal shall ensure availability of all necessary equipment and supplies at DEOC for 24/7 operations. The deputy commissioner or chairperson DDMA will also ensure availability and presence of representatives of DDMA in DEOC during emergency operations for liaison and close coordination and smooth emergency response.
- A contact information of relevant government officials, influential personnel, political figures, volunteer groups, social welfare organizations and communities of high disaster risk prone areas shall be collected and maintained by PEOC and DEOC. For establishing quick liaison and coordination this contact information shall be used by both PEOC and DEOC. In addition to these contacts, PEOC will arrange random SMS alerts, robo calls etc. through commercial cellular services.
- The PEOC will establish the direct contact/coordination with district disaster management officer for disaster alerts and warnings and onward dissemination and other immediate actions.
- All warnings and alerts shall be carefully scrutinized by the central body i.e. PDMA and disaster warning alerts shall only be issued through single nodal agency to avoid any circulation of misinformation etc.
- During the disaster, all instructions, guidelines, action plans and advisories on disaster events, evacuation, relief operations etc. shall be issued by PEOC or DEOC in consultation with PEOC.

DISASTER MANAGEMENT PLAN

INTRODUCTION

Following disaster management measures are recommended for effective preparation, response and rehabilitation of communities. PDMA may identify suitable partners/agencies to carry out each of the below-mentioned measures to maximize the effectiveness of disaster management plan and minimize losses in case of any disaster.

Riverine Flood	
UCs at Risk (10)	Ali Bahar, Bachal Gugo, Bano, Belo, Bijora, Doulat Pur, Goongani, Jongu Jalbani, Kharo Chan, Mureed Khoso
UCs not at Risk (15)	Begna, Chuhar Jamali, Darro, Darya Khan Suho, Gul Mohammad Baran, Jar, Jati, Jhoke Sharif, Kar Malik, Kinjhar, Kothi, Ladiun, Liakpur, Mehar Shah, Mirpur Bathoro
General Description	<ol style="list-style-type: none"> 1. Sujawal is bordered in the northwest by the Indus river which separates it from Thatta District. 2. Indus River flows downstream from Hyderabad and passes through the west of the district till it reaches the delta of the Arabian Sea. 3. District Sujawal is irrigated, mainly, by Indus River and canals. Agriculture and fisheries are the two major sources of employment for the people of district. 4. District Sujawal is prone to riverine flood. It was hit by 2010, 2011 and 2012 riverine floods. The relative severity of floods was ranked as medium in district. 5. In devastating flood of 2010, most of the sources of livelihood were destroyed for the population, particularly for those whose livelihood were dependent on agriculture and the related industries. 6. In floods 2011 a large area of standing crops was washed away as well as agriculture land was filled with the excessive accumulation of mud and water. 7. According to MHVRA study 2022 the hazard of riverine flood in the district is “Low to Very High”. 8. According to MHVRA study 2022 the risk of riverine flood in the district is “Low to Extreme”.
Disaster Management Measures	
Preparedness	
<ol style="list-style-type: none"> 1. Recording of daily river discharge at barrages in Sindh, and regular dissemination among stakeholders. 2. In case of high discharge, dissemination of warnings and alerts to masses living in flood plain. 3. Identification and inspection of vulnerable embankments likely to be affected due to flooding during pre-monsoon season, as per “Bund Manual” of irrigation department. 4. Inspection and readiness of flood fighting equipment available with district government departments prior to flooding season. 5. Classify and map bunds based on their origin (Mud, Brick, Stone, Concrete, Boulder, etc.) 6. Readiness of flood camps in high riverine flood and breaching risk areas. 7. Maintenance and strengthening of identified weak embankments. 8. Awareness and motivation campaigns on construction of flood resilient buildings and infrastructures. 9. Regular awareness campaigns on flood precautions and safe evacuations using various media platform. 10. Inclusion and implementation of Disaster Risk Reduction (DRR) measures in development projects at planning stage for building flood resilient infrastructure. 11. Conduct of satellite imagery based study for identification of vulnerable embankments before each monsoon and flooding period. 12. Collection and management of contact information of area/village influential for alert and warning 	

dissemination.

13. Readiness of community-based volunteers and other related organizations / NGOs.
14. Regular community-based flood fighting trainings through government departments or any other appropriate platforms.
15. Installation of digital flood level gauges along embankments and dissemination of real-time flow level measurements to concerned authorities.
16. Installation of surveillance cameras at safe places for consistent monitoring of structural integrity of vulnerable embankments.

Response

1. Mobilization of rescue services, relevant NGOs, scouts and volunteers.
2. Evacuation of people and livestock to shelters/camps.
3. Camp management as per standard practices.
4. Relief distribution.
5. Precautionary measures for communicable diseases.
6. Activation of mobile health and education services for flood affectees.
7. Arrangements for early recovery including flood de-watering and early restoration of communication and essential services.

Recovery and Rehabilitation

1. Damage assessment of flood affected areas.
2. Conduct post flood repairs or refurbishment of embankments/barrages/canals
3. Resettlement of population on build back better basis.
4. Complete restoration of communication and essential services.

Earthquake	
UCs at Risk	All UCs
General Description	<ol style="list-style-type: none"> 1. District Sujawal falls away from any major fault line and is less likely to be affected by a massive earthquake. 2. There is no recorded historical data available of the damages in the district due to previous earthquakes. 3. Over the last sixty years, earthquakes of intensity lower than 5 on Richter Scale, including those in 1945 and 1985, have struck the region comprising the macro-environment and thus far they have been of minor significance. 4. According to MHVRA study 2022, Earthquake hazard in the district is of intensity "Low". 5. According to MHVRA study 2022, Earthquake risk in the district is "Low".
Disaster Management Measures	
Preparedness	
<ol style="list-style-type: none"> 1. Identifying and inventorying weak buildings and structures especially in urban settings of the district and situation demanding action by concerned departments. 2. Preparation of landuse plans, town plans and implementation of building codes in new residential schemes, schools, public and private offices. 3. Implementation of DRR measures in public infrastructure development schemes. 4. Establishment of search and rescue infrastructure and services which can be mobilized as first responder in post-earthquake situation. 5. Mobilize NGOs, INGOs, community development organizations and volunteers, and conduct earthquake safety awareness campaigns and drills especially in main urban settings. 6. Availability of necessary material and equipment required for establishing temporary shelters with life support facilities i.e. mobile medical camps, schools, power supply, water and sanitation etc. 7. Availability of alternative communication system in case if usual communication means are disturbed by earthquake. 8. Preparation of medical emergency plan to manage mass casualties in case of any major earthquake event. 	
Response	
<ol style="list-style-type: none"> 1. Obtain firsthand information on intensity of earthquake and damages; prioritize areas for search and rescue operation. 2. Mobilize community-based volunteers, scouts and other trained personnel to hard hit areas to assess situation and help victims. 3. Establish emergency camps / shelters with necessary life support facilities. 4. Establish medical camps for provision of first aid and possible medical assistance to injured. 5. Evacuate people from damaged houses to safe places and shelters. 6. Provide security in affected areas and maintain law and order situation to prevent incidents of thefts and stampede. 7. Arrangement and conduct of aerial / drone survey of the affected areas. 8. Establish information and help desks for facilitation of affectees. 9. Restore essential services like power, water supply, and telecommunication of critical infrastructure like hospitals, control Rooms, etc. on priority basis. 	
Recovery and Rehabilitation	
<ol style="list-style-type: none"> 1. Detailed damage and need assessment for recovery and rehabilitation. 2. Rehabilitation on build back better principle. 	

Heatwave	
UCs at Risk	All UCs
General Description	<ol style="list-style-type: none"> 1. Climatic condition of the district can be categorized as Warm and Semi-Arid (Climate Classification of Pakistan (Khan et al., 2010)) 2. The sea breeze blows for eight months of the year, from March to October, making the weather comparatively cooler. 3. The months of May and June are hot during the day with average maximum and minimum temperatures being 38 °C and 27 °C respectively. 4. December and January are the coldest months with average maximum and minimum temperature of 27 °C and 13 °C respectively. 5. According to MHVRA study 2022, heatwave hazard in the district is of “High to Extreme” intensity. 6. According to MHVRA study 2022, risk of heatwave in the district is of “Low to Extreme” intensity.
Disaster Management Measures	
Preparedness	
<ol style="list-style-type: none"> 1. Consistent future development strategy: Tree plantation, restoration of natural ecosystem, construction of environment friendly and well planned residential societies, offices, infrastructure and human dwellings. 2. Monitoring for hot weather alerts through local and international sources and issuance of timely Hot Day Advisories, and Hot Day Warnings. 3. Upgradation of major public health care facilities with necessary equipment and medicines to treat heatstroke patients. 4. Heatstroke awareness campaigns and wide public coverage through media, social media, SMS, NGOs and social welfare organizations. 5. Arrangements for uninterrupted supply of electricity and water in vulnerable areas. 	
Response	
<ol style="list-style-type: none"> 1. Mobilization of NGOs, social welfare organization and volunteers for arranging heatstroke facilitation camps and distribution of fresh drinking water in affected areas. 2. Local radio FM broadcasts to disseminate heatstroke safety and precautions. 3. Mobilize mobile medical teams for first-aid and other medical emergency support in affected area. 4. Record keeping of heatwave patients and fatalities. 	
Recovery and Rehabilitation	
<ol style="list-style-type: none"> 1. Post event review of heatwave plan and modifications if required. 	

Cyclone	
UCs at Risk	All UCs
General Description	<ol style="list-style-type: none"> 1. Due to its geographical setting, district Sujawal is among districts badly affected by the surge of cyclone on several occasions. 2. Historically, the tropical cyclones formed over the Arabian Sea and making landfall at the coastal areas of Sindh including district Sujawal. 3. Tropical cyclones not only wipe out the human settlements and huge losses of human and animal lives, but it also destroys and damages the fishing boats and fish harbours, thus affecting the livelihood of the majority of fishery communities of the district. 4. Some of the major tropical cyclones hit the coastal areas occurred during May 1902, June 1926, June 1964, November 1993, June 1998, May 1999, June 2007 and 2011 and June 2014. The Cyclone Yemyin in 1999 hit three coastal districts of Sindh, where 244 loss of life, 40,177 animals perished and 0.5 million population affected. 5. The cyclones of 2010 (Phet) and 2011 (Kiela) also occurred in the district, out of which PHET caused significant damages in district. 6. According to MHVRA study 2022 the hazard of cyclone in the district is “Cat-1 TC to Cat-2 TC”. 7. According to MHVRA study 2022 the risk of cyclone in the district is “Low”. 8. According to MHVRA study 2022 the hazard of Storm Surge in the district is “Low to Very High”. 9. According to MHVRA study 2022 the risk of Storm Surge in the district is “Low to Extreme”
Disaster Management Measures	
Preparedness	
<ol style="list-style-type: none"> 1. Identify community based DRR measures and inclusion of disaster prone communities in disaster risk management. 2. Establishment of multipurpose permanent shelters with all life support facilities to facilitate safe evacuation of people and livestock. 3. DRR mainstreaming in development planning. 4. Strengthening of cyclone detection, forecasting and warning dissemination centers. 5. Launching a series of public awareness campaign throughout the coastal area by various means including Radio, TV and other media. 6. Training of local administration in warning dissemination and evacuation techniques. 7. Mobilization of NGOs and community based organizations for awareness on construction of houses, billboards, roof tops, and boundary walls, keeping in view effects of high winds. 8. Review/Update emergency response plans and disaster recovery plans. 9. Stocking of key equipment and supplies to carry out immediate response activities including evacuation, shelters, medical camps, water and sanitation, power supply, alternate communication means etc. 10. Design, practice and implementation of evacuation plans with emphasis on self-reliance. 11. Cleaning of water channel, drainage and sewerage before cyclone season in Arabian Sea. 12. Readiness of de-watering machines before start of monsoon and cyclone season. 13. Ensure availability of real-time cyclone hazard map depicting the probable track and landfall impact on PDMA website 	

Response

1. Issue early reliable warning through siren or other relevant means to reduce the severity of the cyclone related disasters and save valuable human lives.
2. Establish communications with isolated fishermen / coastal communities for furnishing cyclone early warning.
3. Identify, involve and mobilize local NGOs which can assist in community awareness and mobilization for response.
4. Identify and mobilize volunteers' / volunteer organizations which can assist various facets of response like provision of emergency healthcare and relief items.
5. Initiate preliminary damage assessment and run search and rescue operations.
6. Provision of immediate relief including provision of food and potable water to affectees.
7. Deployment of emergency medical support.
8. Provide emergency health care to the affected population, in order to cover risk of spread of epidemic diseases like acute watery diarrhea, typhoid fever, malaria and measles, relapsing of fever and acute respiratory illness.

Recovery and Rehabilitation

1. Assess damage to buildings across the impacted areas to gather information about the extent and severity of damage.
2. Rehabilitation on build back better principle.

Drought	
UCs at Risk	All UCs
General Description	<ol style="list-style-type: none"> 1. Climatic condition of the district can be categorized as Warm and Semi-Arid (Climate Classification of Pakistan (Khan et al., 2010)) 2. Average annual rainfall received during a year across the district is 178.84 mm. 3. Indus deltaic region exists in south of the district, with creeks, which brings Indus water into the sea. 4. Agricultural water needs are mostly dependent on canal irrigation system, crops on both sides of river bed is irrigated through river water. 5. Indus River flows along western boundary where Crops are found on both sides of the river bed. 6. Mangroves forests are found in Indus deltaic region, mostly along coastal boundary of the district. Range land natural herbs and shrubs are mostly found across central part of the district. 7. According to MHVRA study 2022. <ol style="list-style-type: none"> a. Meteorological drought hazard for district Sujawal is “Extreme” b. Meteorological drought risk for district Sujawal is “Medium to Extreme” c. Agricultural drought hazard for district Sujawal is “Mild to Extreme” d. Agricultural drought risk for district Sujawal is “Low to Extreme”
Disaster Management Measures	
Preparedness	
<ol style="list-style-type: none"> 1. Implement Drought Early Warning System (EWS) at provincial/district level to get clear indications of the impending drought and its consequences, e.g. forecast of impending drought conditions related to changing weather conditions linked to El Nino or La Nina events. 2. Implementation of water supply and demand management and encouragement of efficient irrigation systems in agriculture. 3. Research and promote drought resistant agriculture crops. 4. Resilience and improvement of adaptive capacity of farmers. 5. Monitoring of temperature, precipitation, potential evapotranspiration, soil moisture, stream flow, groundwater levels, lakes, and reservoirs for drought forecasting. 6. Control ground water extraction from upper and lower aquifers to be within the sustainable yield limits. 7. Desalination of sea water and reuse of treated waste water. 	
Response	
<ol style="list-style-type: none"> 1. Assess data about the nature of drought conditions and their impact. 2. Provision and installation of solar water pumps for availability of clean drinking water. 3. Public information campaign for water management and saving. 	
Recovery and Rehabilitation	
<ol style="list-style-type: none"> 1. Cash and in-kind support to farmers for next cropping. 2. Awareness and encouragement of farmers on best irrigation practices and water saving. 	

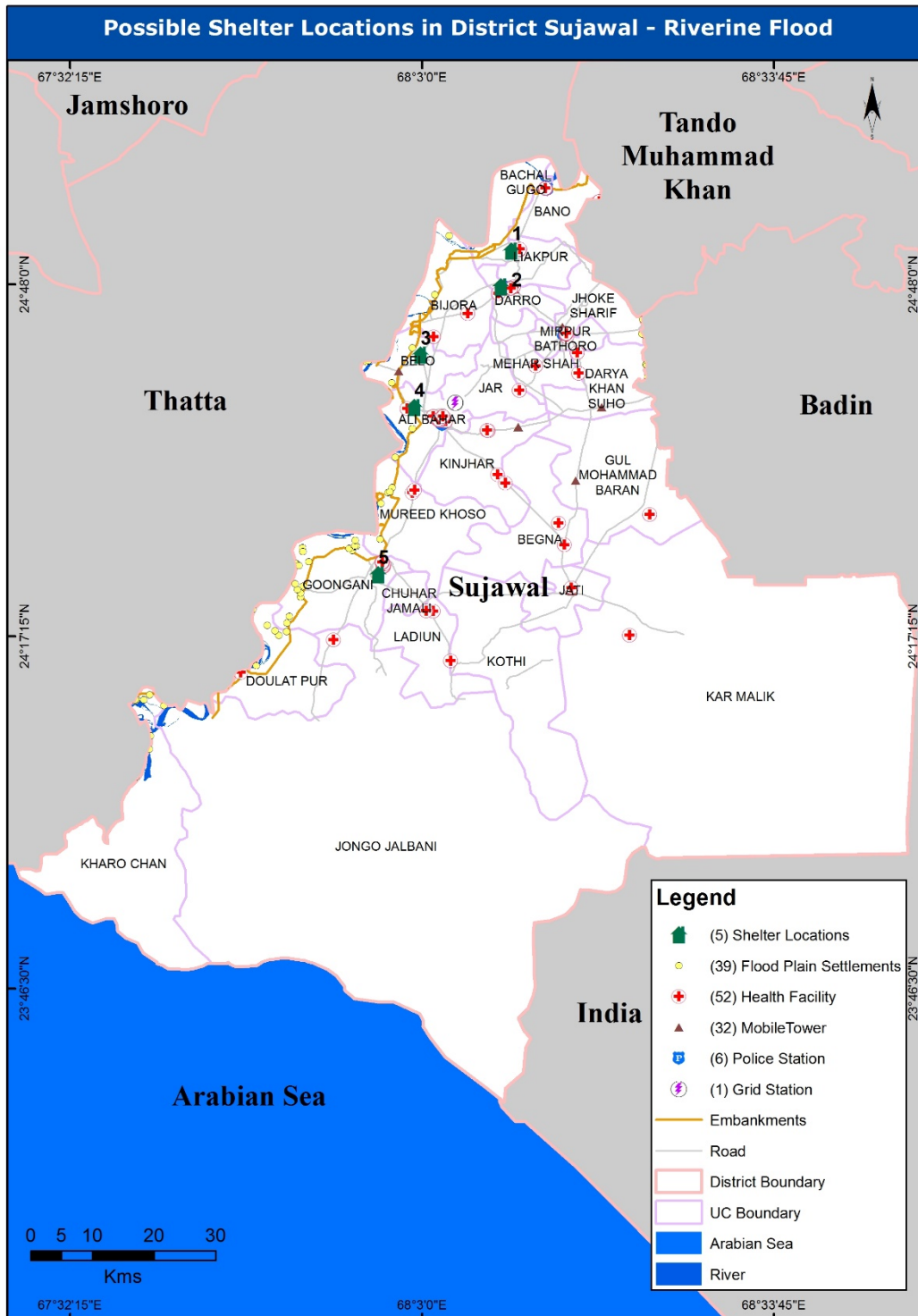
Tsunami	
UCs at Risk (7)	Doulat Pur, Gul Mohammad Baran, Jongo Jalbani, Kar Malik, Kharo Chan, Kothi, Ladiun
UCs not at Risk (18)	Ali Bahar, Bachal Gugo, Bano, Begna, Belo, Bijora, Chuhar Jamali, Darro, Darya Khan Suho, Goongani, Jar, Jati ,Jhoke Sharif ,Kinjhar, Liakpur ,Mehar Shah, Mirpur Bathoro, Mureed Khoso
General Description	<ol style="list-style-type: none"> 1. Due to its geographical location, district Sujawal can be affected by the tsunami disaster. A fault line crossing from Makran coast poses threat to Sujawal coast. 2. In November 1945 an earthquake with a magnitude of 8.1 on the Richter scale generated a tsunami resulted a sea waves of 12-15 meters' height that killed about 4,000 people in the Makran coast. 3. Although Sujawal was away from the epicenter, but still 6 feet high sea waves were observed which affected harbor facilities. 4. Today Sujawal is much more vulnerable to tsunami than it was in 1945 because of high population density, rapid urbanization, lack of land use planning and loss of natural safeguards such as mangroves and sand dunes. 5. The effects of the Tsunami of December, 2004 were also felt along the coastline of Pakistan. The abnormal rise in water detected by tide gauge station in Keti Bunder area of District Thatta created panic in the coastal population including Sujawal district. 6. According to MHVRA study 2022 the hazard of Tsunami in the district is "Medium to Very High". 7. According to MHVRA study 2022 the risk of Tsunami in the district is "Low to High".
Disaster Management Measures	
Preparedness	
<ol style="list-style-type: none"> 1. Strengthening of tsunami detection, forecasting and warning dissemination centers. 2. Conduct feasibility study for deployment of tsunami early warning systems along coastal belt of Sindh. 3. Launching a series of public awareness campaign through NGOs and community development organizations. 4. Training of local administration in warning dissemination and evacuation techniques. 5. Preservation of mangroves and coastal forests along the coast line. 6. Development of a network of local knowledge centers (rural/urban) along the coast lines to provide necessary training and emergency communication during crisis time. 7. Design, practice and implementation of evacuation plans and shelter sites with emphasis on self-reliance. 8. Identify buildings and places that could, in the event of a Tsunami, be used as relief centers or camps and make arrangements for water supply and sanitation in such buildings or places. 9. Protect hazardous material storage facility located in tsunami prone area. 	
Response	
<ol style="list-style-type: none"> 1. Coordination with Pakistan Meteorological Department as nodal agency for earthquake and tsunami detection service and dissemination of alerts and warnings through dedicated tsunami warning systems in coastal belt. 2. Immediate evacuation of nearest coastal belt population to safe sides emphasizing population living near coastal creeks. 3. Arrangement for alternate communication links like satellite phones, HF/ VHF communication, VSAT, etc. 4. Establishment of shelters with all necessary life support facilities. 5. Mobilize and deploy resources e.g. search and rescue and medical teams in the Tsunami affected areas. 6. Supply food, drinking water and medical supplies to the affected population. 7. Assess hygiene of affected area and prevent the spread of disease. 	

Recovery and Rehabilitation

1. Reconstruction of essential infrastructure, such as access to roads, water supply and sanitation, waste water treatment and solid waste disposal.
2. Enhance the ability of the natural system to act as a bio-shield to protect people and their livelihoods by conserving, managing and restoring wetlands, mangroves, spawning areas, seagrass beds and coral reefs.
3. Conduct post-Tsunami damage assessment analysis to provide a clear, and concise picture of post disaster situation, to identify damage caused to different sectors and to develop strategies for rehabilitation, reconstruction and recovery on build back better principle.

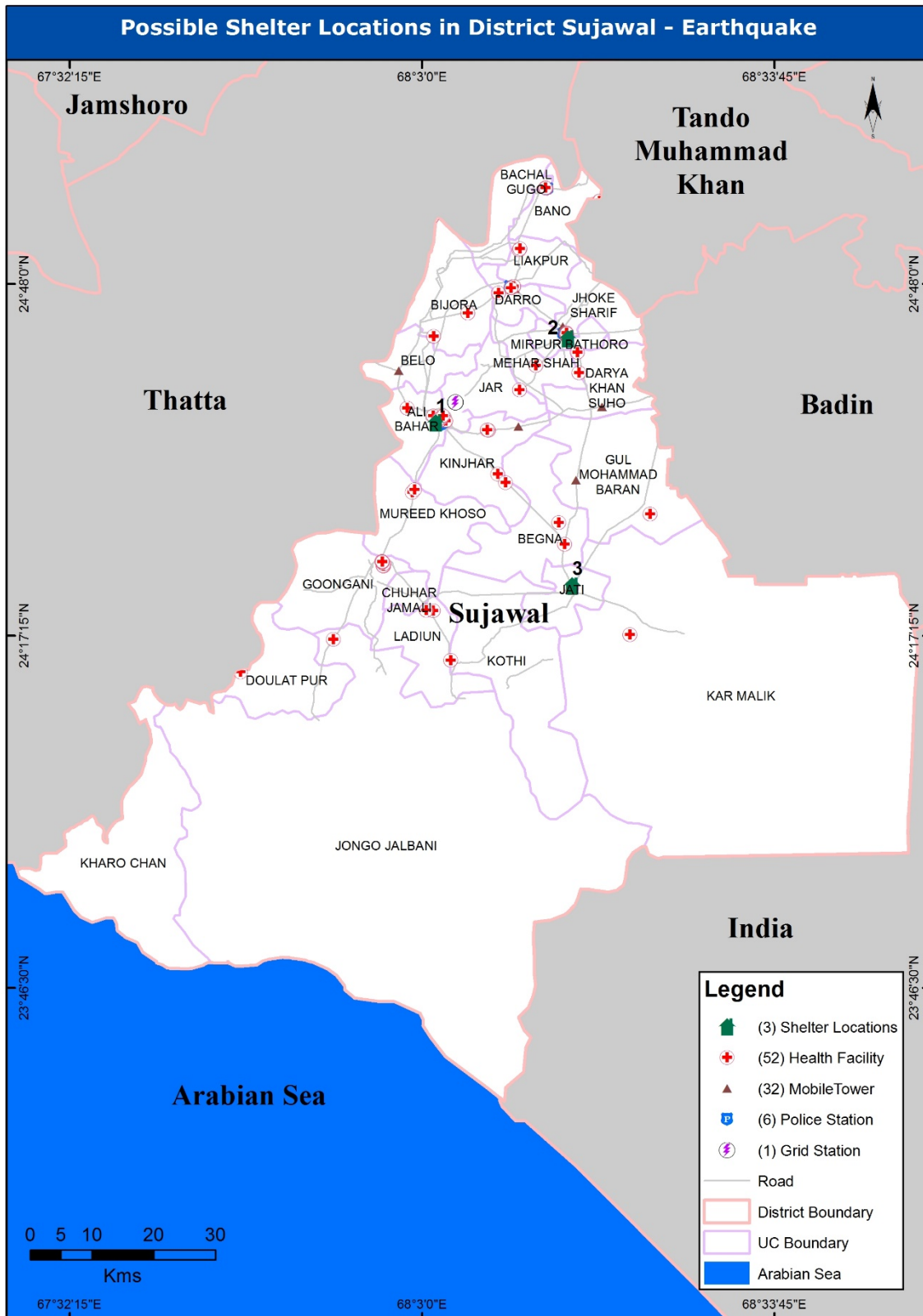
SHELTER LOCATION MAP

As part of preparedness, response, and rehabilitation against hazards, shelter places are integral. These are necessary to relocate, evacuate, or replenish the population that may be affected from hazards. Proposed shelters are illustrated in the maps.

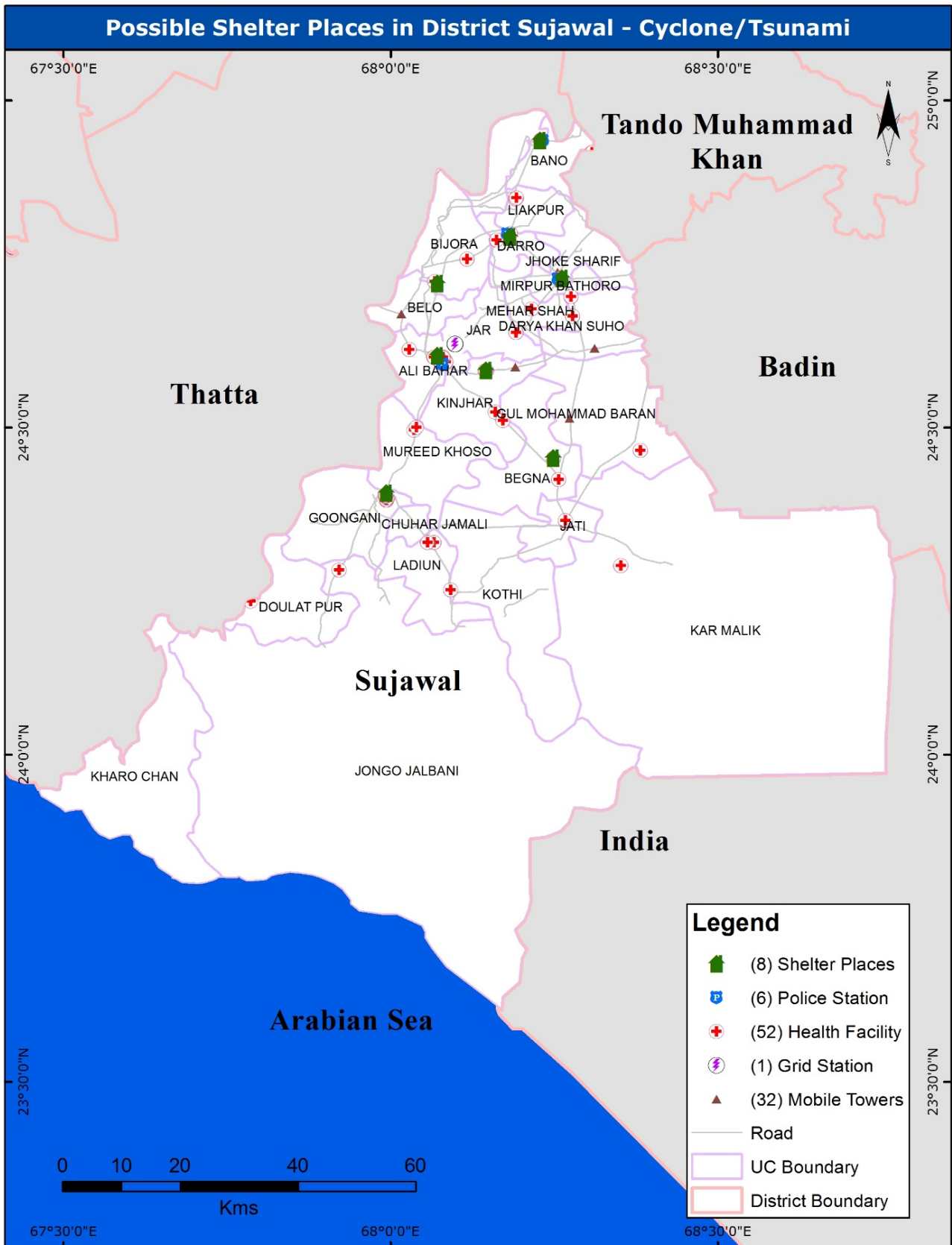


*Annex-A details the list of vulnerable settlements within flood plains prone to riverine flooding

*Annex-B details the list of flood shelter locations



*Annex-C details the list of earthquake shelter locations



PROPOSED PRIORITY DISASTER RISK MANAGEMENT PROJECTS

INTRODUCTION

Following are the recommended disaster risk management projects, which may be initiated to ensure effective disaster management in district Sujawal. PDMA may identify suitable partnering agencies / line departments to carry out and prioritize each proposed project.

Hazard wise list of Priority Disaster Risk Management Projects	
Disaster Risk Management Projects/ Studies	Brief
Riverine Flood	
1. Geomorphological study of flood plain & river course modelling	Conduct flood plain study for identification of bottlenecks, including elevated islands (Annex – D) impeding the flow of (super) flood water, and Indus River course modeling (historic and predictive) for simulating catchment processes and river flow, etc.
2. Conduct feasibility study for Indus River training and straightening (Annex – E).	The river has a tendency to meander over large width of low lying land thereby flooding it occasionally. River training measures, like bell bunds, guide and confine the river flow within the embankments. Straightening the river speeds up the water so high volumes of water can pass through an area quickly. Dredging makes the river deeper so it can hold more water.
3. Installation of river/flood flow digital gauges at suitable locations for real time monitoring of water level, water discharge rates, wave height and flow speed.	Digital water gauges may be installed to collect water flow characteristics. Digital water gauge is an electronic device, which uses an advance processor chip as a controller, records the water flow characteristics through measuring electrodes and transmit it using wired/wireless communication channel after digital processing.
4. Monitoring of vulnerable bunds using IP Camera systems and Drones for surveillance during floods.	Image camera sensors and drones have relatively low procurement cost, portability, high efficiency, durability, maintenance and power consumption. Camera networks can effectively be used at remote 'Landhis' for real-time monitoring of flood level.
5. Capacity building of vulnerable communities	Create Community based disaster risk management (CBDRM) associations and equip them with training and equipment for early response, including rope rescue, sand bags, bamboo and others.
6. Develop emergency operation center.	Establish and equip emergency operation center with modern tools and techniques for management and operation activities in pre, during and post disaster events.
7. Establish a database of resources and equipment for emergency response in relevant agencies.	Create a well-maintained data repository for all available resources with operational status, quantity, location, and maintenance authority in the district.
Earthquake	
1. Ensure implementation of building codes and standards.	Prepare policy and SOP to ensure new buildings in the district are constructed as per the seismic codes and standard of the area.
2. Identification and retrofitting of weak existing structures and unsafe buildings (schools, hospitals and government offices).	Coordinate with local community regarding unsafe buildings and regularly conduct building safety surveys to check structural integrity of buildings against the seismic risk of the district and take necessary retrofitting measures to strengthen weak structures.
	Create database of vulnerable and unsafe buildings and

	retrofitting measures taken to strengthen the structure of such buildings.
3. Preparation of rescue and rehabilitation plan	Coordinate with line departments to create a comprehensive plan with clearly defined roles and responsibilities of first responding departments, as well as, correspond with rescue agencies/NGOs for their role in an event of earthquake. The plan should also details the rescue equipment available with concerned departments.
Drought	
1. Conduct feasibility study for identification of suitable sites for rainwater harvesting and aquifer recharge in the district.	<p>The rainwater harvesting sites should be identified by using geospatial technologies and ancillary data, which can be used as clean water aquifers by communities, which in turn can use it for drinking, and irrigation purposes.</p> <p>Potential rainwater harvesting sites may be identified by using Analytical Hierarchy Process (AHP) and spatial analyst tool, with multiple thematic layers (rain data, population, digital elevation model, soil type, etc.)</p>
Cyclone/Tsunami	
1. Establishment of tsunami/cyclone early warning detection and dissemination system using Common Alert Protocol (CAP).	A single emergency alert using Common Alert Protocol (CAP) can trigger a variety of public warning systems, increasing the likelihood that people receive the alert by one or more communication pathways. The CAP is capable to disseminate rich multimedia such as photographs, maps, streaming video and audio. An early warning system based on CAP may be established at suitable location.
2. Construction of permanent multipurpose Cyclone / Tsunami shelters.	Multi-Purpose Shelters are meant to provide refuge to vulnerable populations at the time of a cyclonic storm and otherwise to be used as community centers etc. The Multi-Purpose Cyclone Shelters act as a safe shelter for people living in a cyclone threatened region or meant for those who fail to evacuate due to various reasons. The number of Multi-Purpose Shelters should be proportionate to the population size with due examination of its safety and sustainability aspects.
3. Preparation of cyclone/Tsunami response and evacuation plan	Collaborate with community leaders to create community evacuation plans, including evacuation zones and routes. Identify and prepare shelter locations above sea level and conduct emergency evacuation trainings to ensure readiness of communities.
4. Installation of tidal gauges along the coast.	Install digital tide gauges as part of the early warning system, to continuously record the height of the surrounding water level and send real-time notifications to monitoring centers.
5. Establishment of a meteorological radar system along coastal areas.	Update and expand meteorological radar stations across the coastal belt as part of early warning system to detect precipitation particles in the atmosphere and send real-time notifications for any in-coming cyclone / heavy precipitation.
6. Construction of coastal dikes along major public facilities against tsunamis and storm surges (cyclones).	Dikes can provide a high degree of protection against flooding in low-lying coastal areas. Important public infrastructure like schools, hospitals and shelter places should be secured by constructing protection dikes with a slope. The sloped dike forces the wave to break when the

	water becomes shallow, and therefore reduces the energy of the wave.
7. Conduct of District Level Mock Exercise (DLME).	Develop a calendar for mock exercises to assess the preparedness, review the District Disaster Management Plans, Standard Operating Procedures and to evaluate the readiness of various departments to any disaster or emergency.
8. Development of insurance policy for financial risk management	Collaborate with Provincial Govt. and Private Partners to devise a disaster insurance policy for vulnerable communities. Disaster insurance provides a means of covering losses incurred through disasters and catastrophic events and reducing disasters' severe financial impact on individuals and communities. Financial liquidity provided by insurance helps mitigate disasters' effects on food security, health and livelihood assets.

COST BENEFIT ANALYSIS

INTRODUCTION

1. Cost Benefit Analysis (CBA) is a key analytical tool that can provide quantitative information regarding the prioritization of risk reduction based on comparing benefits of an actual or planned intervention with its costs.
2. Cost Benefit Analysis (CBA) can play a pivotal role in advocacy and decision-making on Disaster Risk Reduction (DRR) by demonstrating the financial and economic value of incorporating DRR initiatives into planning.
3. In an age of austerity, cost–benefit analysis continues to be an important tool for prioritizing efficient DRM measures but with a shifting emphasis from infrastructure-based options (hard resilience) to preparedness and systemic interventions (soft resilience), other tools such as cost-effectiveness analysis, multi-criteria analysis and robust decision-making approaches deserve more attention.
4. Studies categorize interventions into hard and soft type of measures. Hard resilience refers to the strengthening of structures and physical components of systems in order to brace against shocks imposed by extremes such as earthquakes, storms and floods. In contrast, soft resilience (Behavioural DRR) refers to less tangible and process-oriented measures as well as policy in order to robustly cope with events as they occur and minimize the adverse outcomes.
5. The studies find that many of the highest economic returns exist for behavioural DRR strategies
6. The benefits of hazard mitigation are the avoided losses, i.e., those losses that would have occurred in a probabilistic sense if the mitigation activity had not been implemented.

COST BENEFIT ANALYSIS – SUJAWAL DISTRICT

The existing nature of disasters in Sujawal district can be categorized as low to Extreme. The prominent hazards in the district is heatwave, drought and flood. The meteorological drought risk in the district ranges from medium to extreme, while agricultural drought risk in the district ranges from low to extreme. The risk of earthquake is determined to be low. The risk of tsunami is low to high while storm surge is low to extreme. The cyclone risk in the district is determined to be low. As far as heatwave is concerned Sujawal district is at low to extreme risk. As far as riverine flood is concerned the settled areas of UCs in the district are likely to be effected in breaching scenario of flood protection embankments of river Indus. As far as population living within the flood plain is concerned, they are well aware of flood risk and live on their own risk, therefore, government functionary is recommended to be mobilized for dissemination of warnings and alerts to population, safe evacuation and providing temporary shelters. Based on the results of the MHVRA study the hazards of the district can be managed through soft and enhanced management measures. In this scenario, cost benefit analysis of proposed interventions is appended in table below:

Table 10: Cost Benefit Analysis of Disaster Risk Measures in District Sujawal

S. no.	Soft resilience (Behavioral DRR)	Cost	Benefit
1.	Identification and management of shelters for earthquake, cyclone, storm surge and Tsunami	Identification and management of shelter spaces is a cost-effective way to ensure rapid, and effective management of population at times of crisis. Government schools can serve as ideal cost-effective shelter spaces in district Sujawal, as these can accommodate large number of people during disasters. Gradually, permanent multi-purpose shelters specially in near coast line and at safe location can be established in future to avoid use of education facilities.	Shelter places are highly beneficial at times of disaster as it offers a unified accommodation place for displaced people. Shelter place also help administration in effective management of displaced people and provide them with much needed relief. Shelter space keeps people off the highways during and after disaster. Shelters are often the only safe heaven for those without the financial means to take other protective measures.
2.	Monitoring / Strengthening of flood protection embankments	Pre-emptive monitoring activity to check the wellness and structural integrity of flood protection embankments before the onset of monsoon season. This would allow identification of embankments that are in need of repairs and would help identify areas where new embankments are required. Following this activity, assets can be mobilized to enhance the flood protection embankments prior to the occurrence of high flow in rivers.	Timely identification of weak embankments and repairs would prevent flood water from breaching the river floodplains and thereby save millions of acres of crop land, settlements and infrastructure from inundation, possibly saving life and property. This would also reduce the burden on emergency services during hazard and the government can concentrate efforts on severely affected areas. Less damage to communication lines including roads and power lines would improve disaster response and outreach. This would also result in reduced number of internally displaced people (IDPs).
3.	Early warning system for heatwave	Dissemination of forecast of heatwaves from the meteorological department through public radio announcements, print and digital media increases the preparedness of local populace against the impending hazard.	Early warnings give people time to prepare in advance and postpone activities after daytime. Local authorities would get ample time to establish relief centers with provisions of shade and hydration. Hospitals would be prepared to receive more patients than usual. An overall reduction in emergency cases would reflect in less mortality and more savings in medical expenditure.

4.	Awareness campaigns	Public private partnership and use of electronic/print media for raising public awareness is a cost-effective approach to build society resilience and improved disaster risk management capabilities of vulnerable communities.	Public awareness and public education for disaster reduction helps to reduce disaster risks. It mobilizes people through clear messages, supported with detailed information. People who know how to react in case of a disaster, community leaders who have learned to warn their people in time, and whole social layers who have been taught how to prepare themselves for natural hazards can contribute to better mitigation strategies and dissemination of information on the consequences of hazards. Education and knowledge can provide people with tools for vulnerability reduction and life-improving self-help strategies.
5.	Early warning for riverine floods	Enhanced communication between the upstream and local Irrigation department allows ample time for emptying reservoirs and increase flows to downstream areas in advance of the arrival of flood waters.	Early warning system and streamlined communication between the upstream and local irrigation department help lowers the adverse impacts of floods in the shape of reduced damage to crops, settlements and infrastructure. This all results in a positive socio-economic impact.
6.	Strengthening of mobile health care facilities	Setup of temporary health facilities reduce difficulty in patients' transportation to permanent hospital facilities. Mobile health care units are already available with government of Sindh, their mobilization to disaster management will ensure lifesaving.	Mobile health facilities play a very significant role in the mitigation of disaster because of their particular function in providing essential first aid. Ease of access to basic health facilities will reduce burden on hospitals. The systematic organization and easy mobilization of the staff, equipment and medical supplies in a safe environment are crucial if disaster response is to be prompt and effective.

ANNEX – A – VULNERABLE SETTLEMENTS PRONE TO RIVERINE FLOOD

List of Vulnerable Settlements (39) within flood Plains Prone to Riverine Flood

S.No	Name	Latitude	Longitude	Area (acres)
1	Ali Bahar	24.590	68.036	2.73
2	Behru Kir	24.296	67.836	10.33
3	Ghulam Mohiuddin Shah	24.411	67.877	5.10
4	Goth Ali Baran	24.396	67.885	26.84
5	Goth Charan	24.307	67.854	17.29
6	Goth Dilawar Shoda	24.785	68.069	5.36
7	Goth Guno	24.416	67.876	8.10
8	Goth Haji Arab Kir	24.289	67.841	13.71
9	Goth Haji Mohammad	24.361	67.878	100.06
10	Goth Ismail Charan	24.317	67.857	9.54
11	Goth Mohammad Aplan	24.429	67.989	2.86
12	Goth Pauhar	24.656	68.006	9.21
13	Goth Salih Kanth	24.415	67.944	1.86
14	Goth Sumar Khan	24.412	67.948	11.44
15	Gugara Mohana	24.497	68.000	15.04
16	Haji Allah Bachayo Panhwar	24.391	67.871	9.19
17	Hala	24.707	68.036	28.88
18	Karm Khoso	24.504	68.007	5.49
19	Munarki	24.548	68.011	18.95
20	Otha	24.481	67.990	9.14
21	Ramun Sanghar	24.203	67.654	3.74
22	Untitled Settlement	24.393	67.867	4.18
23	Untitled Settlement	24.687	67.970	2.03

S.No	Name	Latitude	Longitude	Area (acres)
24	Untitled Settelment	24.195	67.635	1.28
25	Untitled Settelment	24.295	67.853	4.88
26	Untitled Settelment	24.304	67.825	3.84
27	Untitled Settelment	24.345	67.873	43.52
28	Untitled Settelment	24.350	67.873	23.93
29	Untitled Settelment	24.355	67.869	5.48
30	Untitled Settelment	24.364	67.866	12.06
31	Untitled Settelment	24.418	67.952	1.90
32	Untitled Settelment	24.419	67.955	2.69
33	Untitled Settelment	24.498	68.003	6.98
34	Untitled Settelment	24.187	67.674	17.06
35	Untitled Settelment	24.194	67.633	7.88
36	Untitled Settelment	24.195	67.645	1.73
37	Untitled Settelment	24.419	67.952	19.69
38	Untitled Settelment	24.427	67.953	5.66
39	Untitled Settelment	24.871	68.090	10.57

ANNEX – B – SHELTER LOCATIONS DESCRIPTION – RIVERINE FLOOD

The given shelter locations for riverine flood are proposed on the findings of the MHVRA 2022 study and information obtained through satellite technology and online verifiable sources. It is recommended to conduct on ground physical surveys to evaluate their suitability.

Shelter location	Co-ordinates	Area (acres)	Estimated Tents (numbers)	Avg. elevation (ft)
1	Upper right corner: 24°51'2.88"N 68°11'7.12"E	142	~6500	45
	Upper left corner: 24°51'5.73"N 68°10'36.06"E			
	Lower right corner: 24°50'41.92"N 68°11'4.05"E			
	Lower left corner: 24°50'47.04"N 68°10'29.87"E			

2	Upper right corner: 24°47'44.57"N 68°10'8.72"E Upper left corner: 24°47'58.05"N 68°9'45.62"E Lower right corner: 24°47'37.37"N 68°10'2.68"E Lower left corner: 24°47'48.62"N 68°9'38.55"E	60.0	~2700	45
3	Upper right corner: 24°41'57.45"N 68°3'0.36"E Upper left corner: 24°41'55.35"N 68°2'41.29"E Lower right corner: 24°41'40.33"N 68°3'3.94"E Lower left corner: 24°41'42.73"N 68°2'41.59"E	63.9	~2900	35
4	Upper right corner: 24°37'21.01"N 68°2'28.78"E Upper left corner: 24°37'19.92"N 68°2'8.46"E Lower right corner: 24°37'8.70"N 68°2'30.31"E Lower left corner: 24°37'11.20"N 68°2'9.08"E	47.1	~2200	32
5	Upper right corner: 24°22'55.13"N 67°59'22.01"E Upper left corner: 24°22'48.35"N 67°58'46.59"E Lower right corner: 24°22'29.59"N 67°59'37.66"E Lower left corner: 24°22'20.30"N 67°58'55.42"E	249	~11200	23

A total of 5 shelter locations have been selected as Flood shelter places across district Sujawal. The shelter locations are selected based on their proximity to the population vulnerable to flood, distance from area under high flood risk, elevation from the nearby areas, and accessibility to roads and other basic facilities (healthcare, education, police station, etc.) A total of approximately 25,500 tents (tent with size of 45 sq. m each) can be set up within the demarcated shelter places.

ANNEX – C – SHELTER LOCATIONS DESCRIPTION – EARTHQUAKE

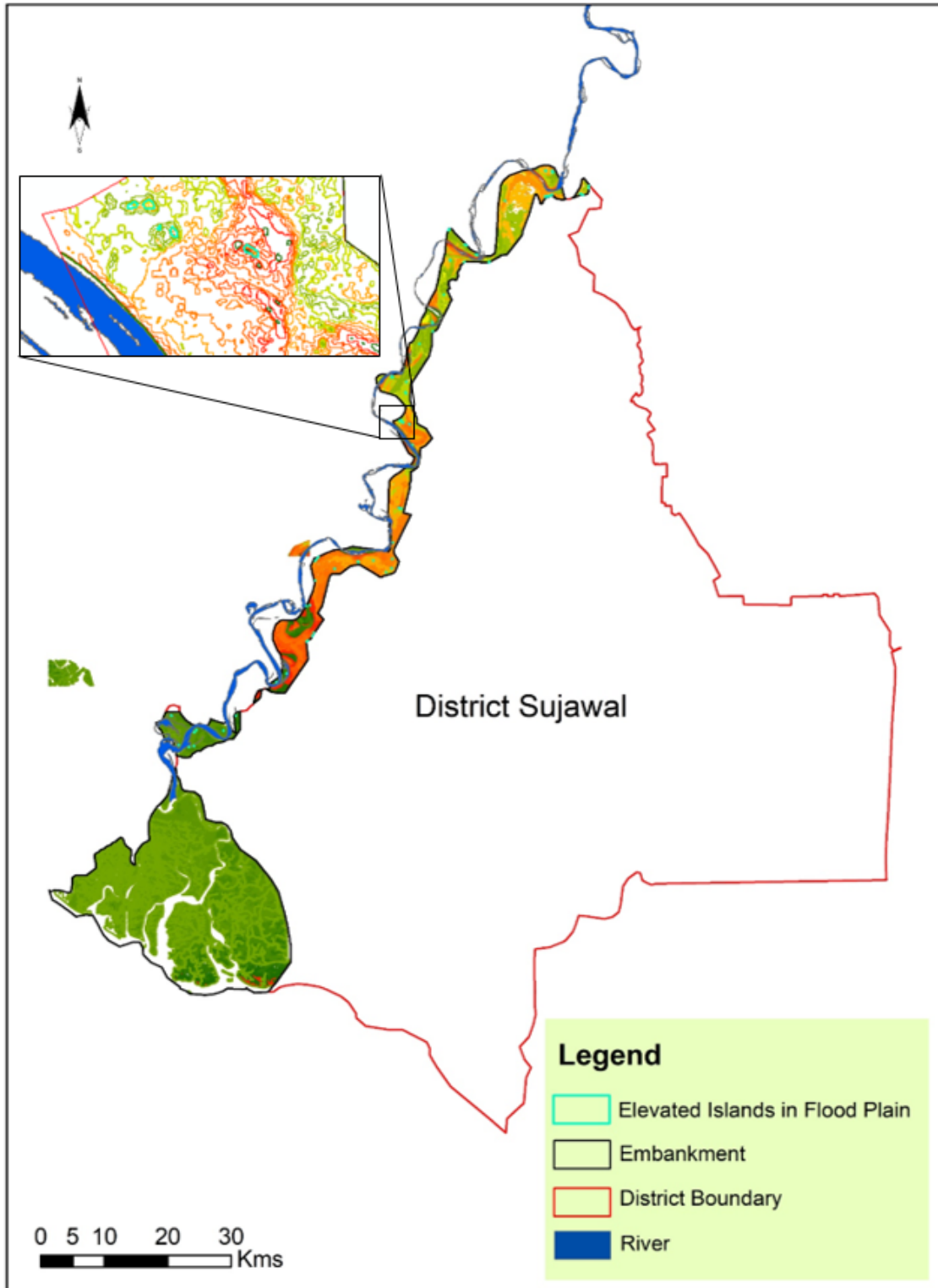
The given shelter locations for earthquake are proposed on the findings of the MHVRA 2022 study and information obtained through satellite technology and online verifiable sources. It is recommended to conduct on ground physical surveys to evaluate their suitability.

Shelter location	Co-ordinates	Area (acres)	Estimated Tents (numbers)	Avg. elevation (ft)
1	Upper right corner: 24°35'45.54"N 68° 4'36.00"E Upper left corner: 24°36'8.14"N 68° 3'58.41"E Lower right corner: 24°35'35.42"N 68° 4'28.52"E Lower left corner: 24°35'53.93"N 68° 3'50.22"E	140	~6500	30
2	Upper right corner: 24°43'18.98"N 68°15'46.51"E Upper left corner: 24°43'16.64"N 68°15'34.85"E Lower right corner: 24°43'12.96"N 68°15'52.01"E Lower left corner: 24°43'7.99"N 68°15'36.38"E	25.1	~1200	27
3	Upper right corner: 24°21'41.92"N 68°16'12.54"E Upper left corner: 24°21'43.11"N 68°15'59.85"E Lower right corner: 24°21'31.75"N 68°16'6.68"E Lower left corner: 24°21'32.26"N 68°16'3.35"E	19	~1000	20

A total of 3 shelter locations have been selected as Earthquake shelter places across district Sujawal. The shelter locations are selected based on their proximity to the population vulnerable to earthquake, and accessibility to roads and other basic facilities (healthcare, education, police station, etc.) A total of 8,700 tents approximately (tent with size of 45 sq. m each) can be set up within the demarcated shelter places.

ANNEX – D – ELEVATED ISLANDS WITHIN EMBANKMENTS IN SUJAWAL

Total 65 elevated islands have been identified within the embankments in district Sujawal, with a cumulative area of approximately 114.56 acres. These elevated islands obstruct the river flow and thereby may be demolished/removed to reinstate the normal river flow within the flood plain.



ANNEX – E – RIVER TRAINING AND STRAIGHTENING

Since most of the time riverine flood are contained in between river embankments therefore only settlements lying in flood plain are prone to low to very high floods while settled areas of Sujawal district are safe from riverine flood. However, settled areas of the district may be endangered to severe flooding condition if any breaching occurs in river embankment.

Embankment breach due to Normal River flow meandering:

Indus river continuously meander within flood plain area (3-5 miles). As river reached very close to embankments it starts eroding it hence making it vulnerable to any type of flood (low to very high flood). To avoid this situation irrigation department, make loop bund where river is close to main bund. This is a costly task and not a permanent solution because of the reason that river again change its path in 4-5 years and starts meandering to other part of bund. Therefore, there is need to stop the river to come close to the main bunds. It is, thereby, suggested to straight the path of river where it is currently meandering inside the flood plain away from the both sides of main bunds.

Below figure illustrate the concept:



Once path A to B has been developed, then river in normal condition will flow in this path. However annual or bi-annual cleaning of this path will be required by removing the sediments/clay deposit in this path. Special boats will be required to carry out this task by excavating the sand/clay beneath the river and put it on its sides. This solution may minimize damaged losses (life and material) due to breaching scenarios.