DRR Mainstreaming Handbook

CONCISE HANDBOOK PREAPRED FOR PROJECT

SUPPORT TO LINE DEPARTMENTS FOR DRR MAINSTREAMING IN DEVELOPMENT PLANNING

CRI
Community Resilience Initiative

PROVINCIAL DISASTER MANAGEMENT AUTHORITY SINDH
GOVT OF SINDH

WORLD BANK GROUP

Document Information

Prepared by	Community Resilience Initiative (CRI)
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About this Handbook

The Provincial Disaster Management Authority, Government of Sindh with mission to effectively and efficiently manage disasters of all sorts, in order to minimize loss of lives, damage to property and environment through coordinated efforts is striving to enhance provincial disaster management capacity. Sindh Resilience Project (SRP) (PDMA Component) funded by World Bank and Government of Sindh is one such vibrant project, which is likely to bring contrasting and dramatic changes in disaster management structure of the Province during the course and on completion.

Disaster Risk Reduction (DRR) is globally accredited and recognized agenda, unanimously adopted by UN member states including Pakistan during Third World Conference on Disaster Risk Reduction, held in Japan. Formally known as Sendai Framework for Disaster Risk Reduction 2015-2030 outlines seven clear targets and four priorities for action to prevent new and reduce existing disaster risks: (i) Understanding disaster risk; (ii) Strengthening disaster risk governance to manage disaster risk; (iii) Investing in disaster reduction for resilience and; (iv) Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

Nowadays, Disaster management is being considered as development issue rather than mere humanitarian response. PDMA Sindh realizing the importance of DRR, has launched timely initiative of DRR mainstreaming in development planning. This start-up initiative is ice-breaking in mainstreaming DRR in the province. It primarily focusses on awareness raising among public sector departments based on solid foundation and proper study conducted on gap assessment and furthering DRR mainstreaming in development planning at Province scale. Gap assessment study is complete and follow-up trainings and awareness sessions at divisional headquarters of the Province are on the way.

This handbook is intended to be distributed among participants of trainings belonging to different departments of government of Sindh engaged in sectorial planning and development. The handbook is handy reference on DRR mainstreaming for practitioners and learners. The handbook is collection and extraction of key concepts and information on disaster management and DRR mainstreaming.

PDMA Sindh hope and wish, this handbook will serve the intended objectives.

Various resources and material have been reviewed and extracted for production of this handbook. The reviewed material includes but not limited to publications of; National Disaster Management Authority, Pakistan, Provincial Disaster Management Authority, Sindh, United Nations Disaster Risk Reduction, Asian Disaster Preparedness Centre, Humanitarian Practice Network, World Bank, Asian Development Bank and OXFAM etc.

Message from Director General, PDMA Sindh

The intricate relationship between climate, calamities, pandemics and economy is pushing poor's more towards poverty. Calamities or disasters are prominent factors which disbalance the poor at individual level and economies at country scale. Almost every year, a huge amount is spent on relief and recovery efforts in Sindh. In addition to countable losses, enormous uncountable losses occur, which either stop the development or slow down the pace. The poor strata of population suffer the most because of disastrous events. Their meager earning resources are either lost or disturbed and undergo long recovery periods. In frequent disaster scenario and likelihood of its aggravation in future associated with climate change, it is right time to consider disaster and risk reduction as development issue.

Various disaster management initiatives are in progress through Sindh Resilience Project (PDMA Component). These initiatives include structural and non-structural reforms, enhancement is service delivery, early warning systems and mechanisms, departmental reforms, community-based disaster management and nonetheless awareness and capacity development of PDMA and line departments to bring a new disaster response paradigm in the Province. The "Support to line departments for DRR Mainstreaming in Development Planning" is one of such initiatives to bring required change in development planning. The entry point for DRR mainstreaming in development planning is infrastructure development because, it is the infrastructure which hold the potential to reduce or add disaster risks in any disaster-prone area. It is hard fact, but we have to believe that until disaster risk reduction is not considered at planning stage of any infrastructure, we may not achieve the desired disaster management objectives. Poor planning will result in unsustainable development and bring in a viscous cycle of construction and reconstruction.

Gap assessment on DRR mainstreaming in the Province with recommendations for implementation have been prepared and follow-up trainings on the subject matter are being executed. Initiatives for implementation of full spectrum DRR mainstreaming have been planned and will be pursued in letter and spirit. PDMA will keep playing its due role in all steps and advancing the process.

I hope that these smaller but calculated steps in right direction will bring major change in disaster management capacity of the Province. I also hope that, this handbook and trainings will bring fruitful results in DRR mainstreaming efforts of PDMA.

Syed Salman Shah

Director General, Provincial Disaster Management Authority, Sindh

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Key Concepts and Definitions

Disaster Management & Disaster Risk Reduction

Disaster Terminology

Hazard

A potential threat to humans and their welfare. Hazards can be natural (such as earthquakes and droughts) or induced by human processes (such as industrial accidents). Some people use the term 'environmental hazards'. Also, hazard is defined as "A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation." A hazard turns into a disaster only if it coincides with people or assets exposed and vulnerable to the hazard and lacking the capacity to deal with the impacts of the hazard. Disasters are hence the product of the social, political and economic context in which they occur.

Disasters are first and foremost a major threat to development, and specifically to the development of the poorest and most marginalized people in the world. Disasters seek out the poor and ensure they stay poor.
Didier Cherpitel
Secretary General (IFRC)

Examples of Hazard:

Geophysical hazards: *earthquake/tsunami, mass movement, volcanic eruption*

Hydrological hazards: *flood, landslide*

Meteorological hazards: *storm, cyclone, extreme temperature*

Climatological hazards: *drought, wildfire*

Biological hazards: *Epidemics, epizootics, pest*

Technological hazards: *technical accident, structural collapse, fire, explosion*

Chemical/Radiological hazards: *chemical/oil spill, radiological contamination, pollution*

Risk

The likelihood of a specific hazard occurring and its probable consequences for people and property.

Risk is combination of the probability of a hazardous event and its consequences, which result from interaction(s) between natural or man-made hazard(s), vulnerability, exposure and capacity.

Disaster risks may be extensive or intensive;

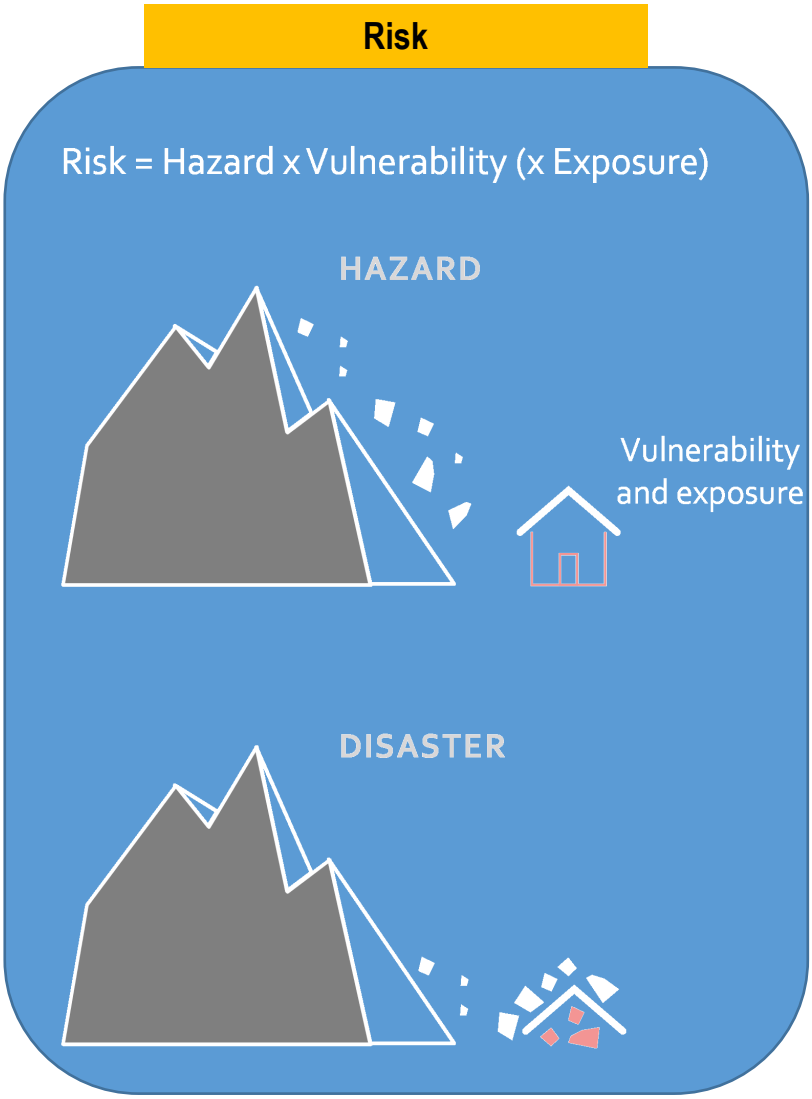
Extensive risks are low-severity, high-frequency disasters associated with highly localized hazards (recurring floods, landslides, storms or droughts characteristic of rural areas and urban margins with exposed and vulnerable communities).

Intensive risks are high in severity and mid to low in frequency. They are mainly associated with major hazards (strong earthquakes, active volcanoes, heavy floods, tsunamis or major storms characteristic of large cities or densely populated areas with high levels of exposure and vulnerability).

The social context in which disaster risks occur is an important consideration. People from different nations, communities or of different cultural backgrounds do not share the same perceptions of risk and have different levels of risk acceptance.

Acceptable risk, or tolerable risk: extent to which a disaster risk is deemed acceptable or tolerable.

Residual risk: is the disaster risk that remains even when effective disaster risk reduction measures are in place.



Vulnerability

The extent to which a person, group or socio-economic structure is likely to be affected by a hazard (related to their capacity to anticipate it, cope with it, resist it and recover from its impact.

Vulnerability is *t*he **condition** determined by physical, social, economic and environmental factors or processes, which **increase the susceptibility** of a community/individual to the impacts of hazards.

- High vulnerabilities increase the likelihood of a disaster.
- Vulnerability is not uniform within a community but often differential among and between groups such as women, children, the elderly, persons with disabilities or ethnic minorities.
- Disproportional vulnerability can result from a combination of innate factors limiting a person's capacity and the physical, cultural or social barriers they face within their environment.

Classification of Vulnerabilities

Vulnerabilities can be classified as following;

- **Physical Vulnerabilities** are the hazard-prone locations of settlement, insecure and risky sources of livelihood, lack of access to basic production resources (such as land, farm inputs, and capital), lack of knowledge and information, lack of access to basic services.

- **Social Vulnerabilities** are reflected in the lack of institutional support structures and leadership, weak family and kinship relations, divisions and conflicts within communities, and the absence of decision-making powers.
- **Attitudinal Vulnerabilities** are seen in dependency, resistance towards change, and other negative beliefs. People who have low confidence in their ability to affect change or who feel defeated by events, are harder hit by disasters than those who have sense of their ability to bring the changes they desire.
- **Economic Vulnerabilities** pertain to how people make their living and from where they get their livelihood. Determining which type of livelihood is easily affected by disasters (e.g., fishing, driving, etc.) is a key issue to be considered in determining the magnitude of economic vulnerability.

Exposure

People, property, other assets or systems exposed to hazards.

Example of exposure:

In areas with high population density in high-risk areas such as flood zones, inhabitants frequently have their houses and assets exposed to the hazard of floods.

Capacity

Capacity is the combination of all the strengths, attributes and resources available within a community, society or organization to manage and reduce risk and strengthen resilience.

Capacities may include the infrastructure, physical means, institutions, societal coping abilities, human knowledge, skills, social relationships, leadership and management that help people and communities to deal with the impact of disasters.

Example of Capacity:

In Pakistan flood protection embankment or bunds are built for protection of settled areas from riverine floods. Traditionally, people use bamboo or like material to protect against floods and wave erosion. This traditional knowledge increases the capacity of communities to cope with disaster events.

Disaster

What occurs when the impact of a hazard on a section of society (causing death, injury, loss of property or economic losses) overwhelms that society's ability to cope. Disaster is a serious disruption of the functioning of a community or a society due to hazardous events interacting with conditions of vulnerability and exposure, leading to widespread human, material, economic and environmental losses and impacts.

A disaster results from the combination of the four factors introduced above: exposure to a hazard under conditions of vulnerability, and insufficient capacity to reduce or cope with the negative consequences.

A 'disaster' is normally defined as damage and disruption that exceeds the affected society's capacity to cope. Databases define disasters according to levels of casualties and losses. The EM-DAT database managed by the Centre for Research on the Epidemiology of Disasters (CRED), the most authoritative source of data on disasters impact worldwide, requires at least one of the following four criteria to be met for an event to be recorded as a disaster:

- ten or more people reported killed
- 100 reported affected
- a call for international assistance
- and/or a declaration of a state of emergency

There is a growing body of research showing that the cumulative impact of what are some- times referred to as 'everyday disasters' – small, local events triggered by natural hazards that do not usually require external humanitarian assistance – may in some countries be greater than that of the much smaller number of larger events that are formally recorded as disasters. For example, data from Guatemala on all hazard events during the period 1988–98 (excluding Hurricane Mitch) records 1,666 individual events leading to;

1,393 deaths and 395,961 people affected. Over the same period (and including Mitch), the EM-DAT database recorded only 19 disaster events in Guatemala, leading to 859 deaths and affecting 192,830 people.

Types of disaster and emergency

Disasters and emergencies are sometimes grouped into six main categories:

Natural, rapid-onset: These are triggered by natural hazards such as earthquakes, cyclones, floods, landslides, avalanches, volcanic eruptions and certain types of disease epidemics. They occur suddenly, often with very little warning.

Technological, rapid-onset: These are the result of industrial accidents (for example a chemical or oil spill or a nuclear accident), major transport accidents, or disruption to other technological systems. They also occur suddenly, with little warning.

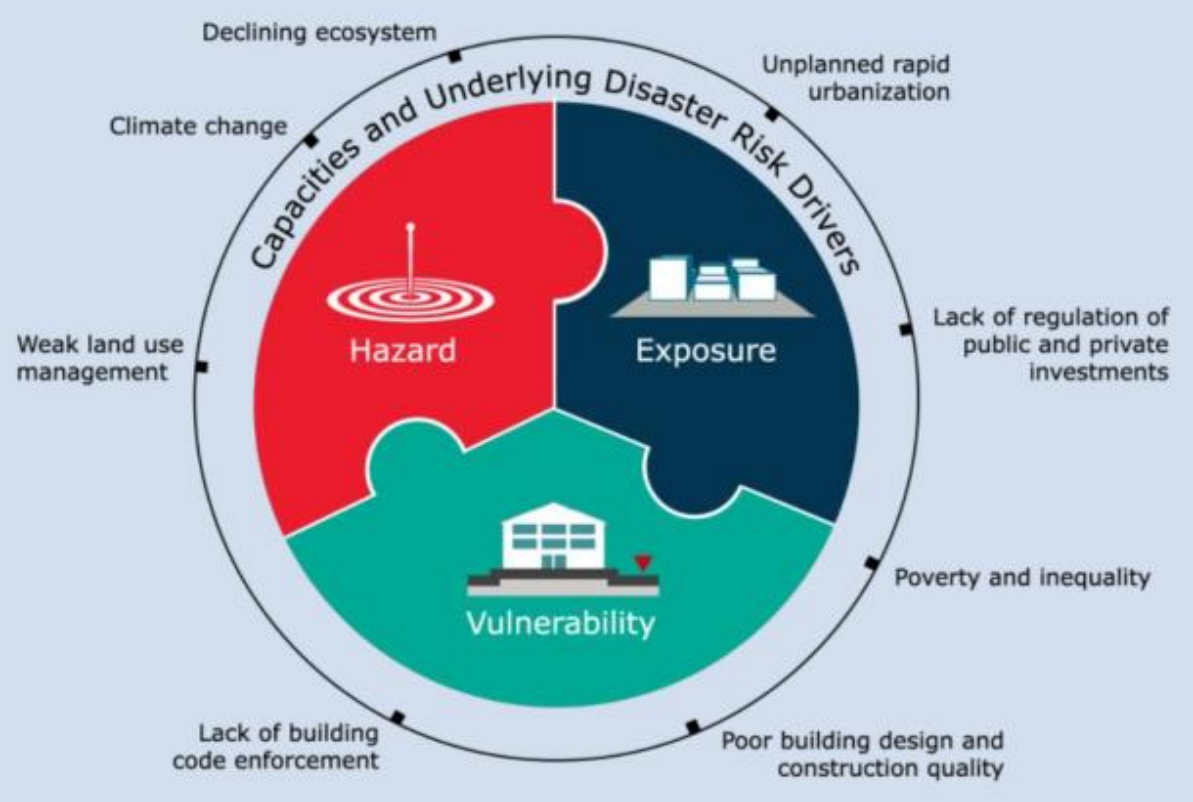
Slow-onset: This term is used mostly to refer to food shortage or famine triggered by drought or pest attacks on crops, where the crisis builds up over several weeks or months. It can also cover disasters caused by environmental degradation or pollution.

Complex political emergencies: Natural hazards, especially drought, may be a factor here, but a complex political emergency is characterized by protracted political instability and often high levels of violence.

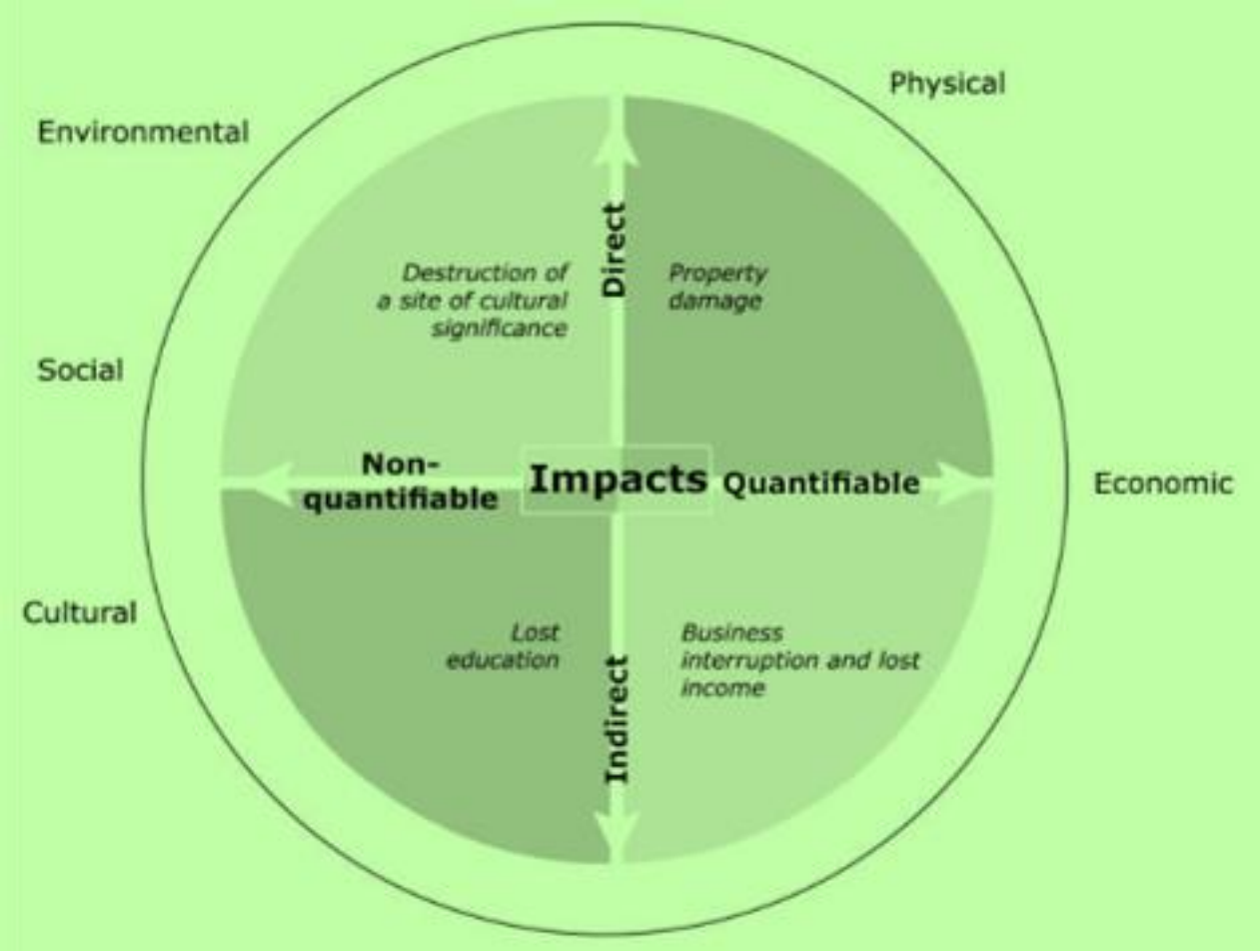
Permanent emergencies: These are the result of widespread structural poverty that requires more or less permanent welfare, but can be made worse by natural hazards.

Mass population displacements: Displacement can be a cause or a consequence of other types of emergency.

Underlying Disaster Risk Drivers



Disaster Impacts



Economic Losses – Total economic impact that consist of direct and indirect economic loss

Direct economic loss – the monetary value of total or partial destruction of physical assets existing in the affected area. Direct economic loss is nearly equivalent to physical damage.

Indirect economic loss – a decline in economic value added as a consequence of direct economic loss and /or human and environmental impacts. Indirect economic loss includes micro-economic impacts (e.g., revenue declines owing to business interruption), meso-economic impacts (e.g., revenue declines owing to impacts on natural assets, interruptions to supply chains or temporary unemployment) and macro-economic impacts (e.g., price increases, increases in government debt, negative impact on stock market prices and decline in GDP). Indirect losses can occur inside or outside of the hazard area and often have a time lag. As a result, they be intangible or difficult to measure.

Disaster Management Terminology

Mitigation

Any action taken to minimize the extent of a disaster or potential disaster. Mitigation can take place before, during or after a disaster, but the term is most often used to refer to actions against potential disasters. Mitigation measures are both physical or structural (such as flood defenses or strengthening buildings) and non-structural (such as training in disaster management, regulating land use and public education).

Preparedness

Specific measures taken before disasters strike, usually to forecast or warn against them, take precautions when they threaten and arrange for the appropriate response (such as organizing evacuation and stockpiling food supplies). Preparedness falls within the broader field of mitigation.

Prevention

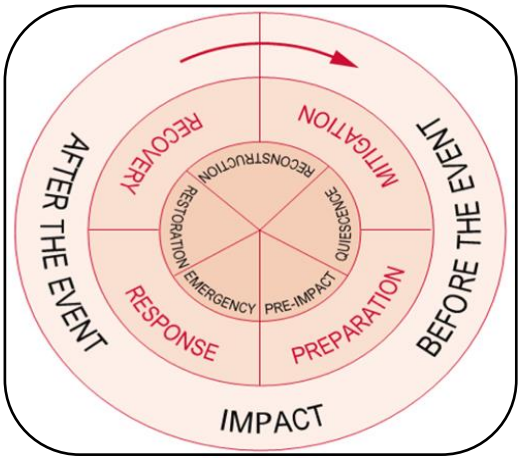
Activities to ensure that the adverse impact of hazards and related disasters is avoided. As this is unrealistic in most cases, the term is not widely used nowadays.

Disaster management

Disaster management is often used in a general sense, covering the implementation of preparedness, mitigation, emergency response and relief and recovery measures.

Disaster Management Cycle

Disaster 'cycle' illustrate where the different elements of disaster management (including relief and recovery) link with one another. This is an over-simplification, as the components do not fit together neatly or in exact sequence in the way shown in most diagrams: there can be substantial overlap. Nevertheless, a diagrammatic presentation may be helpful.



Disaster Management and Myths

Myths about disasters are widespread and persistent, despite repeated experience to the contrary and the findings of social science research. They are often reinforced in the public mind by media coverage. Disaster myths are a significant problem, because they influence the way operational agencies think and act. Among the most prominent myths are the following;

- Disasters are acts of God (which means that nothing can be done about them) or acts of nature (which means that the problem can be resolved by scientific or technical interventions alone).
- People are fatalistic about disasters and do not take action to protect themselves against future events.
- When a disaster strikes, people are helpless, passive, dependent victims.

Traditional View of Disasters

The traditional view of disasters held that they were temporary interruptions of a linear development process that was leading to ever improving standards of living. The task of humanitarian aid, therefore, was to patch things up so that the process of development could start up again. Emergency relief would be followed by rehabilitation, leading in turn to renewed development work.

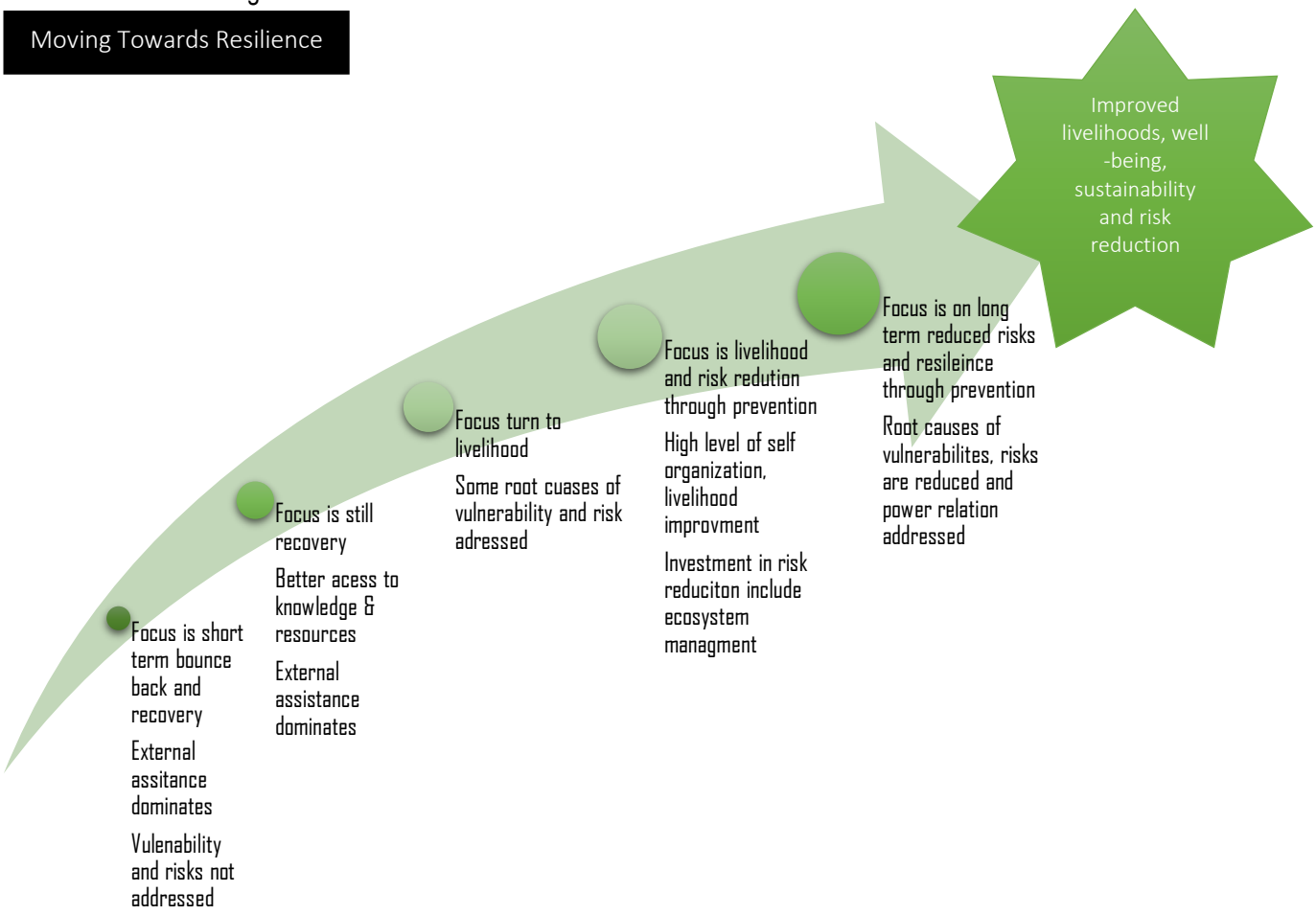
Resilience

A term of multiple meaning /definitions;

- Ability to resist, absorb, accommodate to and recover in a timely and efficient manner (UNISDR, 2009).
- Ability of individuals, communities, organizations or countries exposed to disasters, crises and underlying vulnerabilities to anticipate, prepare for, reduce the impact of, cope with and recover from the effects of shocks and stresses without compromising their long-term prospects (IFRC, 2014).
- Capacity to survive, adapt and grow when facing stress, shocks and transform when conditions require it (Rockefeller Foundation 2016).
- Capacity to deal with change and continue to develop (Stockholm Resilience Centre).

In recent years resilience has emerged as combination of ideas from different disciplinary traditions which can help to frame intervention during disasters.

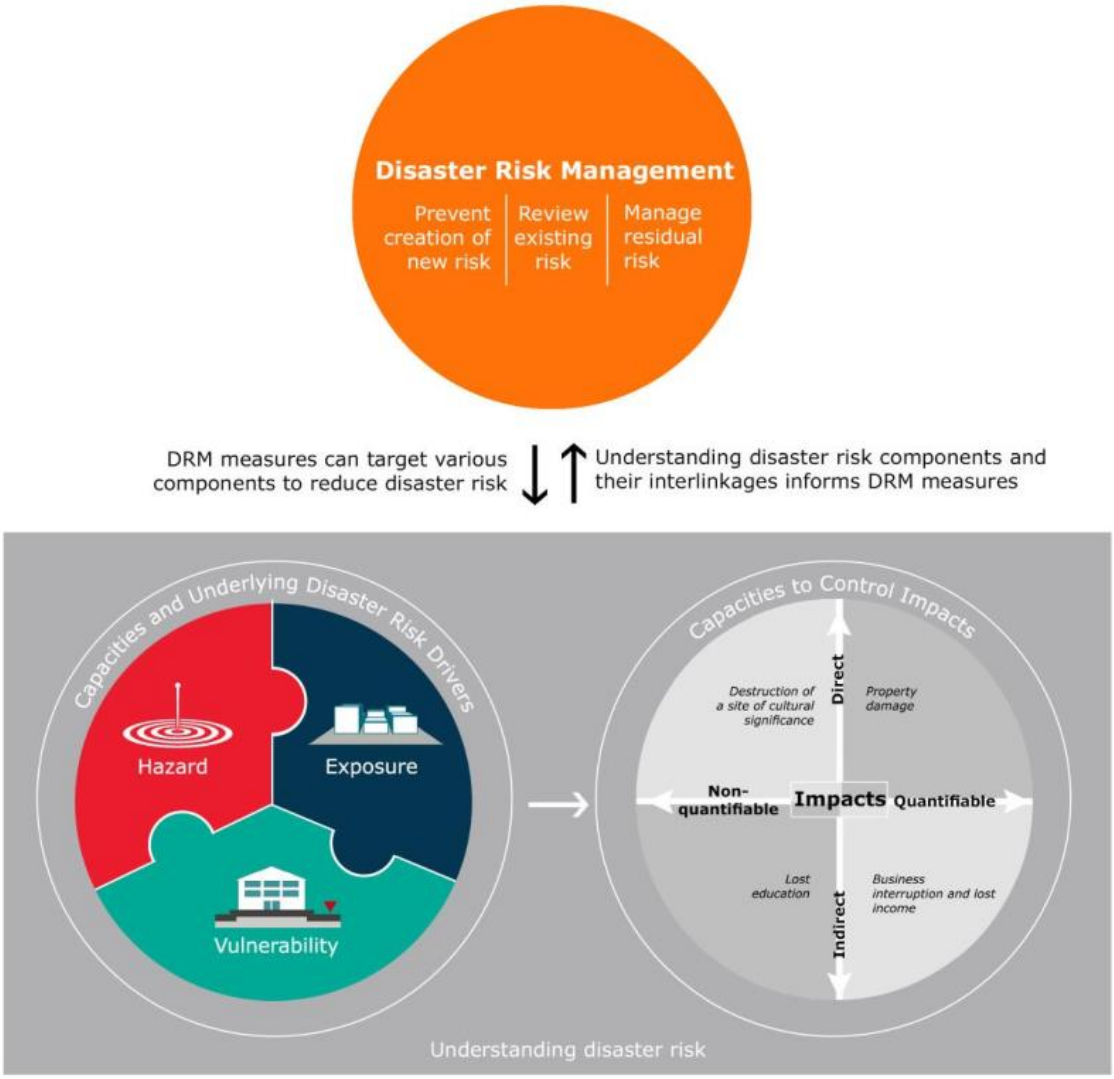
Moving Towards Resilience



Disaster Risk Management (DRM)

Disaster risk management aims to avoid the generation of new risks, improves resilience to the effects of natural events and contributes to sustainable development. Specific risk factors can have very different implications for different population groups within a society or groups in particular geographic areas.

DRM Process



Disaster risk management (DRM) aims to avoid, reduce or transfer the adverse impacts of hazards on people, property and the environment through activities and measures. It is the systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

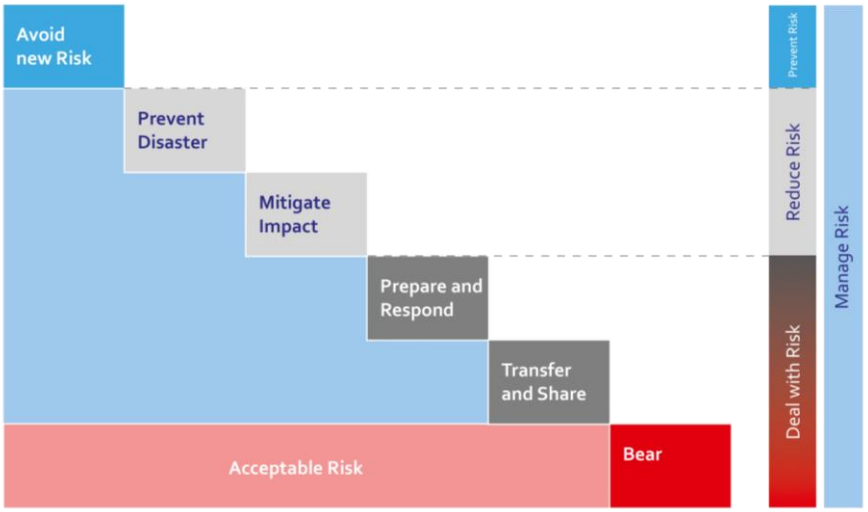
Disaster Risk Reduction (DRR)

Compared to disaster risk management, DRR is the overarching concept for a holistic approach on reducing risk. It is a policy objective that aims to prevent new disaster risk, to reduce existing disaster risk and to manage residual risk, all of which contributes to strengthening resilience (UNISDR 2015). DRR is a systematic approach to identifying,

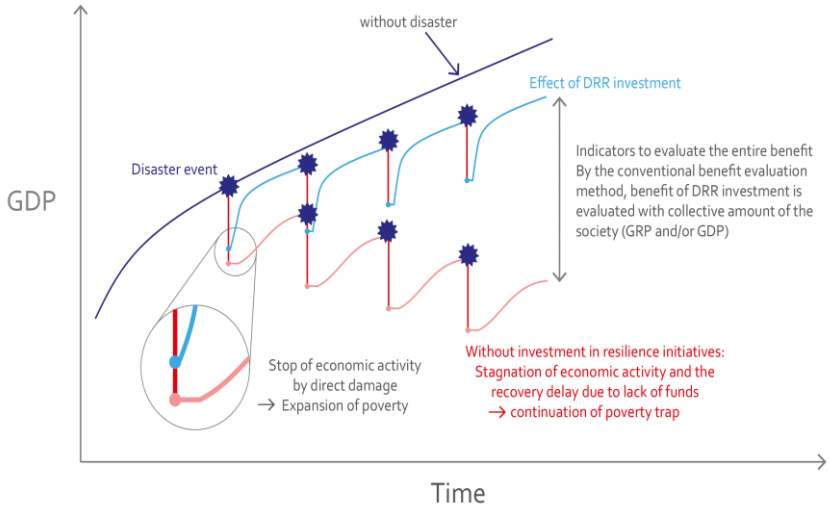
assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them. It is concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

DRR and Risk Staircase

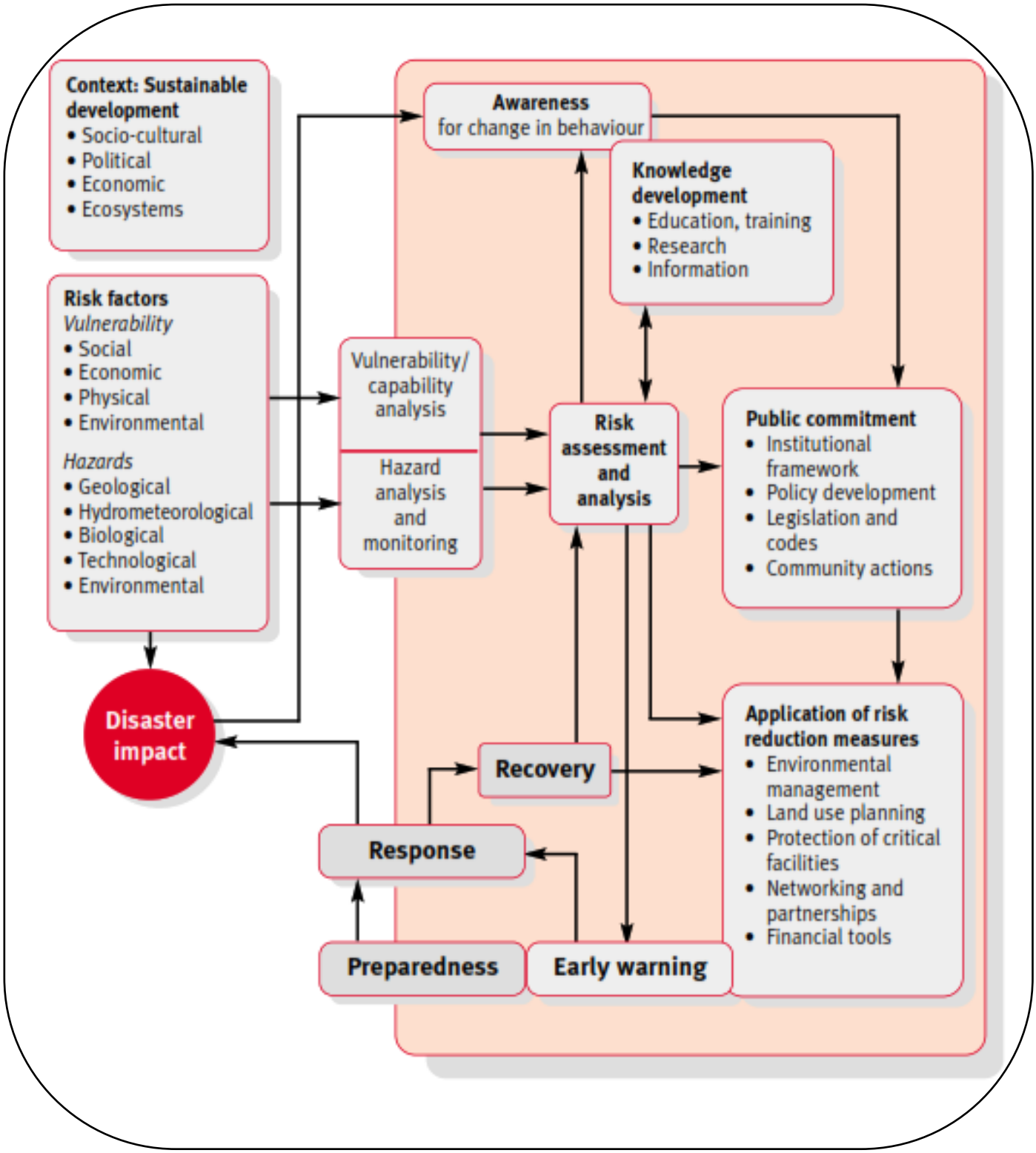
Risk staircase is sequencing of disaster risk reduction. The vertical represents the total risk, which is diminished with every step along the staircase. Avoidance of new risks is the starting point for managing risks, followed by prevention of disasters, mitigation of impacts, to preparedness for response and risk sharing mechanisms, down to a minimal level of acceptable risk. The acceptable risk is the level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural and environmental conditions.



Effects of DRR Interventions



Framework of Disaster Risk Reduction



Disaster Risk Reduction (DRR) Mainstreaming

The term "mainstreaming" is derived from the concept of how small, isolated tributaries flow into the larger main-stream of a river, a seamless integration of disparate flows into a larger whole. Hence "mainstreaming risk reduction" describes a process that fully incorporates and integrates the efforts of disaster risk reduction (DRR) into larger relief efforts and development policy. Disaster Risk Reduction (DRR) is a contemporary theme to be mainstreamed into all development interventions and also needs to be promoted through DRR- specific interventions focused on: strengthening policy and organizational structures and knowledge management. To reinforce and facilitate, DRR interventions are needed to strengthen the disaster management system, develop appropriate information systems for coordination and early warning, promote knowledge management for DRR, create DRR awareness and initiate community-based DRR programs.

There is rising harmony among major walks of life that the key to sustained disaster risk reduction lies in 'mainstreaming' the reduction of risks into development. Essentially, this is a process of incorporating the key principles of disaster risk reduction (DRR) into development goals, governance arrangements, policies and practice. On one hand, mainstreaming requires the analysis of how potential hazard events could affect the performance of policies, programs and projects, and on the other hand, it needs to look at the impact of the same policies, programs and projects on vulnerability to hazards.

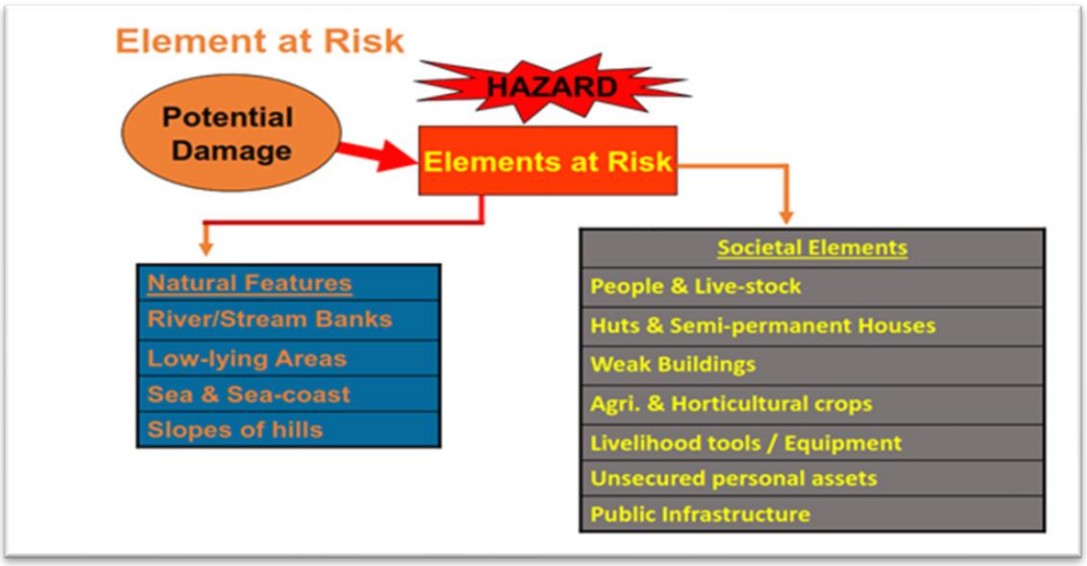
Outcome of DRR Mainstreaming

Disaster Assessment

Hazard, Exposure, Vulnerability, Risk and Coping Capacity Assessment

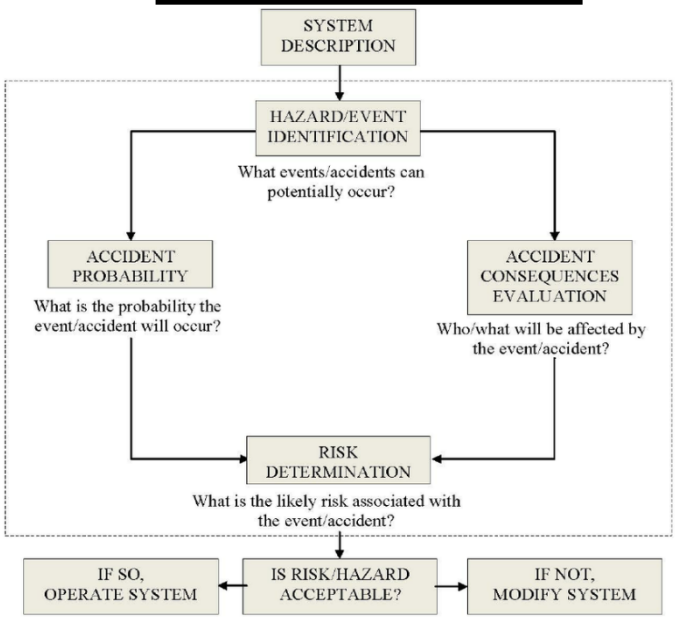
Hazard Assessment

Hazard assessment is a process of defining and describing hazards by characterizing their probability, frequency, and severity and evaluating adverse consequences, including potential losses and injuries. Hazard Assessment is the process of estimating, for defined areas, the probabilities of the occurrence of potentially-damaging phenomenon of given magnitude within a specified period of time.



Elements at risk considered in Hazard Assessment

Flowchart of Hazard Assessment

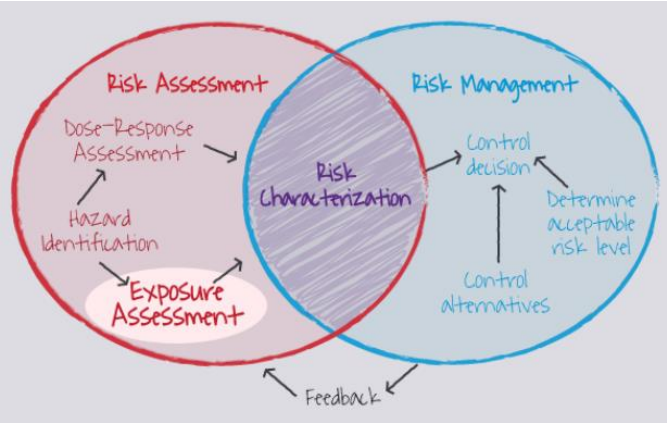


Hazard Impact Scoring

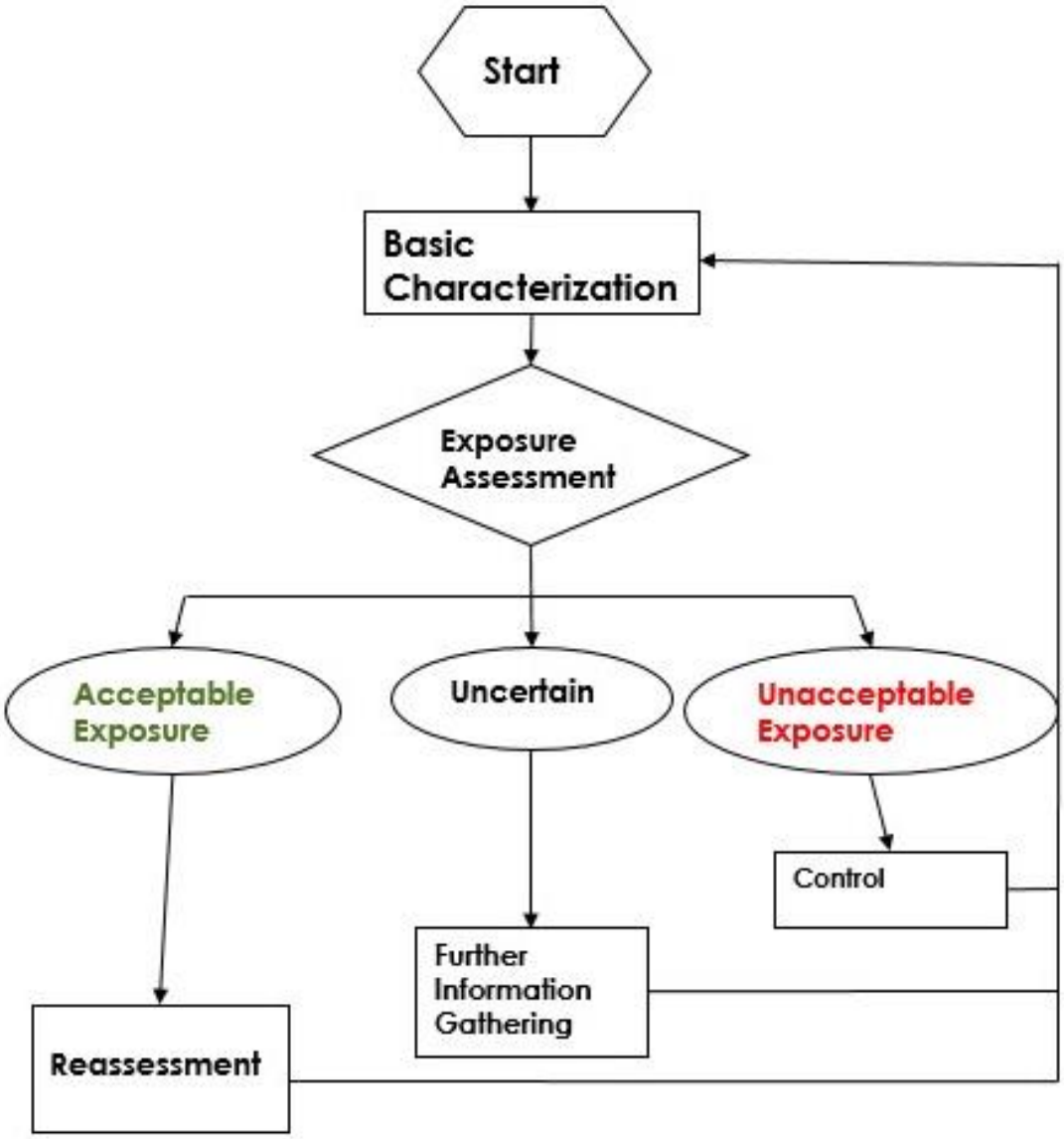
Impact	Severity	Score
Catastrophic	Serious Effect	4
High	Major Effects	3
Moderate	Minor Effects	2
Low	Negligible Effects	1
Very Low	No Effects	0

Exposure Assessment

Exposure assessment is a quantitative process involving measurement and modeling that addresses the questions 'Is this person or elements at risk exposed?' and 'How much is this person or elements at risk exposed to?' In many situations it is also critical to consider how the exposure profile changes over time, because exposure typically does vary with time, and this variability may impact the ability to detect a relationship between exposure and hazard.



General Flowchart of Exposure Assessment



Vulnerability Assessment

Vulnerability assessment is systematic process of Identifying what elements are at risk and why (refer to unsafe conditions, dynamic pressures and root causes). A hazard vulnerability assessment is a systematic approach to identify all possible hazards that may affect a specific population, assess the risk associated with each hazard (e.g., the probability of hazard occurrence and the consequences for the population), and study the findings to develop a prioritized comparison of hazard vulnerabilities. The consequence, or vulnerability, is related to both the impact on the population and the likely service demands created by the impact.

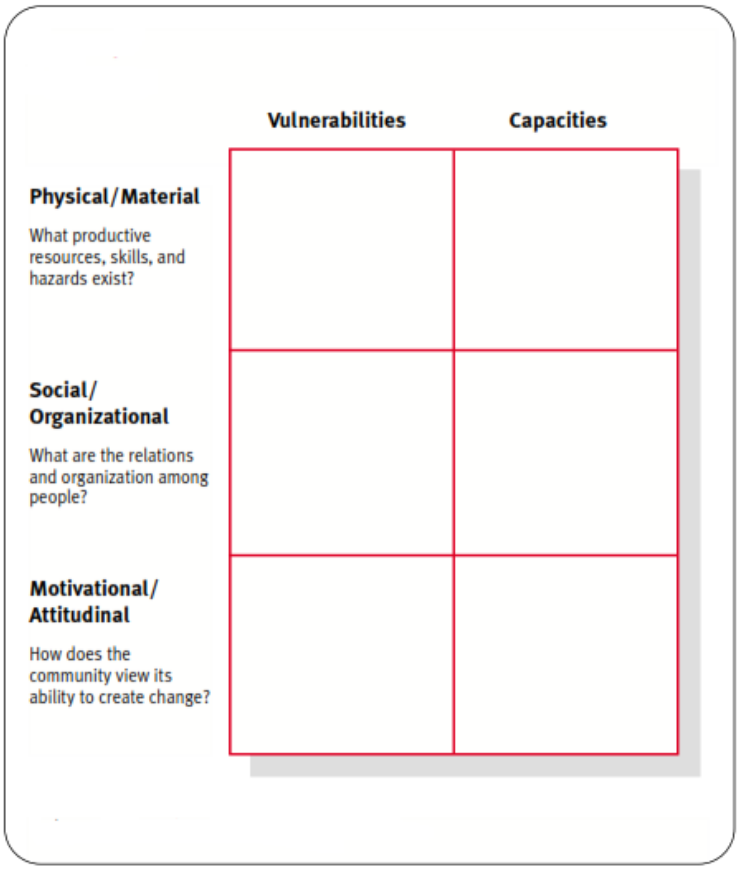
Things to remember

- Vulnerability assessment framework must be simple enough to be useful, but complex enough to capture reality
- Vulnerability is specific to location, sector, interest group, etc.
- Vulnerability is dynamic
- Vulnerability is sometimes irreversible
- Vulnerability and poverty are strongly linked with each other.

Example of vulnerability assessment

Class	Score
Extremely High	76-100
High	51-75
Medium	26-50
Low	1-25
No to Negligible	0

Vulnerability Assessment Matrix



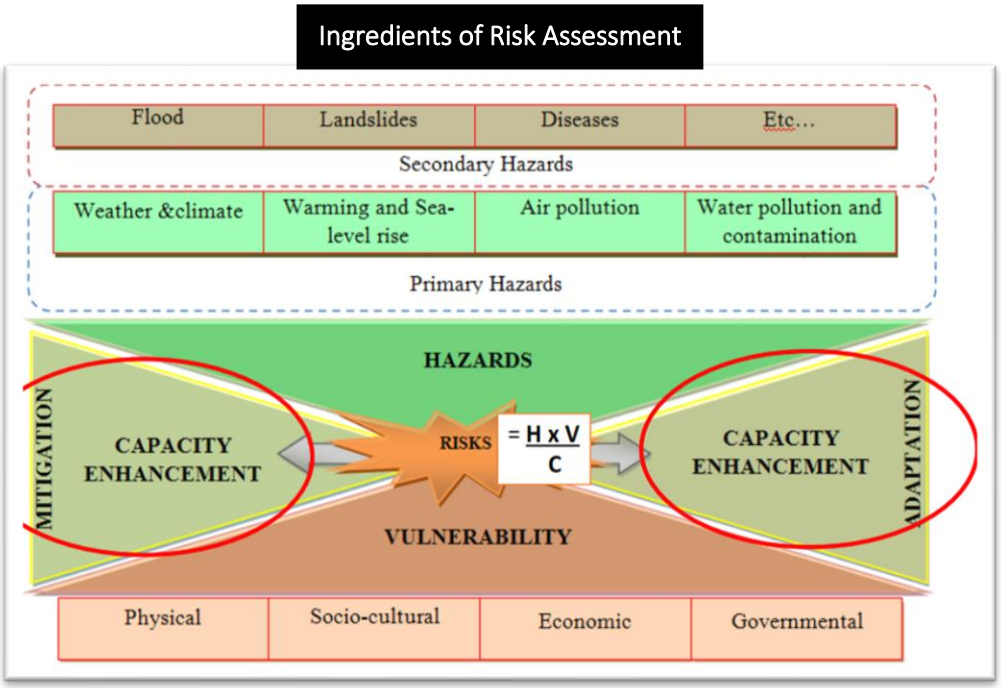
Vulnerability analyses often draw upon existing sources of information that are publicly available, such as general social and economic surveys by governments and other agencies. Other commonly used data sources are drought and food security early-warning systems, situation reports by operational agencies, the news media, analyses commissioned or carried out by international and bilateral donors, and anthropological studies. Such sources can provide a large amount of data, especially quantitative data. Finding and extracting relevant information can be a major job, however, official surveys are often out of date, inaccurate or biased. Often, analyses rely solely on basic national-level indicators of socio-economic development (e.g., size of land holdings, per capita income, literacy levels, mortality and morbidity rates, access to clean water), which are readily available in government statistical yearbooks.

Risk Assessment

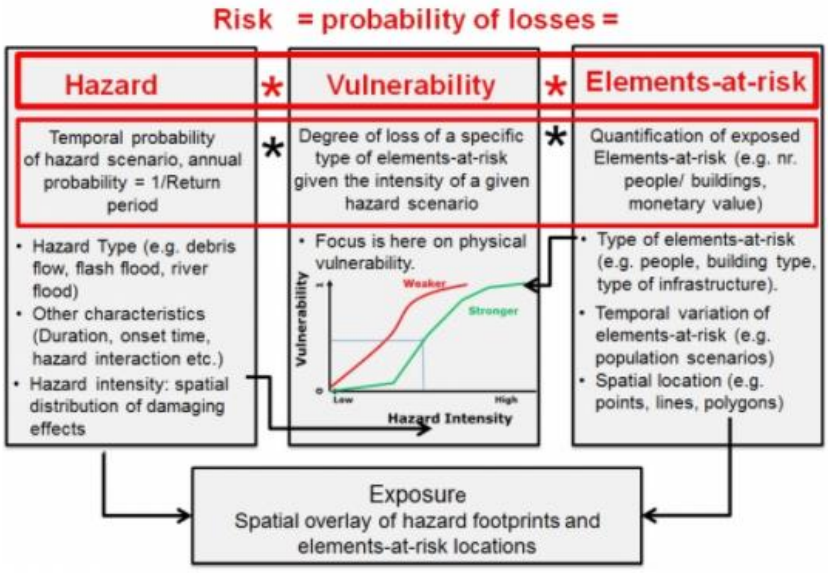
Risk Assessment provides a systematic process for identifying, estimating, and ranking disaster risks. Disaster Risk Assessment is done for the purpose of risk reduction planning to:

- Identify prioritized risks that need to be reduced;
- Ensure that the risk reduction is going to be adequate and appropriate;
- Ensure that risk reduction will be cost effective and sustainable;
- Balance between preparedness and long-term mitigation measures;
- Identify if there are other activities that would have a more positive development impact;
- Identify existing capacities to assist in risk reduction both externally & within communities;
- Assess if we are succeeding in reducing risk

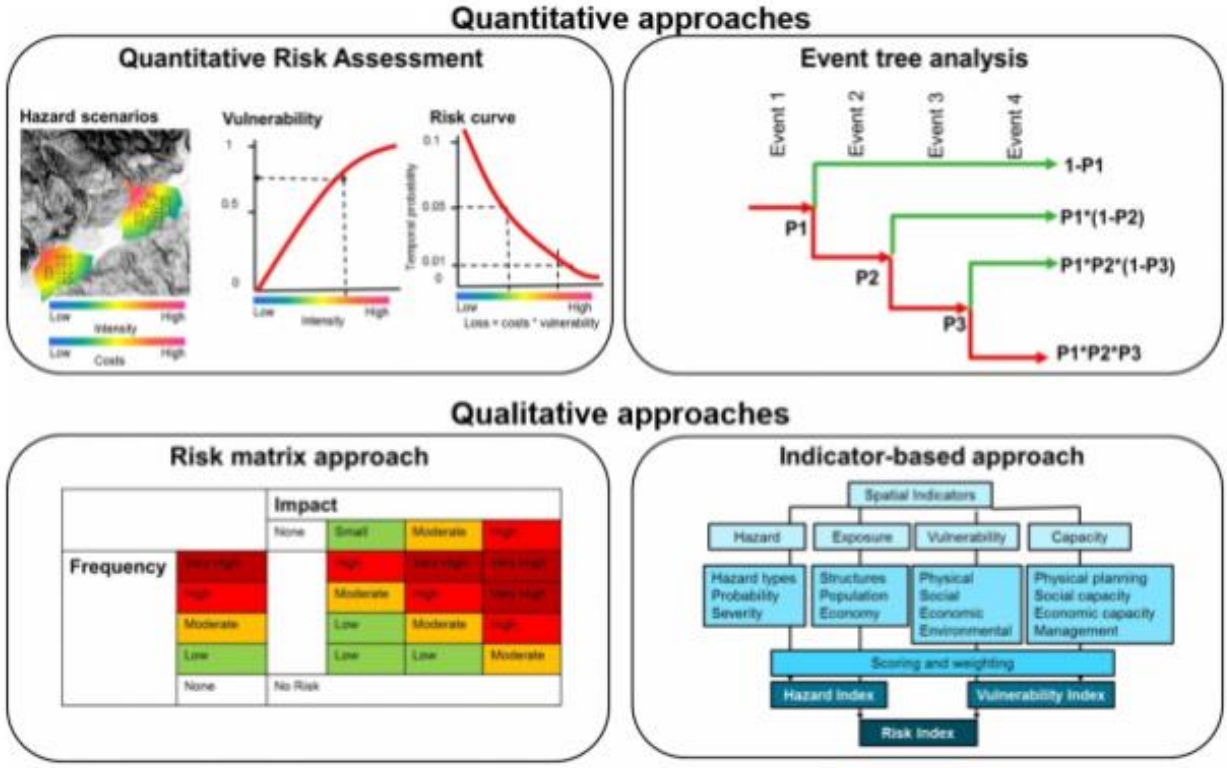
It provides disaster specific baseline data that can be integrated in a situational analysis for development program purposes.



Risk Calculation



Risk Determination Methods



Probabilistic and Deterministic Risk

Probabilistic risk assessment simulates those future disasters which, based on scientific evidence, are likely to occur. As a result, these risk assessments resolve the problem posed by the limits of historical data.

Deterministic risk considers the impact of a single risk scenario, whereas probabilistic risk considers all possible scenarios, their likelihood and associated impacts. Deterministic approaches are used to assess disaster impacts of a given hazard scenario, whereas probabilistic methods are used to obtain more refined estimates of hazard frequencies and damages. Probabilistic assessments are characterized by inherent uncertainties, partly related to the natural randomness of hazards, and partly because of our incomplete understanding and measurement of the hazards, exposure and vulnerability under consideration.

While historical losses can explain the past, they do not necessarily provide a good guide to the future; most disasters that could happen have not happened yet. Probabilistic risk assessment simulates those future disasters which, based on scientific evidence, are likely to occur. As a result, these risk assessments resolve the problem posed by the limits of historical data. Probabilistic models therefore "complete" historical records by reproducing the physics of the phenomena and recreating the intensity of a large number of synthetic events.

In contrast, a deterministic model treats the probability of an event as finite. The deterministic approach typically models scenarios, where the input values are known and the outcome is observed.

Coping Capacity Assessment

Capacity assessment is the process by which the capacity of a group is reviewed against desired goals, where existing capacities are identified for maintenance or strengthening and capacity gaps are identified for further action. Capacity resides at three related levels: in individuals, in organizations and in the overall working environment within which individuals and organizations operate - 'the enabling environment', which strongly relates to the concept of resilience.

Entry points for Coping Capacity Assessment

Enabling environment; Sometimes referred to as the 'societal' or 'institutional' level, capacities at the level of the enabling environment relate to the broader system within which individuals and organizations function. Understanding the enabling environment can be obtained from the 'institutional analysis', 'power analysis' or 'drivers of change analysis' increasingly being undertaken by donor organizations as the basis for country assistance plans. Capacities at the level of the enabling environment relate to all the rules, laws and legislation, policies, power relations and social norms.

The Organizational Level; This level is a common entry point for capacity assessment. This level relates to the internal structure, policies, systems and procedures that determine an organization's effectiveness and ability to deliver on its mandate and allow individuals to work together. Organizational level capacities help develop and apply internal policies, arrangements, procedures and frameworks, which is necessary to deliver the organization's mandate.

The Individual Level; This level relates to the skills, experience and knowledge of people that allow them to perform. Capacity assessment at this level is commonly implemented by researchers and non-governmental organizations working at the local level, as well as by some local level governments. However, individual capacity has to be understood within the context of both the organizational level and enabling environment.

Four key issues common to most capacity assessments are institutional arrangements, leadership, knowledge and accountability. Not every assessment needs to cover all four of these issues, but they should be at least considered when defining the scope of an assessment.

Basis of Capacity Assessment

Physical / material: People with economic and material resources can survive better.

Social / organizational: People have social resources that help them cope with, resist and handle the threats they may face.

Attitudinal / Motivational: People, who are aware of their abilities and have confidence in themselves, are better able to cope with a crisis.

Coping and Coping Mechanisms: 'Coping' means 'managing resources' in adverse situations. Coping can include defense mechanisms, active ways of solving problems, and methods for handling stress. Coping mechanisms are employed when vulnerable communities face difficulties in recovering from a disaster. Their livelihood has become unstable; they face food shortages and even hunger.

Hazard Profile of Sindh

Physiographically the Sindh province can be divided into 6 broad regions i.e., 1) Western Valley, 2) Khirthar mountains, 3) Kohistan or Kachho, 4) Eastern Valley, 5) Thar Desert and 6) Delta. Due to different characteristics of each region, hazard profile of the regions is slightly different from each other. Based on historical events, major existing natural hazards of the province include, floods, cyclones, drought, heatwaves, earthquake and tsunami.

Floods/ Rains

The topography of Sindh Province is almost flat and located at the bottom of Indus basin. The surplus water of Indus River and its tributaries including monsoon rain water has to pass through Sindh. Hill torrents which emanate from Baluchistan are also adding up to the pressure on both accounts, till its outfall in the Arabian Sea. The River Indus in Sindh is dangerous, because it flows at ridge. In case of breach the out flowing water cannot be drained back into the river at any point. The Indus River is also known for changing its course. High floods since the creation of modern irrigation network in 1932 are being monitored. The river Indus is contained by flood protection embankments, which are 1400 miles long, so as, to protect irrigation network emanating from three barrages having 12.8 million acres of command area. Besides, there is a large network of surface drainage and 6000 public tube wells, roads and railways network, cities / towns, rural settlements etc. The high floods occurred during 1942, 1956, 1957, 1958, 1973, 1975, 1976, 1979, 1992, 1994, 1995, 2003, 2005, 2007, 2010, 2011 and 2012.

Cyclone

The coastal districts have also been adversely affected by heavy rainfall and cyclones. The three coastal districts - Karachi, Thatta and Badin, are highly vulnerable. The districts of Thatta and Badin have been badly affected on several occasions. Cyclones not only wiped out the human settlements and resulted in the huge losses of human and animal lives, but they also destroyed and damaged fishing boats, therefore badly affecting the livelihood of the majority of residents of these two districts. Historically, the tropical cyclones are formed over the Arabian Sea and made landfall at the coastal areas of Sindh. Major cyclones during the last 100 years which hit Sindh were in May 1902, June 1926, June 1964, November 1993, June 1998, May 1999 and June 2007 (Cyclone– 02A). The Cyclone Yemen in 1999 hit three coastal districts of Sindh, where 244 people lost life, 40177 animals perished, villages affected were 1449, houses damaged were 29873 and population affected was 0.5 million. Loss in financial terms was about Rs. 3.231 billion. Keti Bunder town was wiped out four times in recent history. The cyclones of 2010 (PHET) and 2011 (KIELA) also emerged during last few years, out of which PHET caused significant damages in district Thatta.

Drought

Sindh's 60% area is arid receiving rainfall on average of 5 inches during monsoon and very little in December & January. The arid area population depends upon the scanty rainfall raising livestock and millet crops. The failure of rainfall and global climatic effects reduce the water supplies in Indus River System (IRS). Sindh, being at the end of the system, usually takes the brink. Besides, two- third of ground water is brackish and 80% agricultural land is affected by water logging and salinity. People in the arid area usually move to canal commanded area but low flow in the river Indus from 1998-2002 created havoc in the entire province. Historically, Sindh faced the worst drought situation during 1871, 1881, 1899, 1931, 1942 and 1999-2002 and 2013-14.

Heatwaves

Heatwaves are most frequent natural events of the Province. Direct effects of heatwaves are loss of life and damage to crops. Other unaccountable indirect effects are high energy consumption, poor working efficiency, slowing of business activities etc. There has been an increase in the frequency of heatwave hitting the cities in Sindh almost on annual basis. Reportedly, the 2015 heatwave in Karachi claimed over 1000 lives.

Earthquake

The recent earthquake that affected Sindh desert area was recorded in the year 2001 in Tharparkar district and the bordering Badin District was also badly affected. Due to this earthquake 12 people lost their lives, 115 persons got injured, 1989 houses were fully damaged, 43,643 houses partially damaged and 1406 public sector buildings got damaged. Loss in financial terms was recorded around Rs. 2.4 billion. A geological tectonic line runs under Karachi through Khirthar Hills / Mountains to north-west of Sindh and Thar Desert, due to which Sindh has risk of a major earthquake in the future. The latest earthquake occurred on 16th April 2013 in Iran whose effects were felt in Pakistan but damages happened in Balochistan only. It was recorded in Karachi at Richter scale at 5.5 which strongly jolted the entire province.

Tsunami

The Sindh province can be a recipient of a tsunami disaster also. A tsunami disaster occurred in November 1945 at Makran coast in Baluchistan Province. It produced sea waves of 12-15 meters height that killed about 4,000 people. Although Karachi was away from the epicenter, yet it experienced 6 feet high sea waves which affected harbor facilities. This usually happens during the months of March, April and May. The effects of tsunami of December, 2004 were also felt along the Pakistan coastline. Abnormal rise in water, detected by tide gauge station at Keti Bander area created panic in the coastal population including Karachi.

Seawater Intrusion

Other than drought and cyclone/tsunami coastal area of Sindh is also badly affected by sea intrusion. Thatta and Badin districts are among the most vulnerable areas. The out flow of water downstream Kotri Barrage is continuously declining which has resulted in massive sea intrusion in coastal area of both the districts. This intrusion has wreaked havoc not only on human and fish population, but has also badly damaged the precious agricultural land. The sea intrusion is shrinking sea food market every year due to depletion of fish and shrimp population in the area. By one estimate coastal district of Thatta and Badin's 9 Taluka, 87 Dehs, 47 Irrigation Channel are affected. Area affected is 1.2 million acres.

Hazard Levels at Provincial Scale

Type of Hazard	Hazard Level
River Floods	High
Urban Floods	High
Coastal Floods	High
Cyclones	High
Drought	High
Heatwaves	High
Earthquake	Medium
Tsunami	Medium

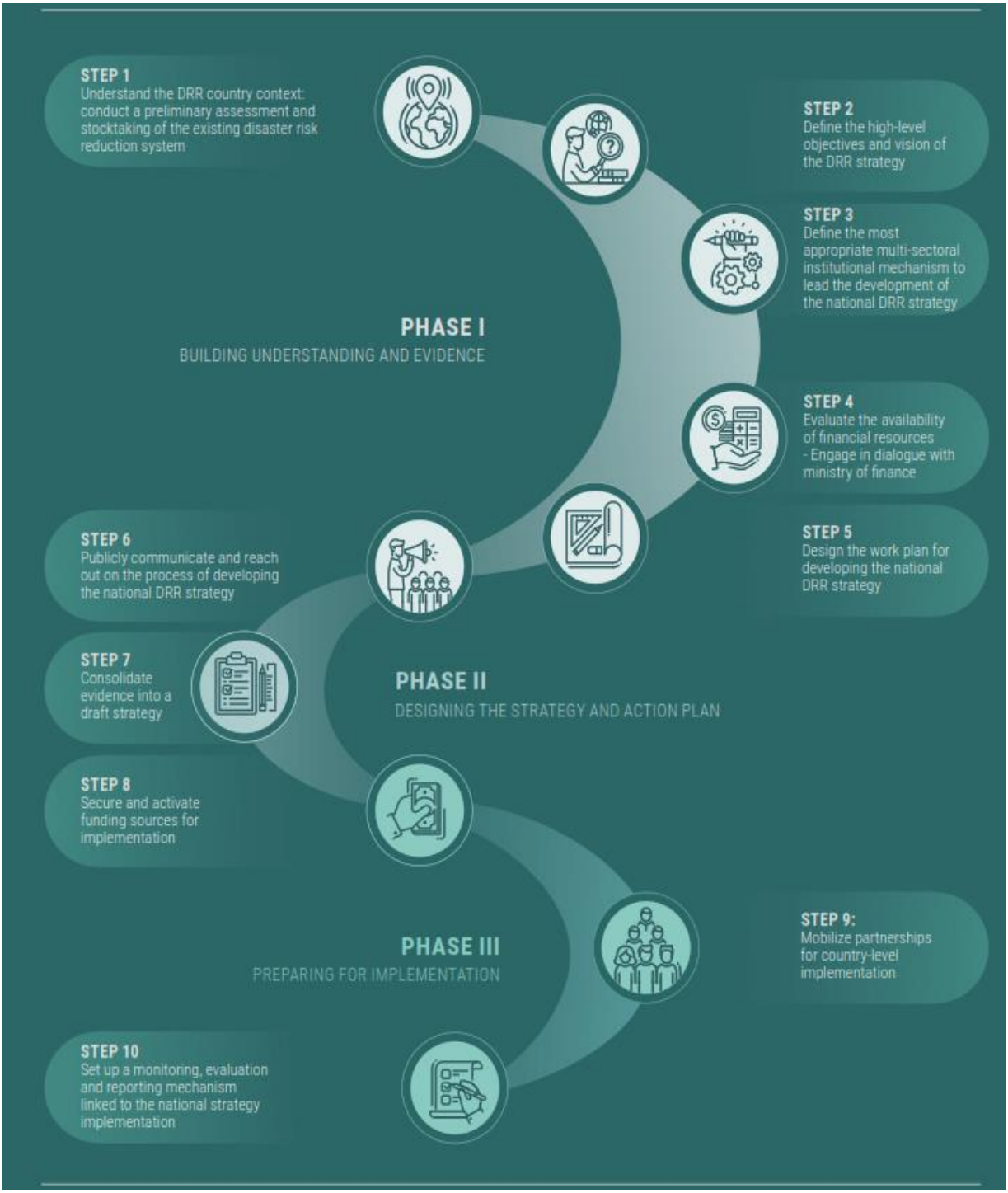
District-wise Disaster Risk Profile

District	Flood risk	Landslide risk	EQ risk	Tsunami risk	Cyclone risk	Drought risk	Avalanche risk	GLOF risk	Total
Karachi	4	1	5	5	5	5	1	1	27
Badin	5	1	3	-	5	2	1	1	18
Dadu	5	1	2	-	2	5	1	1	17
Hyderabad	5	1	4	-	4	5	1	1	21
Qambar Shahdadkot	5	1	3	-	2	4	1	1	17
Tando Muhammad khan	5	1	4	-	4	5	1	1	21
Thatta	4	1	2	3	4	1	1	1	17
Tando Allah Yar	4	1	4	-	4	5	1	1	20
Miatiari	5	1	4	-	2	5	1	1	19
Jacobabad	5	1	3	-	2	5	1	1	18
Jamshoro	5	1	2	-	3	5	1	1	18
Kashmore	5	1	3	-	2	5	1	1	18
Mirpur Khas	4	1	3	-	4	4	1	1	18
Naushoro Feruz	5	1	3	-	2	5	1	1	18
Nawab shah	5	1	2	-	3	5	1	1	18
Shikarpur	5	1	3	-	2	5	1	1	18
Ghotki	5	1	2	-	2	5	1	1	17
Khairpur	5	1	2	-	2	5	1	1	17
Sukhar	5	1	2	-	2	5	1	1	17
Larkana	5	1	2	-	2	4	1	1	16
Tharparkar	3	1	2	-	4	4	1	1	16
Sanghar	4	1	2	-	3	2	1	1	14
Umerkot	3	1	2	-	3	3	1	1	14

SCORING KEY	V.High	High	Medium	Low	V.Low	Non Hazard
	5	4	3	2	1	–

DRR Mainstreaming Approaches & Guidelines

United Nation's 10 – Step Approach



Asian Disaster Preparedness Centre (ADPC) Approach

Cross Sectoral Initiatives

Education

- Introducing DRM modules into the school curriculum
- Promoting hazard resilient construction of new schools
- Introducing features into schools for their use as emergency shelters

Environment and Natural Resources

- Including disaster risk Impact assessment into environmental Impact assessments for new development projects
- Linking with the national adaptation Plan of action under the UN Framework Convention for Climate Change
- Action on other environmental hazards and links between environmental degradation and disaster risks

Health

- Vulnerability assessment of hospitals in hazard prone areas
- Promoting hazard resilient construction of new hospitals
- Implementing of disaster preparedness plans for hospitals

Housing

- Promoting the increased use of hazard resilient designs in rural housing in hazard prone areas
- Utilization of national building codes; and the compliance and enforcement of local building laws in urban hazard prone areas

Urban Planning and infrastructure

- Introducing disaster risk Impact assessments into the construction of new roads and bridges
- Promoting the use of hazard risk information in land-use planning and zoning programs

Financial Services

- Incorporating flexible repayment schedules into microfinance schemes
- encouraging financial services and local capital markets to finance DRM measures

DRR Mainstreaming Building Block

1. Legislation	for DRM, including the mainstreaming of DRR into development, to provide an enabling environment in which DRM strategies can be 'empowered'
2. Comprehensive DRM	plan that has been developed through the active participation of stakeholders at all levels of government
3. Institutional Arrangement	the institutional structure should strengthen the horizontal and vertical integration of DRR between different levels of government, various line agencies and other stakeholders
4. Budget	budget lines should be created at the level of local government to support the basic functioning of DRM offices and their activities
5. Skills, capacities and tools	need to be developed by government agencies for incorporating risk considerations in their day-today operations
6. Awareness-raising	among government officials as well as the public to secure a solid appreciation and understanding of the linkages between DRR and sustainable development
7. Monitoring	monitoring and measuring progress against performance indicators are essential for gauging the success of the mainstreaming process, and for generating evidence on results and impacts, as well as lessons learned that will be useful to other cities

NDMA's 7-Step Approach

Step 1. Awareness-raising

- Appreciation and understanding of the relevance of disaster risk reduction to sustainable development. Increased awareness of the potential importance of examining and, if necessary, addressing disaster risk is critical, on the part of both governments and development organizations, in striving for sustainable development and poverty reduction.
- **Accountability.** Most fundamentally of all, governments need to accept greater accountability for hazard-related human, physical and economic losses. Governments need to assume greater responsibility for their countries' and peoples' vulnerability and to actively seek to reduce risk.

Step 2. Enabling environment

- Appropriate organization policies, strategies and institutional capacities. Overarching policies and strategies need to pay due attention to disaster risk reduction, regarding it as a development issue rather than the responsibility of humanitarian departments.
- Government prioritization of disaster risk reduction. It is essential that governments themselves prioritize risk reduction as a critical development challenge in high-risk areas.

Step 3. Development of tools

- Programming, appraisal and evaluation tools are required to investigate sectors and individual projects at risk from natural hazards, provide detailed information on the nature and level of risk and ensure that appropriate risk reduction measures are taken.

Step 4. Training and technical support

- Government needs to provide appropriate internal training and technical support to support the integration of disaster risk concerns into development.

Step 5. Change in operational practice

- Early assessment. It is essential that hazard-related issues are considered during the very early stages of sectoral programming and project design so that they can be fully and systematically taken into account and appropriately addressed where relevant.
- Adequate supporting information. Sufficient information is necessary to permit a full and accurate assessment of disaster risk and its appropriate treatment.
- Cost minimization. Disaster risk analysis should be integrated into sectoral programming and project design at minimum cost. Pooling of relevant information and related analysis within the government would help achieve this.

- Treatment of low-probability, high-impact risks. Climatologically hazards are most likely to be identified as potential risks, reflecting their shorter return periods and thus higher probability that they will occur over the life of a project or country strategy. In contrast, risks emanating from earthquakes and volcanic hazards, with much longer return periods, may be discounted. However, even if ignored from an economic perspective, it is important to ensure that earthquake risks are adequately considered from a safety perspective, taking rights to safety and protection into account.
- Transparent, inclusive and accountable consultation. The consultative process must give a voice to poor and marginalized groups, who are often among the most vulnerable to natural hazards, and ensure that their interests are adequately addressed and their rights protected.
- Adequate upkeep and maintenance of development investments. Mechanisms for ensuring that development investments are adequately maintained and remain in good condition are essential in ensuring that their designed level of hazard resilience is maintained.

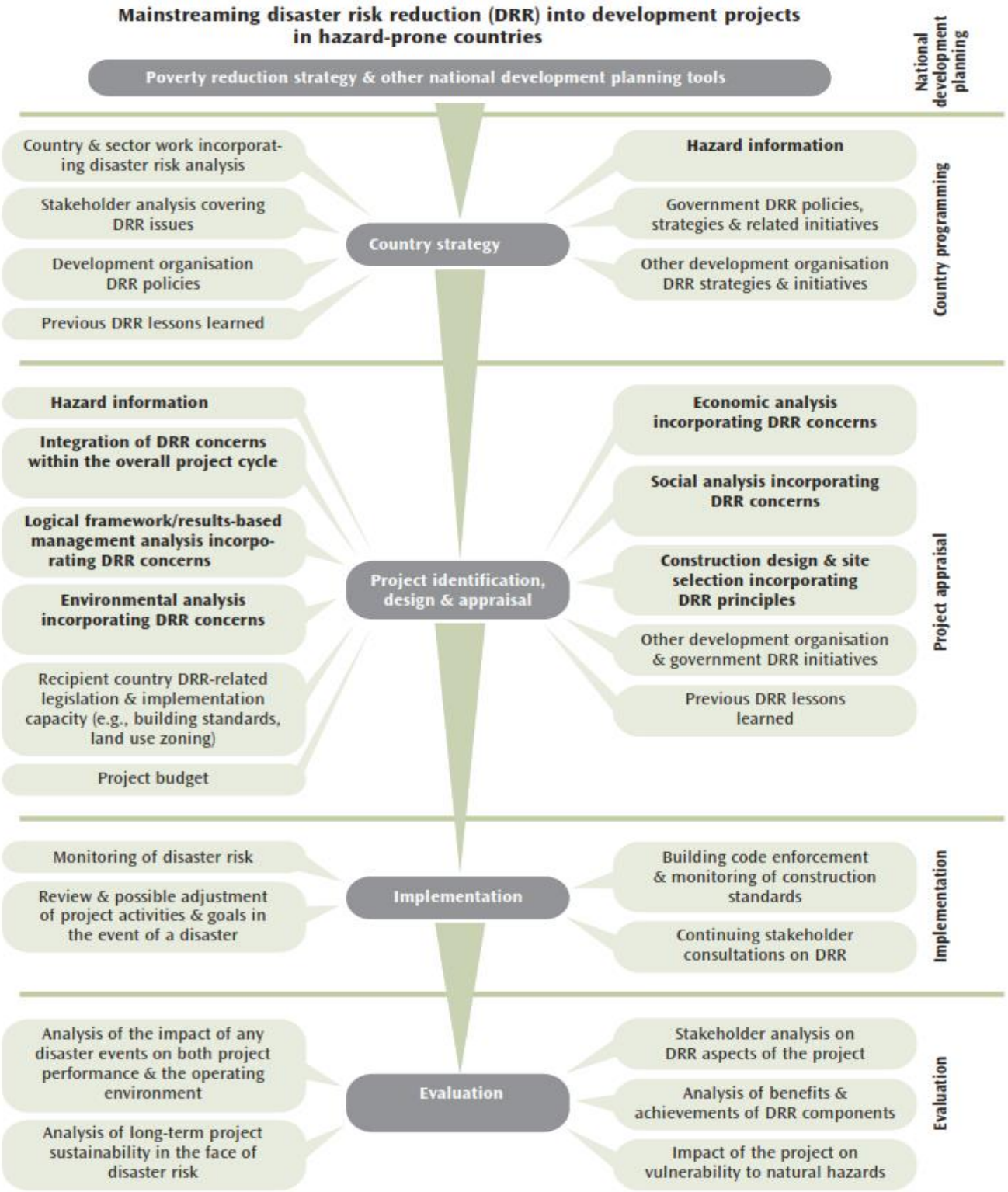
Step 6. Measuring progress

- Internationally agreed targets for disaster reduction should be established, providing a focus for the government against which progress in mainstreaming can be measured.

Step 7. Learning and experience sharing

- The government, together with other stakeholders, should make a concerted effort to monitor, share and learn from its experience in mainstreaming disaster risk reduction into development.

The ProVention Consortium on DRR Mainstreaming



DRR Mainstreaming Scenario of Sindh & Gap Assessment

DRR Initiatives in Sindh

- The National Disaster Risk Management Framework envisages a multi-hazard approach in dealing with disaster risks. Accordingly, the multi-hazard risk assessment exercise is being executed by the NDMA with an objective to develop Hazard Atlas of Pakistan. The pilot project has been completed in Sindh province and Multi Hazard Vulnerability Assessment for Sindh province at macro scale has been prepared. Micro level Multi-Hazard Vulnerability Risk Assessment at Union Council level supported by Disaster Management Information System (DMIS) and Informed Disaster Management Plans are under development.
- Provincial Emergency Operation Centre (PEOC) has been established and is in process of upgradation to house DMIS.
- Disaster Risk Management Needs Report 2012 has been prepared.
- Provincial and District level SoPs for Flood / Rain / Cyclone emergencies have been prepared and being modified in the light of micro level MHVRA.
- Capacity Building Programs/workshops are being conducted for Provincial, District officers, Civil Society and NGOs in DRM and DRR under Sindh Resilience Project.
- Community Based Disaster Risk Reduction (CBDRM) model for the province has been development and in process of implementation.
- Initiatives for DRR Mainstreaming has been launched and in process of implementation. Various awareness programs on DRR mainstreaming have been planned and in execution phase.
- Development schemes have been launched for drought mitigation in desert areas of district Umerkot and Tharparkar.

Though few initiatives have been completed by the province, but Provincial Disaster Management Authority, Sindh have envisioned comprehensive program to address complete disaster management cycle. PDMA Sindh under Sindh Resilience Project is working on diverse initiatives, which once complete will pave way for enhancing the capacity of the Province in managing disasters and steps in right direction for disaster risk reduction on globally accepted contemporary practices.

Gap Assessment

Strategic or Provincial Level

Focus Areas	Desired Future State	Current State	Identified Gap	Action Plan
Hazard information	Multi-hazard micro level hazard information required	District level hazard information available. Micro level MHVRA of Sindh under development by PDMA	90%	Micro level MHVRA and Disaster Management Information System (DMIS) being developed by PDMA is likely to fill information gap
Government DRR policies, strategies	Provincial Disaster Risk Reduction Policy	National Disaster Risk Reduction	50%	Action required by PDMA for preparation of

and related initiatives		Policy is prepared by NDMA		Provincial DRR policy
Other development department's DRR strategies and initiatives	Preparation and implementation of sector specific DRR policies by all public and private entities engaged in development planning	No such structured policies exist at any level	100%	Development sector departments collaborate with PDMA Sindh and prepare sectoral policies under the ambit of Provincial DRR Policy

Project Level

Focus Areas	Desired Future State	Current State	Identified Gap	Action Plan
Integration of DRR concerns within overall project cycle	Well structured, practical and implementable and quantifiable provisions in project cycle	Checklist for DRR analysis available in project cycle	80%	Revision / recommendation for DRR inclusion included in this initiative i.e., support to line departments for DRR mainstreaming in development planning
DRR related legislation and landuse planning	Legislation for DRR enabling environment required at provincial and sectoral level	Earthquake zoning Building code provision available	100%	Action required by PDMA for preparation of hazard specific landuse planning legislation in consultation with other stakeholders. Such provision restrict development in hazard prone areas such as floods plains etc.
Construction design & site selection incorporating DRR principles	This is highly important aspect and disaster physical vulnerability is directed related to this aspect of the	No such structured design and exist at levels except Building and Fire Codes	70%	PDMA may initiate pilot studies on subject matter in consultation with other stakeholders

	project. In line with Building Codes provision, all hazard specific building codes must be designed			

Implementation Level

Focus Areas	Desired Future State	Current State	Identified Gap	Action Plan
Monitoring of Disaster Risk	Regular studies, research and development be carried out for monitoring of disaster risks	Being monitored by PDMA	100%	PDMA may collaborate with national and international research institutes on subject matter
Review and adjustments in project activities and goals in the event of disaster	Periodic adjustment is always required in projects and policies for improvement. For example, Building Codes are not always fixed can be reviewed after earthquake to determine their effectiveness	No such practice exists at any level	100%	PDMA and all stakeholders may prepare such mechanism
Building code reinforcement and monitoring of construction standards	Be enforced by project sponsoring and executing departments	No such practice present	50% (Require strict enforcement)	Project sponsoring or executing department may develop such framework
Continuing stakeholder consultations on DRR	An epic body be constituted to arrange and ensure regular consultations	No such practice present	100%	PDMA may play leading role to hold meeting on annually or half annually basis

Evaluation Level

Focus Areas	Desired Future State	Current State	Identified Gap	Action Plan
Analysis disaster impacts on project performance and operating environment	Each sponsoring or executing department prepare such mechanism	No such practice present	100%	Project executing departments ensure this practice

Analysis of long-term sustainability in the face of disaster risk	Each sponsoring or executing department prepare such mechanism	No practice present	such	100%	Project executing departments ensure this practice
Analysis of Benefits and Achievements of DRR Component	Each sponsoring or executing department prepare such mechanism	No practice present	such	100%	Project executing departments ensure this practice
Impact of project of on vulnerability to natural hazards	Each sponsoring or executing department prepare such mechanism	No practice present	such	100%	Project executing departments ensure this practice

DRR Mainstreaming Strategy for Sindh

Strategic Level

- Focused areas in Gap Matrix are highly important but gradual implementation of full spectrum DRR will prove as sustainable approach.
- All steps towards DRR mainstreaming shall be taken considering opinions of communities at disaster risks.
- Necessary policies and legislation be prepared in consultation with all stakeholders to establish ownership of departments. Consultation on each phase of preparation and implementation will smoothen the DRR implementation process. PDMA may lead the process.
- Trainings, awareness at gross root level and induction of qualified / trained manpower in DRR or related fields is highly important and capacity development programs other than this initiative be prepared and conducted. PDMA may consider this initiative as regular feature of capacity development program.
- Ideal entry point for mainstreaming disaster risk reduction is inclusion of well-structured and applicable mechanism in appropriate PC Forms.
- Potential public sector departments for DRR mainstreaming are education, health, agriculture, irrigation, transport and communication, forestry, water and power and local government. DRR entry at project planning (PC-I) will cover most of the departments in mainstreaming. However, agriculture sector for example will require other DRR treatments such as damage compensation, crop insurance etc.
- Government policies may also be reviewed in terms of disaster risk reduction. Policies if not properly vetted for environmental impacts or disaster risks can produce large scale adverse impacts.
- Disaster Risk Reduction section may be created in Planning and Development Department. This will ensure scrutiny of PC-I in terms of DRR measures.
- DRR may be considered in all phases of project cycle as obligatory.
- An epic committee may be created comprising cross sectoral participation inducing academia and research for directing DRR mainstreaming process in full spectrum of development planning.
- All department may prepare sector related DRR policies and legislation in in-line with provincial disaster management policy. This will greatly facilitate DRR mainstreaming process.
- Provincial Disaster Management Fund may be created to divert fiscal shocks of disasters on development.

Project Level

- If project requires feasibility study it is taken-up through PC-II. Either feasibility study is to be taken in-house or through third party consultant firm, disaster risk reduction assessment and mitigation measures be made part of the study. In case of consultant firm, ToRs for the study be specifically tailored to include DRR assessment and mitigation requirements.
- Cost Benefit Analysis of mitigation measures be also conducted in feasibility study of projects and made part of PC-II. Feasibility of project may be considered with respect to cost benefit analysis of mitigation measures.
- Para-9 of PC-II Form suggest study TORs (for consultant as well), which also include 'Environmental Impact Assessment including CDM and DRRA'. In addition to environmental impact assessment, feasibility of location with respect to multi-hazards and mitigation measures be included in PC-II. Detailed multi-hazard risk assessment study be conducted for mega infrastructure projects.
- In physical progress monitoring of the project, inclusion of DRR mitigation measures be insured in PC-III proforma. Progress on disaster mitigation measures being undertaken in project be reported along with overall progress of the project.
- Completion of disaster risk reduction measures as envisioned in project PC-I be reported in PC-IV. For the purpose provision on reporting be devised on PC-IV proforma.
- PC-V to include compliance reports on DRR intervention mentioned in PC-I or PC-II. In addition to PC-V reporting, performance of mitigation measures be measured after occurrence disaster for which mitigation

measures were planned. Such reporting will greatly help in updating disaster mitigation measures and serve the purpose of lesson learned for other similar projects.

- Part-A of PC-I form cover project digest comprising various aspects of project. It is recommended that; Disaster Risk Reduction Analysis be made part of Project Location. As per Manual of Development, following information is required with respect to project location;
    - Place and administrative district where the project is located.
    - Map of the project area with GIS/GPS coordinates.
    - Reasons for selection of location.
    - The availability of land needs to be assured.
    - In addition to above information following information may also be added in for DRR mainstreaming,

      Feasibility of project location in terms of multi-hazard risks

- As far as hazards of Sindh province are concerned following hazards and consequential effects be considered in multi-hazard assessment for project location;
    - Floods (all kinds i.e., riverine, urban, torrential, tidal surges)
    - Cyclones (Wind gusts, heavy rains, thunderstorms and tidal surge)
    - Heatwaves
    - Drought
    - Sea intrusion
    - Waterlogging and salinity
    - Erosion and Land sliding
    - Earthquake
    - Tsunami
- Feasibility of project location in terms of multi-hazard risks is recommended to be carried out using modern techniques such as remote sensing and GIS. The same is extensively used globally. Numerous free datasets are available which can be used for the purpose.
- Recommended details and useful information for location / project risk assessment are;
    - **Geographical Location / Coordinates project site**
      (Instruction: The geographical coordinates of project sites are highly important and be made part of every project PC-1. On the basis of geographical coordinates, the pertinent analysis can be carried out such as required in project location details i.e., Place and administrative district where the project is located, map of the project area with GIS/GPS coordinates, reasons for selection of location, and the availability of land needs to be assured. Similarly, physical environment of site prior to project can be assessed with the help of satellite imagery. If the site is well-known to executing department then, geographical coordinates of project site can be obtained through freely available mapping service like Google Earth or Map. In other case, same can be obtained through smart phones which is now a days very common commodity in everyday life)
    - **Brief history of disaster events**
      (Instruction: District level information can be obtained from NDMA and PDMA Sindh websites and various other sources such as Prevention Web etc. With this information disaster frequency assessment can be done. Determination of disaster frequency is highly important for project design in terms of disaster risk reduction)
    - **Landuse / Landcover Mapping of the area where project is located**
      (Instruction: Landuse / Landover is highly important for not only disaster risk reduction but for environmental assessment. Landuse provide information on manmade use of land while Landcover is natural features over the land area. This is also useful in Risk Landscape mapping. For this purpose, freely downloadable satellite imagery can be used if latest landuse / landcover is required, otherwise archived landuse and landcover maps can be used for the purpose)
    - **Topographic mapping of area where project is located**

(Instruction: Topographic assessment is essential and highly useful for site selection specifically in terms of flood management. Digital elevation model, slope mapping, natural flow direction mapping, natural sinks and depression mapping must be included in topographic mapping. This will answer many questions related to project site such as; whether project is located in a natural depression, or will cause obstruction in natural flow, will there be sufficient slope to naturally drain rain or flood water etc. The topographic mapping can be done with freely available datasets (improved versions of these datasets are available now). Also, such assessment can be done through Google Earth platform.)

- **Probabilistic and Deterministic Hazard Risk Assessment**
  (Instructions: This is essential part of site suitability assessment in terms of hazard and disaster risks. Assessment of all disasters pertinent in Sindh be carried out. Risk assessment manuals and guidelines are provided by NDMA for each hazard. Hazard assessment at district level is available on NDMA website. PMDA Sindh is in process of developing such database at Union Council level which will be launched soon on its completion. The Disaster Management Information System (DMIS) is a web-based application and can be accessed by any one through web. On completion of this database all required information for risk assessment will be readily available and downloadable for users.)
- **Risk Reduction Measures**
  (Instructions: Once hazard risks are identified, risk mitigation measure be proposed in PC-I. The mitigation measures will vary according to hazard and risks. Example: for road construction, local or regional catchment depending on length of road be studies, all water ways be identified and bridges and culverts be suggested to avoid road damage or possible flooding caused by the road. For road safety recommended practice is to include drain along the road drain rain water such practices be proposed in PC-I.)

- DRR Analysis checklist as mentioned in Manual of Development will be more useful and be kept in PC-I Appraisal Section after addition of feasibility study of project location with respect to hazard risks is added in PC forms specially PC-II and PC-I.

Feasibility of Location in Terms of Multi-Hazard Risk – An Example

Geographical Coordinates of Project Area

i) 419483.34 m E; 2692264.70 m N
ii) 416308.01 m E; 2692140.93 m N
iii) 419856.79 m E; 2689084.70 m N
iv) 417603.39 m E; 2688267.65 m N
v) 416256.46 m E; 2689889.38 m N

Disaster chronology, Frequency and Severity

The disaster chronology, frequency and severity are given in Table-1. It is to be noted that Sujawal was part of Thatta district till declared as district in October, 2013.

Table 1 - Chronology of Disaster Events in Thatta & Sujawal Districts

District	Hazard	Frequency	Severity	Years
Thatta	Flood	Monsoon	High	1840,1856, 1874,1942, 1946,1948, 1956,1973, 1974,1976, 1978,1978, 1988,1989, 1992,1994, 1995,1996, 1999,2003, 2006,2007, 2010, 2011 and 2020
	Cyclones	Seasonal	High	1964,1993, 1999,2003
	Monsoon rains	Seasonal	Medium	Every year
	Tsunami	Rare	High	1945
	Earthquake	Rare	Low	2001, 2013
Sujawal	Floods/Rain	Monsoon	Medium	2012
	Droughts	Rare	Medium	1998 to 2012
	Earthquake	Rare	Low	2011,2013

General Description of Site Area

The site location is about 7 Km in south-west of Jati town and about 15 km south-east of Shah Aqeeq town. The site is approximately 10 Km inland from sea / creeks. Landuse in and around of the site is depicted in Figure-1.

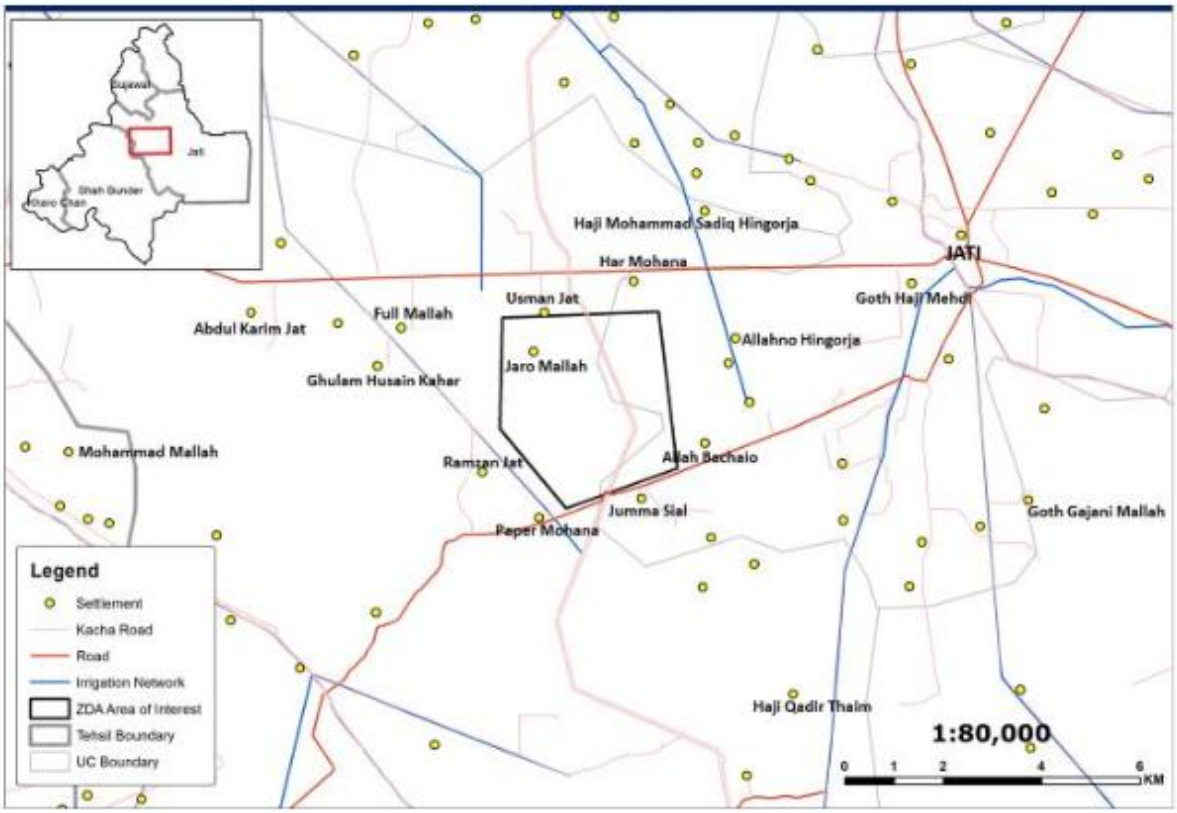


Figure 1 - Landuse features in and around site area

Figure-2 is high resolution satellite image of the site, which precisely focuses on land parcel. Most of land within parcel is barren, except few marshy patches and natural depressions on eastern side, where stagnant water is visible in the image. The obvious manmade feature is drainage channel which crosses the land parcel.

Figure 2 - High Resolution Image of site

Topography of in and around of site area

As it can be seen in Figure-3, natural terrain is almost flat with maximum surface elevation upto 10 m above mean sea level. Most of land within site is either at sea level or just above sea level.

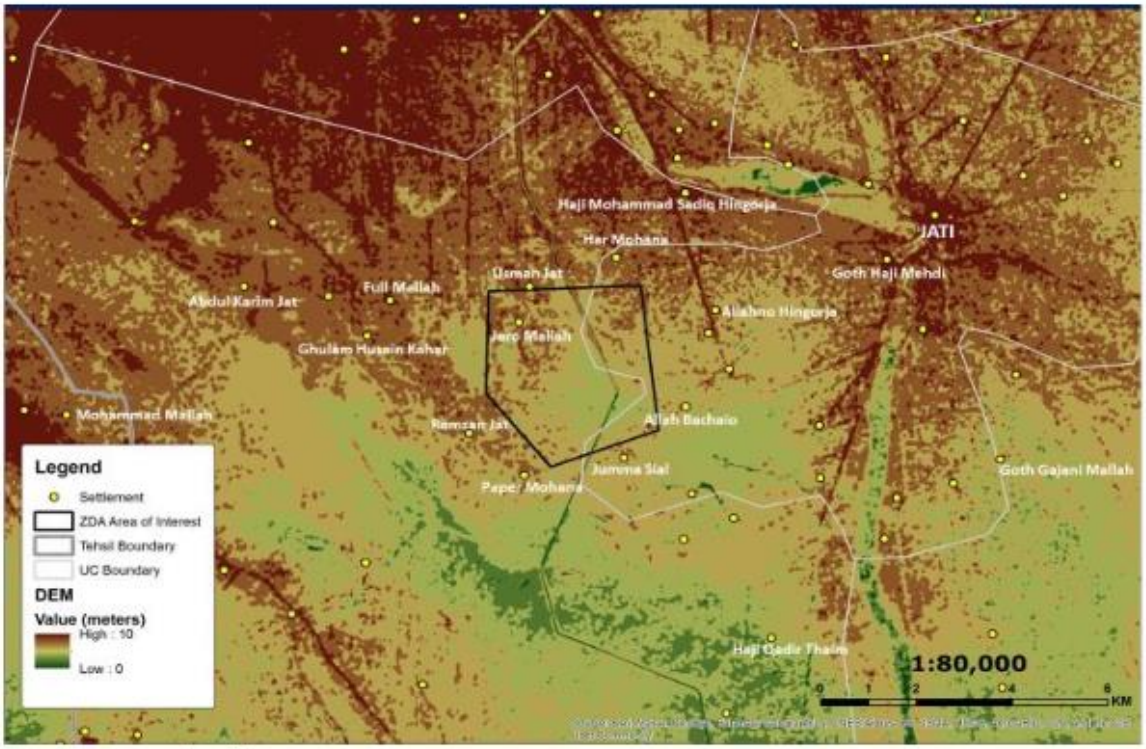


Figure 3 - Topography of the area

6. Landuse / Landcover of the area

It can be seen in Figure-4 Baren Land is dominant feature, specially in site area.

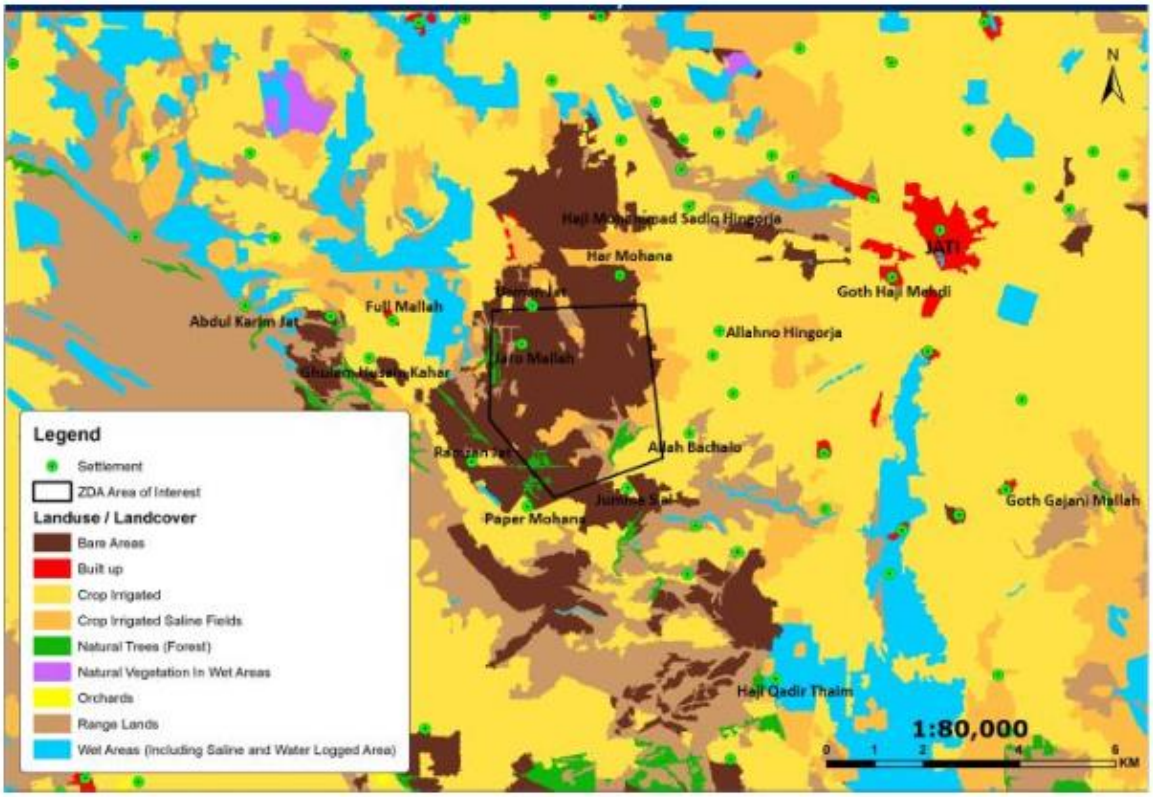


Figure 4 - Landuse / Landcover of the area

7. Flood Hazard

The location of site, falls in low lying area with low gradient and consequently poor natural drainage, therefore, flooding caused by rains is likely permanent hazard in the area. Figure-5 shows rain water accumulation / stagnant water couple of days after rain in the area.

As far as riverine flooding is concerned, the site area is away from active Indus River flood plain. As we know that, during floods, River Indus in Sindh flows above the surrounding lands and is confined by embankments on both sides. The residual risk of breaches in embankments is always present all over the province. As it happened in 2010 floods. Two breaches in embankments at Tori and Kot Aalmo rampaged different districts of upper and lower Sindh. Breach at Kot Aalmo, coupled with rains caused havoc in Thatta and Sujawal districts. As it can be seen in Figure-6, site location was also inundated in flood water. If

similar situation happens, it will pose threat to established infrastructure at the location.

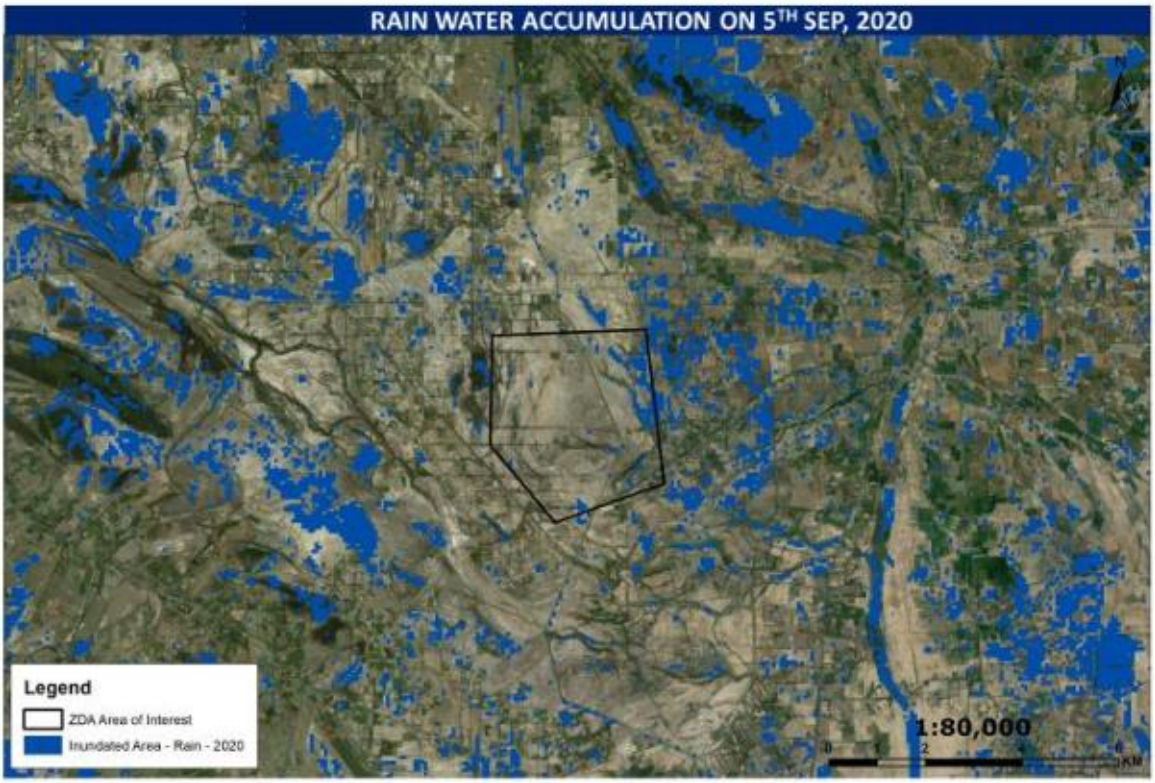


Figure 5 - Rain water accumulation in area during monsoon 2020

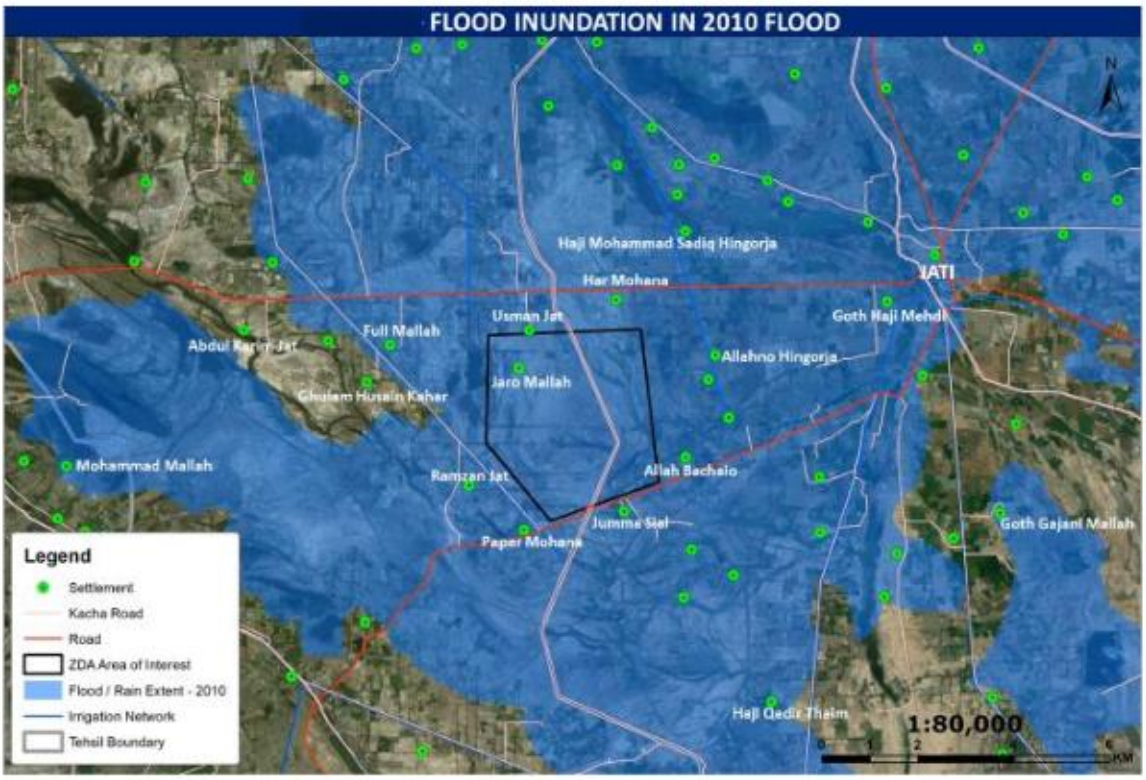


Figure 6 - Flood inundation in area during 2010 Floods

8. Cyclone Hazard

Both probabilistic and deterministic risk assessment suggest high risk of cyclone in the area. Category-3, Cyclone 2-A made landfall on 20 May, 1999 over the south-east coast of Sindh and affected approximately 600,000 people. Over 82,000 houses were destroyed and nearly 68,000 were damaged. While 675 fishing boats were destroyed and 191 fishermen lost their lives. The cyclone caused widespread damage to agricultural land and the infrastructure of the region. Figure-7 shows cyclone hazard risk computed over 100-year return period. However, there is less chance of storm surge in the area. The storm surge computed for 25-year return period is shown in Figure-8.

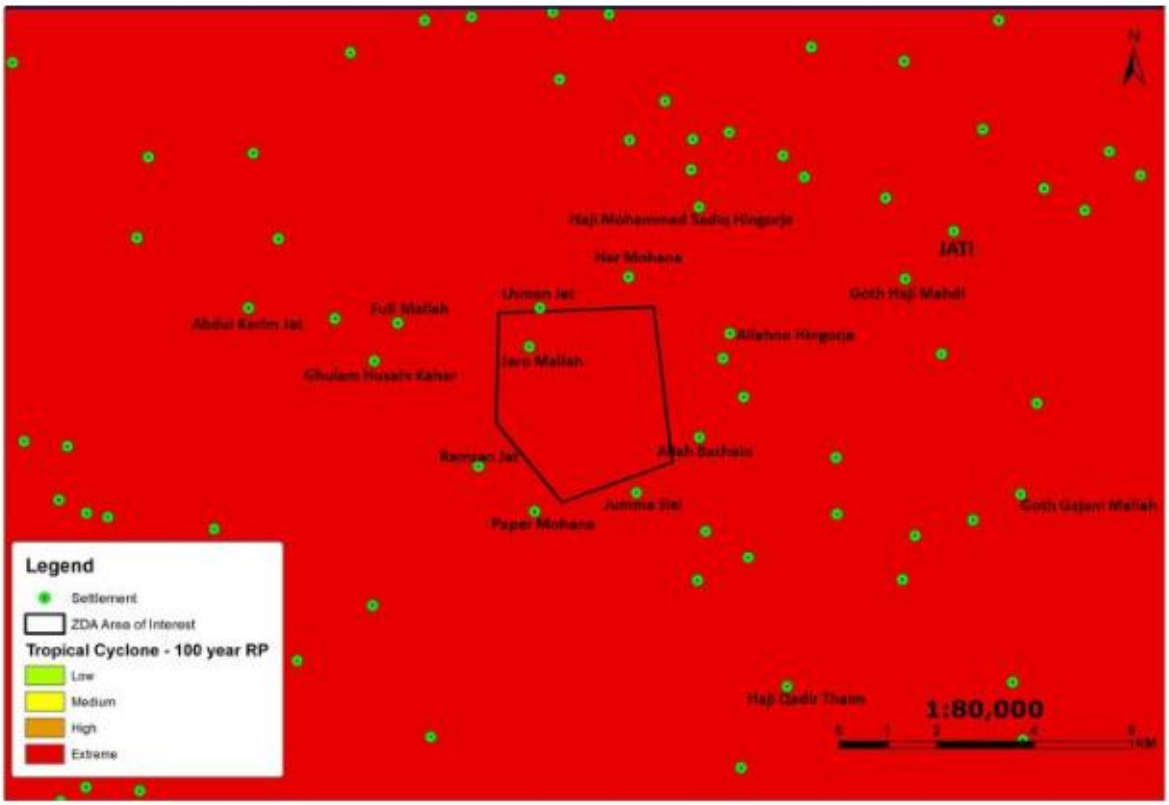


Figure 7 - Cyclone Hazard in the area

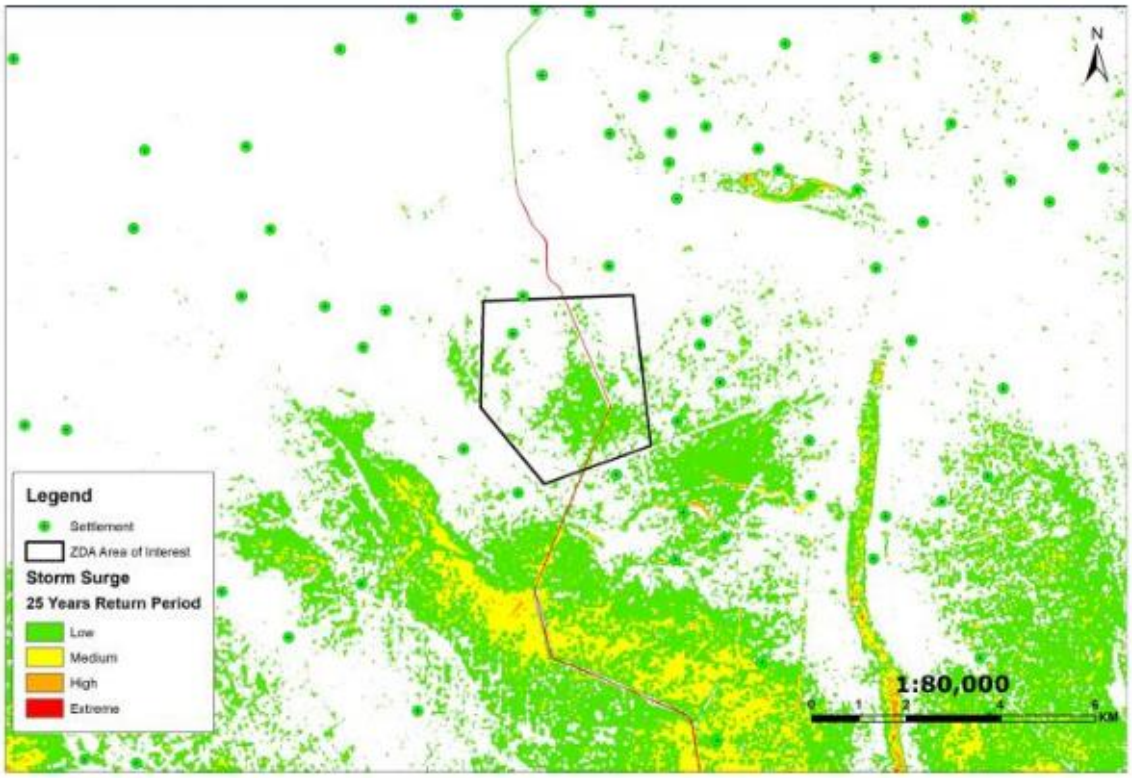


Figure 8 - Storm Surge Map

9. Heatwave Hazard

Due to closeness of site with respect to sea, marine climate is dominant in the area with high humidity. Summers remain bit hot. Values of Heat Index (HI) (used for heatwave computation) for 5-year return are on borderline i.e. in the middle of low and extreme values. Heat Index map is shown in Figure-9. This suggest that area is susceptible to heatwaves.

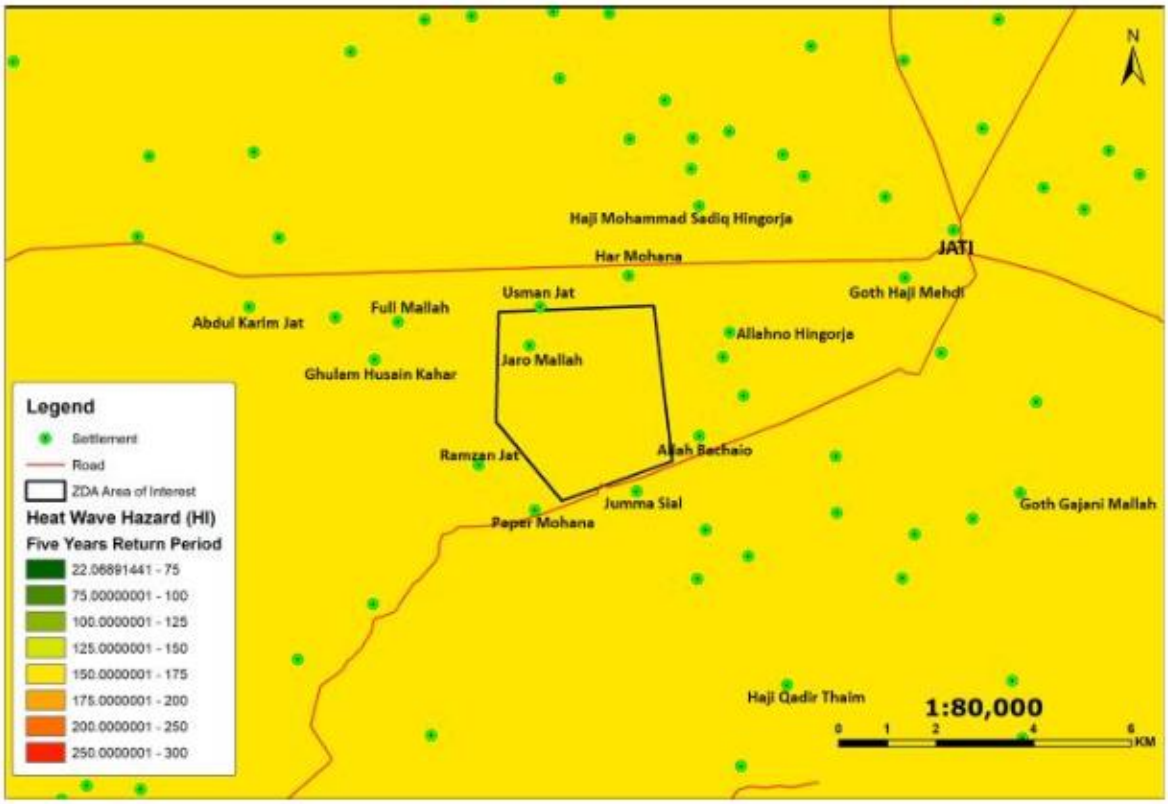


Figure 9- Heatwave Index

10. Earthquake Hazard

Probabilistic and deterministic hazard risk assessment suggest low chances of major earthquake in the area. Earthquake hazard computed for 50-year return period is shown in Figure-10.

11. Tsunami Hazard

Makran subduction zone in Balochistan has the potential to generate tsunami in the area as it happened in 1945. For tsunami hazard in the area of interest, different synthetic (model) tsunami events were generated but susceptibility of tsunami surge remained low for the area.

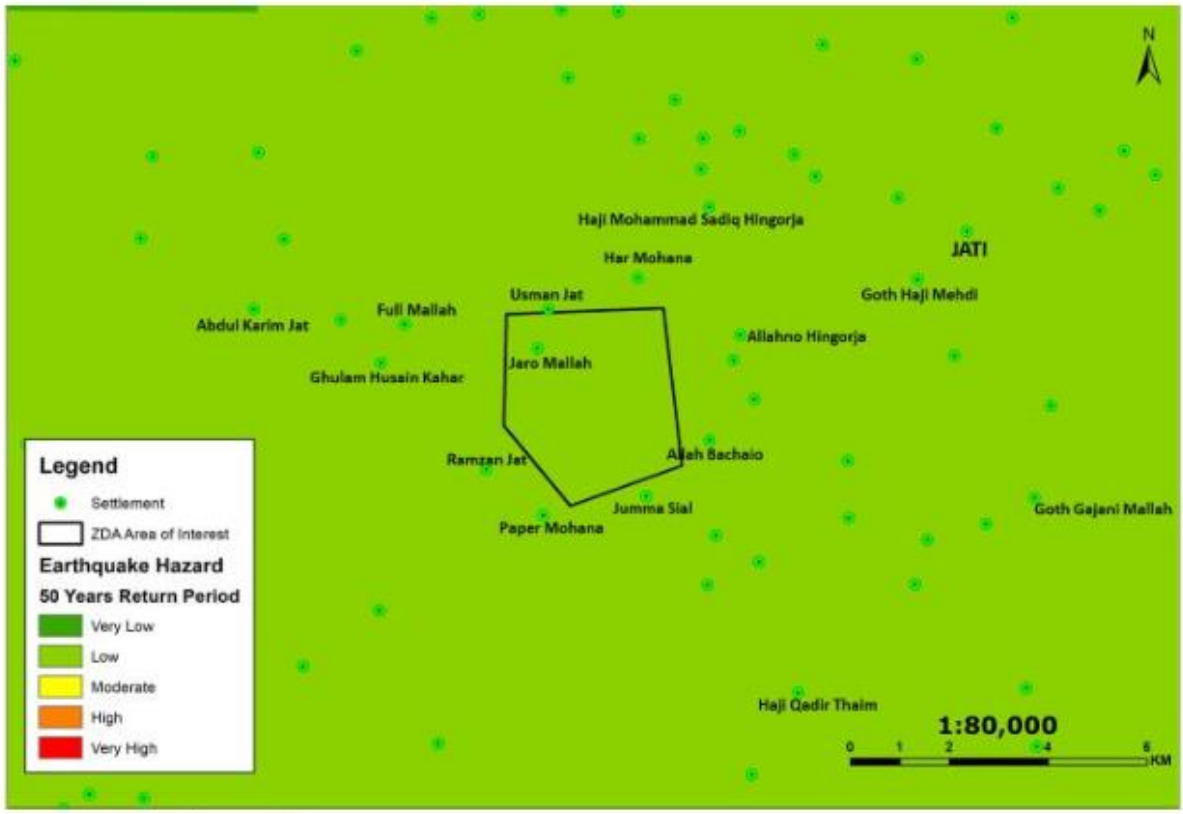


Figure 10 - Earthquake Hazard Map

Conclusion

Conclusion on feasibility of location in terms of natural hazards is follows:

a) Site falls in natural low lying area
b) Land parcel is mostly barren with marshy patches
c) A drainage channel passes through the land parcel and risk of breaching will be high specially in heavy rains / cyclone events
d) Rain water accumulation and residual risk of riverine floods persist in the area
e) Artificial draining of flood / rain water will likely be required in case of unusual event
f) The waterlogging and salinity problems persist in the area and the groundwater is likely brackish
g) Cyclone risk specially high wind gusts accompanied with rain is high in the area
h) The site is well above inland hence in present conditions no chances of sea / tidal effects in the area
i) Tsunami and storm surge hazard in low in the area
j) Earthquake hazard is low in the area
k) Heat Index is on borderline so area can receive occasional heatwaves

Recommendations

Development can be initiated in land parcel but considering the following:

i. All the development must be considered keeping view the rain / flood hazard in the area. The structures and supporting infrastructure should be elevated enough to avoid submergence in rain / flood water.

ii. The designing of structure should be conducted keeping in view cyclone hazard specially, high wind gusts and heavy rain. Also, precautionary measures / system should be in place to avoid lightning strikes during thunder storms.

iii. Environmental friendliness should be considered in structural design.

iv. Though earthquake risk is low in the area still structures should be designed to withstand low to medium earthquake jolts.

v. Due to high humidity, waterlogging and salinity in the area, material to be used in construction should be used to withstand weathering effects in order to avoid regular maintenance requirements of the structures.

NDMA's Sectoral Guidelines for DRR Mainstreaming

Community - Basic Infrastructure

- DRR primarily consists of structural and non-structural measures. Safer building codes, land use, and quality control through regular monitoring and inspection regimes are important amongst structural measures while creating DRR awareness, planning, training and capacity building of all stakeholders, especially the community and the government departments are important nonstructural measures.
- DRR must be an integral part of project selection and implementation. In order to set the design criteria for a risk reduction project, the hazards, the current risk and level of risk that is socially acceptable must be identified. A multi-hazard appraisal should be carried out at an early stage to identify the types of hazards, their likely severity and recurrence.
- An evaluation of the current risk includes identifying locations most likely to become unsafe in the event of a natural hazard (e.g., areas prone to flooding, landslides or earthquake- induced liquefaction) and assessing their land use, as well as assessing the ability of local construction to resist the identified hazards.
- If, for the identified hazards, the level of current risk is greater than that which is socially acceptable, then the need for hazard-proofing (and/or re-siting) is established, and the socially acceptable risk and identified hazards become the design criteria for the new construction or strengthening works.
- Determine whether additional works are required to render the site viable for development or whether land use should be restricted to reduce vulnerability to natural hazards. Also consider whether re-siting to a location of reduced risk is an option. Topographical features and landscape can be used to reduce the impact of potential natural hazards (e.g., to minimize flood risk or modify wind-speed and wind direction).
- A technique to strengthen constructions or make them hazard-safe should consider all potential hazards, not just the recent floods. In many cases, design features intended to enhance resilience to one type of natural hazard will augment resilience to others, for example, the provision of good connections between foundations, frames, walls and roofs of buildings. However, in certain cases, design features that help resist one type of hazard may be detrimental to the resistance of another. For example, heavy roofs help withstand strong winds due to cyclones, storms or typhoons, but will increase the forces on buildings subjected to earthquakes.
- The siting and design of critical facilities (e.g., bridges) and infrastructure that are essential for relief and recovery purposes in the event of a disaster should be given special consideration.
- The site for development will typically be defined by local government based on availability and economic criteria. The suitability of these sites needs to be assessed. This can be done by following. Any hazard assessments carried out in previous stages should also be considered
- Develop building codes and guidelines, accounting for local hazard conditions, building material characteristics, construction skills and quality. The aids and guidelines prepared by UNHABITAT Pakistan should be used wherever applicable.

Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Link roads and paths	• Incorrect alignments can result in blocking the natural water courses and become potential flood hazard. • Substandard construction can result in different types of disaster risks. • Slope cutting for roads widening may trigger landslides.	○ Avoid new alignments which can block natural water courses. Adopt slop stabilization measures; ○ Ensure proper designing and quality control through monitoring and inspection regimes. ○ Identify proper debris dumping site away from streams and rivers

		• Improper disposal of debris like dumping into rivers and streams.	probably in depressions that need filling
2.	Street pavement	• Drainage system may be blocked, which may result in stagnant water; • Improper disposal of the debris	○ Ensure that proper designing and quality control of the street pavements; ○ Identify proper debris dumping preferably in depressions that need filling
3.	Bridges (wooden, suspension,)	Selection of wrong site and design may cause obstruction to freshwater flow and hence movement of aquatic life; Gradient of stream may be changed and thus may change the morphology of a stream and river	○ Adopt safer designs and ensure quality control. ○ Give ample space for free movement of freshwater down the stream; do not obstruct water flow; ○ Do not give too much gradient to the river or stream beds so that movement of the aquatic fauna is obstructed; ○ Create DRR awareness among the community.
4.	Culverts	• Substandard construction can become a hazard rather than an aid to the community; • Lead to high risk of water obstruction and hence water logging, flooding and restricted movement of aquatic life	○ Ensure quality control through proper monitoring and inspection regimes. ○ Use standard designs and proper sites to allow free movement of water and avoid water logging. ○ Create DRR awareness among the community/ all stakeholders.
5.	Water channels, Water mills, Micro-hydal power units	• Cutting of slopes, which may lead to soil disturbance and landslides; • Improper disposal of debris, may lead to water contamination; • Improper diversion bunds in streams and rivers at source may hinder the freshwater flow downstream	○ Safe designing and quality control. ○ Avoid realignment in slope and mountainous areas; ○ If unavoidable adopt appropriate slope stabilization measures. Identify proper debris dumping site away from streams and rivers probably in depressions that need filling; ○ Construct diversion bunds in a way to allow proper flow of water. ○ Create DRR awareness among the community/ all stakeholders.
6.	Dug wells	• Water could be contaminated; • May not fall within safe distance from a sewerage point or solid waste disposal point; • Men or animals may fall in it if not walled properly • Improper design / construction may lead to collapse or water contamination;	○ Before repairing an existing dug well test the water samples and ensure that it is according to the approved standards; ○ If it falls at a distance less than 10 m from a sewerage or waste disposal point then change the location to a safer site; ○ Construct proper safety wall around it. ○ Ensure proper designing and quality construction. ○ Create DRR awareness among the community/ all stakeholders.
7.	Bore (Hand pumps etc.)	Same as for the dug wells	Same as for the dug wells
8.	Water ponds	• Improper design and structure may lead either to flash floods in case of breach or blockage of downstream flows in	○ Proper design according to the available slope and quantity and

		case heave structure and less water availability; • Improper techniques may lead to excessive land and soil disturbance, which may lead to soil erosion; • Ponds on steep slopes have the risk of breach and thus may result in flash floods	duration of rainfall should be ensured; ○ Steep slopes should be avoided; Quality of construction should be ensured. ○ Create DRR awareness among the community/ all stakeholders.
9.	Flood protection Embankments/ Bunds	• Improper structures may obstruct water flows downstream; • Construction of flood protection spurs only on one side may redirect to water flow to the other side and thus may lead to banks cutting on the opposite side of the rivers and streams; Substandard construction may become hazardous; • Breaches in the embankments can transform into major disaster for the people, livestock and agriculture.	○ Proper designs should be adopted to ensure that water flows are not obstructed but only the banks are protected; Flood protection spurs be constructed on both sides of the water ways; ○ Quality control must be ensured. ○ Repair the existing breaches and create DRR awareness among the community/ all stakeholders. ○ Develop community awareness about risks of creating unauthorized breaches in the embankments.

Governance

- Policy planning, legal and regulatory frameworks, resources and organization and structures constitute major components of governance. Reconstruction of the damaged infrastructure is extremely important for improving the service delivery which is the real challenge and the ultimate goal. As for as reconstruction of the governance buildings is concerned, like other infrastructure, selecting the hazard free / safer sites, enforcement of building codes, the accessibility, quality control and following the timelines are the main areas of emphasis while service delivery revolves around capacity building through training / provision of essential resources, policy planning and strengthening the legal and regulatory frameworks.
- Mainstreaming DRR into the Governance sector involves the reconstruction and retrofitting of governance facilities so that they are hazard-resilient. The location, design and construction of these facilities must take all types of hazard risks into account. This needs to be given credence by clear policies on the development of governance facilities, and supported by the training of different departments on incorporating DRR into the construction / development of these facilities and coordination at all levels
- Institutional and Legislative Systems (ILS) for Disaster Risk Management. ILS are important components of "good governance" and should be guided by the same basic principles, (i.e., accountability, participation, rule of law, effectiveness and sustainability). Five important dimensions:
- 1) legal and regulatory frameworks, 2) policy and planning, 3) organizational aspects, 4) resources and capacities, 5) partnerships (international and national levels)
- Elements Necessary for Comprehensive DRR Strategy
    - Vulnerability and risk assessment;
    - Effective early warning systems;
    - Information sharing and public awareness;
    - Political commitment at international, regional, national, local and community levels;
    - Creation of multi-disciplinary and inter-sectoral partnerships;
    - Improved scientific knowledge about the causes of natural disasters as well as the effects that natural hazards and related technological and environmental factors have on society;
    - International cooperation and partnerships; and
    - Strengthening of disaster reduction capabilities and coordinating structures for policy and strategy development and the development of early warning.

- Guidelines for Reconstruction of Infrastructure
    - In order to set the design criteria for a risk reduction project, the hazards, the current risk and level of risk that is socially acceptable must be identified. A multi- hazard appraisal should be carried out at an early stage to identify the types of hazards, their likely severity and recurrence.
    - An evaluation of the current risk includes identifying locations most likely to become unsafe in the event of a natural hazard (e.g., areas prone to flooding, landslides or earthquake-induced liquefaction) and assessing their land use, as well as assessing the ability of local construction to resist the identified hazards.
    - In order to determine the socially acceptable risk, Post-disaster diagnostic surveys should be integrated into disaster reconstruction programmes, wherever these have been conducted, local and national building codes, and good practice should be examined to obtain an idea of current accepted levels of risk for different hazards and infrastructure.
    - If, for the identified hazards, the level of current risk is greater than that which is socially acceptable, then the need for hazard-proofing (and/or re-siting) is established, and the socially acceptable risk and identified hazards become the design criteria for the new construction or strengthening works
    - A technique to strengthen constructions or make them hazard-safe should consider all potential hazards, not just the recent floods. In many cases, design features intended to enhance resilience to one type of natural hazard will augment resilience to others, for example, the provision of good connections between foundations, frames, walls and roofs of buildings. However, in certain cases, design features that help resist one type of hazard may be detrimental to the resistance of another. For example, heavy roofs help withstand strong winds due to cyclones, storms or typhoons, but will increase the forces on buildings subjected to earthquakes.
    - The strengths and durability of materials need to be determined for structures which will incur costs of more than Rs. 2 million.
    - The siting and design of critical facilities (e.g., bridges) and infrastructure that are essential for relief and recovery purposes (e.g., schools and other Government buildings) in the event of a disaster should be given special consideration.
    - Consider different performance objectives for critical facilities and infrastructure, in particular factoring in the potential impact on the users or clients who would be negatively affected to varying extents by loss of service.
    - The site for development will typically be defined by local government based on availability and economic criteria. The suitability of these sites needs to be assessed. This can be done by following. Any hazard assessments carried out in previous stages should also be considered.
    - Determine whether additional works are required to render the site viable for development or whether land use should be restricted to reduce vulnerability to natural hazards. Also consider whether re-siting to a location of reduced risk is an option. Topographical features and landscape can be used to reduce the impact of potential natural hazards (e.g., to minimize flood risk or modify wind-speed and wind direction).
    - Experienced hazard specialists and engineers should coordinate or implement construction projects (by either employing them directly or ensuring that the contracted work will be led by such people.
    - Engineers specialized in hazard-resistant construction be consulted in the initial stages of construction projects.
    - Land swaps might be a potential solution in collaboration with local government,
    - Ensure (e.g., through testing and research) that the proposed solution will yield the performance objectives determined in the previous step
    - Develop building aids and guidelines, accounting for local hazard conditions, building material characteristics, construction skills and quality. The aids and guidelines prepared by UNHABITAT Pakistan should be used wherever applicable.

Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Absence of land use plans leading to siting of Governance facilities at land vulnerable to natural hazards	○ Siting of these facilities at slopes/ land sliding areas can result in damage to these facilities and render them unusable in case of earthquake or heavy rains/ floods. ○ Siting in low laying areas / depressions can render the facilities vulnerable to flooding and unusable following heavy rains / floods. ○ Routes to the governance buildings / facilities are blocked by the flood / rains / traffic / natural hazards.	○ The Location should not be at the edge of a slope, near the foot of a mountain vulnerable to landslides, near creeks, rivers or bodies of water that could erode its foundation, on top of or in proximity to active fault lines (less than 10 meters away), near the river banks and areas prone to storm surges. ○ The building should have appropriate provisions for addressing hazards related to location such as rainwater drainage and dikes ○ Relocate the facilities away from land sliding areas. ○ Adopt slop stabilization measures including bio engineering. ○ Site these facilities on higher grounds or make flood protection bunds around these facilities
2.	Governance buildings difficult to access and different departments are located wide apart.	○ Will become unusable during an emergency due to difficult access. ○ The people will have to travel long distance to approach different government departments. This will cost them more time and money and result in poor service delivery.	○ Governance buildings should be located at most accessible places. ○ Preferably all government departments at district level should be located at one place / within one complex. ○ If that is not possible, they should be grouped together as per the service delivery needs by readjustments / relocation.
3.	Lack of building codes and standards for the infrastructure.	○ Unsafe buildings codes can endanger both the staff and the facilities. ○ The designs may not suit the local environment and culture. ○ The facility may not be available for the service delivery during an emergency following a disaster.	○ Develop and enforce safe building codes for multiple hazards like floods, earthquake and windstorms. ○ Develop designs suitable to local environment and customs.

4.	Firefighting Arrangements.	○ Non installation of fire alarm system. ○ Substandard or non-functioning fire alarm system. ○ Substandard or non-functional firefighting equipment.	○ New structures should be built with fire-resistant and non-toxic materials. ○ Fire Suppression System with alarm, detection and extinguishing systems should be provided. ○ Training of HR for proper maintenance and use of fire alarm and firefighting equipment.
5.	Additional engineering works for improving the safety of the buildings.	○ A building needing retrofitting can be unsafe ○ both the government officials and the visiting public. ○ A building located in low lying area may be vulnerable to flooding unless an embankment is constructed around it. ○ A building located at slop will be vulnerable without the support of a retaining wall.	○ There should be no major structural cracks on structural members. ○ Minor or hairline cracks should be investigated by a qualified civil or structural engineer and determined to be localized and repairable. ○ Carry out proper retrofitting and ensure quality control through regular monitoring. ○ Construct an appropriate bund / embankment to make the building safe for use during an emergency. ○ Construct an appropriate retaining wall to provide required protection to the building.
6.	Coordination between the relevant sectors / stakeholders	○ Lack communication and coordination between the various national and international stakeholders can result in duplication of efforts in some areas and leaving gaps elsewhere.	○ Improving the communication and coordination between the various stakeholders within different departments and outside. ○ Establishment of a well-defined and efficient coordination mechanism at union council level, district level, provincial level and national level.
7.	Capacity building of the government officials and different line departments.	○ Lack of capacity / incompetence of the officials can result in to a total failure of the services during a disaster situation. ○ The officials may not be trained to function efficiently during a natural disaster.	○ Educate the officials about possible hazards and required risk reduction measures. ○ Build capacity of officials of different departments through training workshops and short courses. ○ Build capacity of different departments through provision of required equipment and resources.

Water & Sanitation (WatSan)

- Mainstreaming DRR into the WatSan sector involves the reconstruction and retrofitting of WatSan facilities so that they are hazard-resilient. The location, design and construction of these facilities must take all types of hazard risks into account. This needs to be given credence by clear policies on the development WatSan facilities, and supported by the training of staff on incorporating DRR into the construction / development of these facilities and coordination at all levels.
- Three Pillars of WatSan Planning. A systematic process for sustainable development, allocation and monitoring of water resource use in the context of social, and economic and environmental objectives:
    - Moving towards an enabling environment of policies, strategies and legislation for sustainable water resources management and development;
    - Putting in place the institutional framework through which these policies, strategies and legislation can be implemented;
    - Setting up the management tools required by these institutions to do their job.
- Physical Measures for Mainstreaming DRR into WatSan Facilities;
    - Elevated concrete platform for tube-wells.
    - Elevated level for sanitary latrines with the prevention of any kind of leaching.
    - High wall or embankment all around the ponds.
    - Women friendly and "comfortable" technology for "children, old people, and disabled people".

Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Absence of land use plans leading to siting of WatSan facilities at land vulnerable to natural hazards	○ Siting of these facilities at slopes/ land sliding areas can result in damage to these facilities and render them unusable in case of earthquake or heavy rains/floods. ○ Siting in low laying areas / depressions can render the facilities vulnerable to flooding and unusable following heavy rains / floods.	○ The Location should not be at the edge of a slope, near the foot of a mountain vulnerable to landslides, near creeks, rivers or bodies of water that could erode its foundation, on top of or in proximity to active fault lines (less than 10 meters away), near the river banks and areas prone to storm surges. ○ The building should have appropriate provisions for addressing hazards related to location such as rainwater drainage and dikes ○ Relocate the facilities away from land sliding areas. ○ Adopt slop stabilization measures including bio engineering. ○ Site these facilities on higher grounds or make flood protection bunds around these facilities
2.	Lack of building codes and standards for the infrastructure	○ Unsafe buildings codes can endanger both the staff and the facilities. ○ The designs may not suit the local environment and culture. The facility	○ Unsafe buildings codes can endanger both the staff and the facilities.

		may not be available for the service delivery during an emergency following a disaster.	○ The designs may not suit the local environment and culture. The facility may not be available for the service delivery during an emergency following a disaster.
3.	Firefighting arrangements	○ Non installation of fire alarm system. ○ Substandard or non-functioning fire alarm system. ○ Substandard or non-functional firefighting equipment.	○ New structures should be built with fire-resistant and nontoxic materials. ○ Fire Suppression System with alarm, detection and extinguishing systems should be provided. Training of HR for proper maintenance and use of fire alarm and firefighting equipment.
4.	Additional engineering works for improving the safety of the buildings	○ A building needing retrofitting can be unsafe both the staff and the patients. ○ A WatSan building located in low lying area may be vulnerable to flooding unless an embankment is constructed around it. ○ A building located at slop will be vulnerable without the support of a retaining wall.	○ There should be no major structural cracks on structural members. Minor or hairline cracks should be investigated by a qualified civil or structural engineer and determined to be localized and repairable. ○ Carry out proper retrofitting and ensure quality control through regular monitoring. ○ Construct an appropriate bund / embankment to make the building safe for use during an emergency. ○ Construct an appropriate retaining wall to provide required protection to the building.
5.	Coordination between the relevant sectors / stakeholders	Lack communication and coordination between the various national and international stakeholders can result in duplication of efforts in some areas and leaving gaps elsewhere.	○ Improving the communication and coordination between the various stakeholders within the WatSan sector, as well as outside the health sector. ○ Establishment of a well-defined and efficient coordination mechanism at union council level, district level, provincial level and national level.
6.	Capacity building of the staff / Sanitation workers.	Lack of capacity / incompetence of the staff can result in to a total failure disaster situation.	○ Update knowledge and skills about hazards and risk reduction. ○ Train the Sanitation workers in operating efficiently under a disaster situation.
7.	Non - availability of enough water	○ Due to damage to water supply, the number of water resources sustaining a community significantly decreases.	○ Existence and capacity building of local water resource management authorities is vital. ○ Municipal services should be equipped with emergency water

		○ In a post-disaster scenario, non - availability of enough water is critical and can lead to a health crisis.	tankers to bring in water to IDP shelters from distant locations. Bottled water is a priority relief good. ○ Average amount of water for drinking, cooking, and personal and domestic hygiene: 15 liters per person daily. ○ Supply of water in health centers: 40-60 liters per patient per day.
8.	Co-location of tap water lines with sewage lines.	○ Can result in mixing of the two and non-availability of clean drinking water. ○ Water-borne illnesses can spread very quickly at IDP camps.	○ WatSan pipelines should be at a safe distance from the sewage lines. ○ Water samples from outlets should be tested for contamination. ○ Continuous monitoring of drinking water at IDP camps is mandatory to prevent breakout and spread of water-related diseases.
9.	Accessibility of WatSan facilities	○ Disasters can render WatSan facilities inaccessible. ○ Locating WatSan facilities without considering social and cultural aspects.	○ Water points, toilets and bathing facilities should be located and designed to ensure privacy and security. ○ Water points should be located such a way that they are safe to access for women and children. ○ Physical designs of toilets and bathing facilities should be such as to ensure ease of use for the elderly, the disabled and injured. ○ Public-use hand pumps and tube wells should be installed and strategically spaced out in disaster-prone areas. Provisional emergency shelters such as schools and hospitals should have groundwater access where possible. ○ Affected families should be supplied with water containers such as Jerry cans and buckets which should also be priority relief goods. ○ Maximum allowable distance between houses and water collection point: 500 meters.
10.	Neglect of gender issues	Local and traditional beliefs such as women should collect the water, women should not go out in public and only men should make important decisions can be a hindrance in	○ All WatSan services should be gender sensitive and must take into account the needs of both male and female population. Post-disaster demographic

		providing assistance to women and to families headed by women.	surveys should be carried out to determine the proportions of men and women and male and female headed households in the affected population. ○ Ensure staff have an understanding of the importance of gender in water, sanitation and hygiene programming and provide training and support where necessary. ○ Establish mechanisms (e.g., workshops, focus discussion groups, etc.) to make sure women's and men's voices are heard on decisions related to immediate location and appropriate technology for water and sanitation systems (design, type, cost and affordability), using appropriate facilitators where necessary and ensure convenient times and locations. ○ Ensure equitable and dignified access to distributions of hygiene- related materials; ensure materials are appropriate for users. Consult with women on appropriate menstrual cloths, smaller containers for children to collect water and appropriate shaving materials for men. Security of the women should be ensured at both household and community level. As in many cases it was found that women face sexual harassment while going to latrine at night or at shelter houses. The latrines and water points should be in a safe place where there is enough light and air. ○ Separate toilet for every 10 males and females living in the shelter house has to be ensured.
11	Neglect to address sanitation issues	Poor sanitation conditions can lead to outbreak of diseases.	○ Construction of Latrines (Pit / Pore Flush). ○ Provision of latrine Slabs (fiber glass etc.). ○ Provision of Latrine construction tools.

			○ Paved streets and drainage particularly at IDP camps Washing / Bathing places in IDP camps.

Education

Tools and Approaches for Mainstreaming DRR into the Education Sector

- Raising awareness about the hazards, related risks and responses possible in the area.
- Mainstreaming DRR into the national education system, in primary and secondary schools as well as within universities, in order to help raise awareness and understanding about different hazards (this can also be passed on by students and teachers to family members, and therefore has an additional secondary impact).
- Providing the necessary teacher training, curricula and teaching materials for teachers in all education institutions to raise awareness about DRR in the Education Sector.
- Developing school preparedness/response plans and conducting drill.
- Training teachers on what to do in a disaster and post-disaster situation.
- Promoting hazard resilient construction of new schools.

Suggested Measures for Safer School Construction

- Set up a committee for the school building at the community level (school director, community leaders) to monitor maintenance.
- Capacity building of the committee members so that the committee members can explain to the architect the design that will suit the local conditions.
- Build all structures above the high flood level
- Ensure early warning of storms for the community
- Roads should be flood proof for continued access even after flood
- Train architects, private contractors, masons, etc.
- Master plan is essential. Should include the size and location of school and how much area needed for playground and class rooms.
- Must have professional architect for school building. Also need to study the level of water and volume of flood before initiating construction.
- Knowledge should be imparted to community on what they should and should not do to ensure storm resilience in the construction. This can be done through capacity building campaign.
- Clear evacuation routes during floods or during emergency should be developed for the community.
- Need to manage and utilize funds appropriately and effectively. Community and concerned government officials should form a committee to monitor school building construction.

Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Absence of land use plans leading to siting of Governance facilities at land vulnerable to natural hazards	○ Siting of these facilities at slopes/ land sliding areas can result in damage to these facilities and render them unusable in case of earthquake or heavy rains/ floods. ○ Siting in low laying areas / depressions can render the facilities vulnerable to	○ The Location should not be at the edge of a slope, near the foot of a mountain vulnerable to landslides, near creeks, rivers or bodies of water that could erode its foundation, on top of or in proximity to active fault lines (less than 10 meters away),

		flooding and unusable following heavy rains / floods. ○ Routes to the governance buildings / facilities are blocked by the flood / rains / traffic / natural hazards.	near the river banks and areas prone to storm surges. ○ The building should have appropriate provisions for addressing hazards related to location such as rainwater drainage and dikes ○ Relocate the facilities away from land sliding areas. ○ Adopt slope stabilization measures including bio engineering. ○ Site these facilities on higher grounds or make flood protection bunds around these facilities
2.	Lack of building codes and standards for the schools	○ Unsafe buildings codes can endanger both the teachers and the students. ○ The designs may not suit the local environment and culture. ○ The building may not be available for the service delivery during an emergency following a disaster.	○ Develop and enforce safe building codes for multiple hazards like floods, earthquake and windstorms. ○ Develop designs suitable to local environment and customs.
3.	Construction of ramps for students with disabilities.	○ Non-availability of ramps for students and other persons with disabilities can result in them getting trapped following a disaster.	○ Ramps should be constructed at appropriate places for use by the persons with disabilities.
4.	Construction of multiple exits for emergency and doors opening outwards.	○ In case of single entry and exit it is likely to be choked during an emergency and result in casualties. ○ Similarly, the doors opening inwards are likely to be choked in an emergency specially following an earthquake.	○ Construct multiple emergency exits and create DRR awareness among all stakeholders. ○ Ensure that doors open outwards. ○ Lay down and rehearse SOPs for evacuation in an emergency.
5.	Firefighting arrangements	○ Non installation of fire alarm system. ○ Substandard or non-functioning fire alarm system. ○ Substandard or non-functional firefighting equipment.	○ New structures should be built with fire-resistant and nontoxic materials. ○ Fire Suppression System with alarm, detection and extinguishing systems should be provided. ○ Training of HR for proper maintenance and use of fire alarm and firefighting equipment.
6.	Additional engineering works for improving the safety of the	○ A building needing retrofitting can be unsafe both the staff and the students. ○ A building located in low lying area may be vulnerable to flooding unless an embankment is constructed around it. ○ A building located at slop will be vulnerable without the support of a retaining wall.	○ There should be no major structural cracks on structural members. ○ Minor or hairline cracks should be investigated by a qualified civil or structural engineer and determined to be localized and repairable.

			○ Carry out proper retrofitting and ensure quality control through regular monitoring. ○ Construct an appropriate bund / embankment to make the building safe for use during an emergency. ○ Construct an appropriate retaining wall to provide required protection to the building.
7.	Lack of awareness and Capacity building of the teachers, community and students.	○ Lack of capacity / awareness about possible disasters and capacity to respond appropriately can result in a paralysis during a disaster situation. ○ The teachers other staff may not be trained to function efficiently during a natural disaster.	○ Educate the both the staff and the students about possible hazards and required risk reduction measures. ○ Build response capacity of the staff and the students through training workshops and short courses. ○ Involve the parents teachers committees in DRR awareness and capacity building. ○ CBDRM.

Health

- Mainstreaming DRR into the health sector involves the reconstruction and retrofitting of health facilities so that they are hazard-resilient.

Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Absence of land use plans leading to siting of health facilities at land vulnerable to natural hazards and/ access routes being vulnerable	○ Siting of these facilities at slopes/ land sliding areas can result in damage to these facilities and render them unusable in case of earthquake or heavy rains/ floods. ○ Siting in low laying areas / depressions can render the facilities vulnerable to flooding and unusable following heavy rains / floods. ○ Routes to the governance buildings / facilities are blocked by the flood / rains / traffic / natural hazards. ○ Siting in areas vulnerable to becoming inaccessible in the event of a flood or earth quake or a land slide can result in non-availability of these facilities to the affected people in event of a natural hazard.	○ The Location should not be at the edge of a slope, near the foot of a mountain vulnerable to landslides, near creeks, rivers or bodies of water that could erode its foundation, on top of or in proximity to active fault lines (less than 10 meters away), near the river banks and areas prone to storm surges. ○ The building should have appropriate provisions for addressing hazards related to location such as rainwater drainage and dikes ○ Relocate the facilities away from land sliding areas. ○ Adopt slope stabilization measures including bio engineering. ○ Site these facilities on higher grounds or make flood

			protection bunds around these facilities
2.	Lack of building codes and standards for the schools	○ Unsafe buildings codes can endanger both the staff and the patients. ○ The designs may not suit the local environment and culture. The facility may not be available for the service delivery during an emergency following a disaster.	○ Develop and enforce safe building codes for multiple hazards like floods, earthquake and windstorms. ○ Develop designs suitable to local environment and customs. ○ The facility has a simple shape and is symmetrical along both the lateral and longitudinal axes (e.g. square or rectangle), making it resilient when subjected to stress such as that produced by an earthquake. ○ The foundation, columns, beams, floors, slabs and trusses should conform to Building code of Pakistan. ○ Glass walls, doors and windows resist basic wind speeds of 200-250 kph with regional application of secondary covers
3.	Standard of construction	○ Substandard construction can result in different types of disaster risks. ○ The men and material can be injured /damaged and rendered ineffective following an earthquake, heavy rains or wind storm etc. ○ The facility can become unusable following a disaster event.	○ Ensure proper quality control through monitoring and inspection regimes. ○ Ensure use of safer materials and construction techniques.
4.	Ensure proper quality control through monitoring and inspection regimes. Ensure use of safer materials and construction techniques.	○ Non-availability of ramps for bed patients and persons with disabilities can deny easy access to these people.	○ Ramps should be present in appropriate areas for moving bed patients and for use by people with disabilities
5.	Construction of multiple exits for emergency and doors opening outwards	○ In case of single entry and exit it is likely to be choked during an emergency and result in casualties. ○ Similarly, the doors opening inwards are likely to be choked in an emergency specially following an earthquake.	○ Construct multiple emergency exits and create DRR awareness among all stakeholders. ○ Ensure that doors open out wards. ○ Spell out detailed SOPs for evacuation in an emergency.
6.	Fire fighting arrangements	○ Non installation of fire alarm system. ○ Substandard or non-functioning fire alarm system. ○ Substandard or non-functional firefighting equipment.	○ New structures should be built with fire-resistant and nontoxic materials. ○ Fire Suppression System with alarm, detection and

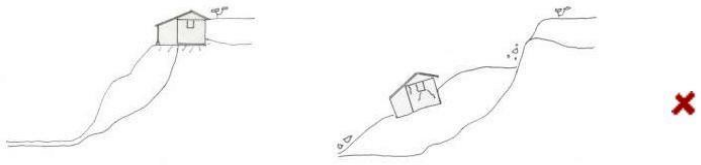
			extinguishing systems should be provided. An emergency ○ Exit System with directions at all points including angles and intersections of corridors and passageways, landings of stairs and exit doors; should be provided. ○ Training of HR for proper maintenance and use of fire alarm and firefighting equipment.
7.	Architectural Elements	○ Insecure roofing, different fittings or leakage can harm the occupants. ○ Unsafe doors and windows material and choking of doors can be dangerous during emergency. ○ Check list for architectural elements is given in the remedial measures.	○ Roofing materials should be ○ completely and securely fastened, welded, riveted or cemented. The roof is leak-proof and where possible, insulated. ○ Door materials are wind- and fire- resistant. Doors are securely attached to jambs. Main doors are double swing; bathroom door is swing out; emergency room doors are swing in and out, fire exit doors fire-resistant; swing out; with self- enclosing device and panic bar. Corridors should be double swing, per groups of rooms or sections, for compartmentalization. Windows should have wind and sun protection devices, should have features to secure the safety of the patient (e.g., grilles, railings). ○ Rooms may be subdivided provided that the arrangement allows for direct and constant visual supervision by nursing personnel ○ Exterior elements (cornices, ornaments, facade, plastering) should be securely fastened to walls, hanging light fixtures properly anchored, electrical wires and cables properly fastened and secured, non- slip floor materials without crevices should be provided in all clinical and service areas and easy-to-clean floor materials in all other nonclinical areas.
8	Coordination between the	Lack communication and coordination between the various national and	○ Improving the communication and coordination between the

	relevant sectors / stakeholders	international stakeholders can result in duplication of efforts in some areas and leaving gaps elsewhere.	various stakeholders within the health sector, as well as outside the health sector. ○ Establishment of a well-defined and efficient coordination mechanism at union council level, district level, provincial level and national level.
9	Capacity building of the staff / health workers.	○ Lack of capacity / incompetence of health workers can result in to a total failure of health services during a disaster situation. ○ Otherwise, trained staff may not be trained to function efficiently during a natural disaster.	○ Updating knowledge and skills about hazards and risk reduction, to improving health workers 'leadership role in emergency situations. ○ Train the health workers in operating efficiently under a disaster situation.
10	CBDRM. The community which is first one to help itself may not be organized to react with resilience and prudence following a disaster.	○ Lot of damage would have been done before arrival of outside help and irrecoverable losses would have occurred due to poor response at the community level. ○ Provision of first aid and casualty evacuation may be neglected and people may get involved in burials and other things.	○ Organizing the community at village and UC level to react resolutely. ○ Educating the community on priority of work specially importance of first aid and causality evacuation. ○ Training volunteers in first aid and administration, as well as having an emergency Rota with a list of extra available health professionals that can work following a disaster. ○ Create DRR awareness among the community.
11	Lifeline facilities / back up support for health sector.	○ The health facilities particularly in rural areas generally lack life line facilities and run short of medicines due to inadequate financial support. ○ These facilities do not have important back up like electricity, water, medicines, ○ medical gasses etc. and thus cannot function properly during an emergency.	○ Emergency generator should be provided with the capacity to meet priority hospital demands (provision for backup electrical system to include operating room, intensive care, pathways). ○ There should be functional electrical and emergency lights with battery backup in all critical areas. ○ The water tank storage should ○ have sufficient reserve to satisfy the hospital demand for three days at all times. ○ Medical Gases should be properly stored and secured in well ventilated areas or compartmented storage areas and secured from theft and vandalism. ○ A Logistic System should be put in place for estimating drug requirement, maintaining an inventory, storing and stocking

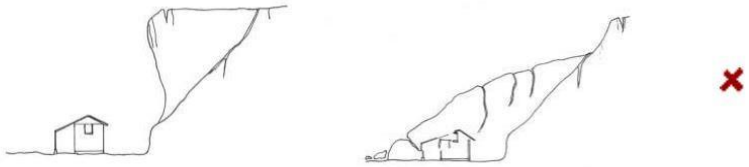
			and issuing and controlling the use of drugs, stockpile of emergency medicines and supplies, special arrangement with vendors and suppliers for emergency purchases in times of disaster emergency kits and blood bank facility during emergencies.

Housing

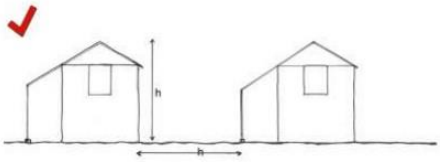
DONT BUILD: On steep/ unstable slopes or loose ground



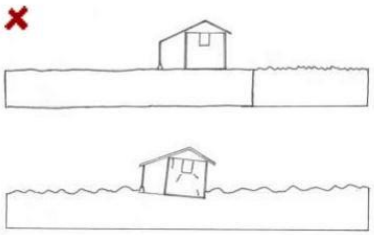
DON'T BUILD: On areas susceptible to landslides and rock fall



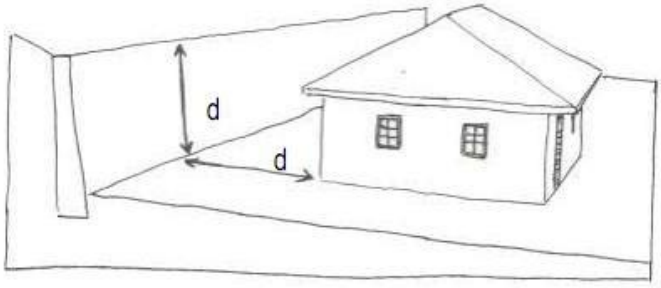
DO: Place buildings a good distance between each other (at least equal to height of tree or house).



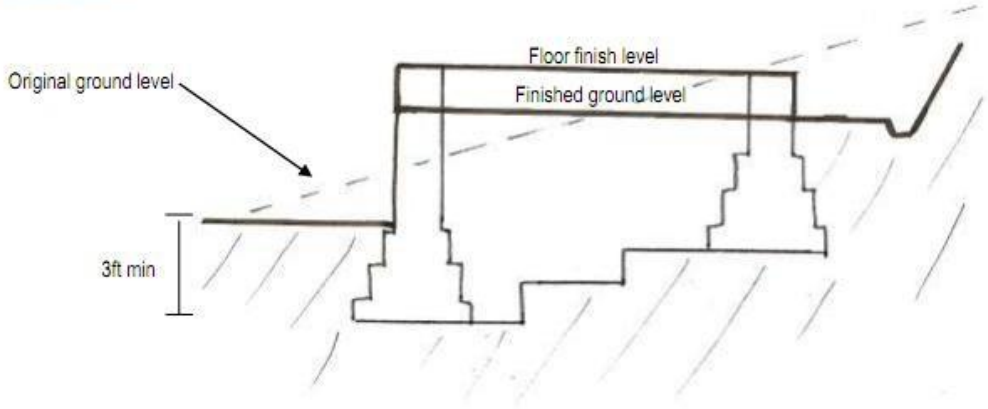
DON'T BUILD: Near rivers as water saturated soils can lose bearing capacity during ground shaking (this is termed liquefaction) and flooding can be a risk.



If building near a slope position house a minimum of 4ft from the slope and provide a retaining wall if necessary.



If building on a sloping site terrace and level the land prior to beginning house construction.



Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Absence of land use plans leading to siting of health facilities at land vulnerable to natural hazards and/ access routes being vulnerable	○ Siting of the houses at slopes/land sliding areas can render them vulnerable to damage in case of earthquake or heavy rains /floods ○ Siting in low laying areas /depressions can render them vulnerable to flooding and unusable following heavy rains / floods.	○ The Location should not be at the edge of a slope, near the foot of a mountain vulnerable to landslides, near creeks, rivers or bodies of water that could erode its foundation, on top of or in proximity to active fault lines (less than 10 meters away), near the river banks and areas prone to storm surges. ○ The houses should have appropriate provisions for addressing hazards related to location such as rainwater drainage and dikes ○ Adopt slop stabilization measures including bio engineering.
2.	Non-environment friendly designs and lack of	○ The designs may not suit the local environment and culture. ○ Too heavy timber-based designs can result in deforestation.	○ Develop designs suitable to local environment and customs. ○ Develop and enforce safe building codes for multiple

	Institutional arrangements for enforcement of building codes.	○ Unsafe building codes can endanger the habitants.	hazards like floods, earthquake and windstorms.
3.	Construction of single exits and doors opening inwards.	○ In case of single entry and exit it is likely to be choked during an emergency and result in casualties. ○ Similarly, the doors opening inwards are likely to be choked in an emergency specially following an earthquake.	○ Construct multiple emergency exits and create DRR awareness among the residents. ○ Ensure that doors open outwards.
4.	Additional engineering works for improving the safety of the houses.	○ A house needing retrofitting can be unsafe residents. ○ A habitation located in low lying area may be vulnerable to flooding unless an embankment is constructed around it. ○ A house located at slop will be vulnerable without the support of a retaining wall.	○ There should be no major structural cracks on structural members. ○ Minor or hairline cracks should be investigated by a qualified civil or structural engineer and determined to be localized and repairable. ○ Carry out proper retrofitting and ensure quality control through regular monitoring. ○ Construct an appropriate bund / embankment to make the habitation. ○ Construct an appropriate retaining wall to provide required protection to the house.
5.	Lack of awareness and capacity building of the community.	○ Lack of capacity / awareness about possible disasters and capacity to respond appropriately can result in a paralysis during a disaster situation. ○ The community may not be trained to resiliently during / following a natural disaster.	○ Educate the community about possible hazards and required risk reduction measures. ○ Build response capacity of the community through training workshops and short courses. ○ Involve the local government and NGOs in CBDRM.

Agriculture and Food Security

Sector Specific Infrastructural Measures

- Raised seeds beds, dams, wind breaks, fire breaks.
- Proofing of storage facilities and livestock shelters.
- Erosion control structures, routine clearing of drainage system and canals.
- Safe rescue places/platforms and strategic animal fodder reserves.
- Drought resilient strategic water points
- Earthquake proof fish ponds and irrigation facilities
- Flood safe seed and fodder stocking infrastructure.

Livestock

- Destocking
- Emergency water provision.
- Emergency feed provision.

- Veterinary services.
- Re-distribution of livestock.

Possible Shortfalls, their Impact and Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Non availability of seeds, fertilizers and pesticides	○ Poor crop cultivation and yield. ○ Exploitation of farmers by the traders. ○ Early recovery and restoration of livelihood badly affected.	○ Distribution of seeds, fertilizers and pesticides among the poor farmers especially with land holdings less than 5 acres. ○ Making enough seeds, fertilizers and pesticides available in the market by establishing agriculture input hubs. ○ Ensuring quality control in consultation with the local administration.
2.	Uncontrolled and incorrect distribution of seeds.	○ Local seed market may be adversely affected. ○ Distribution of new and untried seeds can be extremely harmful for the farmers. ○ If seeds cannot be provided in time for cultivation, it may ultimately do more harm than good.	○ A proper assessment be carried out prior to distributions of seeds to safeguard the interest of the seed traders. ○ Seed distribution should never be used to test a new variety of seed. Farmers should be familiar with the varieties provided, and families must accept the variety, including taste and performance. ○ Local varieties should be considered if available. ○ Timing is critical. The seeds must be provided at the right time for timely cultivation and obtaining optimum yield.
3.	Non availability of land for cultivation at due time	○ The farmers fail to cultivate the lands and leading to disruption of livelihood means.	○ Dewatering and clearing of cultivable lands at priority.
4.	Non availability of, tools and implements	○ Exploitation by those who are in possession of seeds, fertilizers and agriculture machinery	○ The farmers need to be provided support tools and implements. ○ Rehabilitation of tertiary channels, farmer- managed water courses (FMWCs) and tube- wells should be given priority in the affected areas.
5.	Exploitation due to non- availability of cash for livelihood / sowing of crops.	○ The famers are forced to sell their livestock and property at throw away prices	○ Provision of cash support / interest free loans for sowing of crops.
6	Incorrect crop selection and management	○ Low yield. ○ Wastage due to poor storage and marketing.	○ Appropriate crop selection (testing and introducing new varieties, drought/saline/flood

		○ More prone to pest attacks.	resistant crops, quick crowing crops) and animal breeding. ○ Improved cropping systems and cultivation methods (crop diversification, intercropping, adjustment of cropping calendars, soil conservation). ○ Post-harvest management (storage, food drying, food processing). ○ Pest control.
7	Loss of livestock due to non-availability of fodder, vaccination and medication	○ Loss of livestock adversely affects livelihood. ○ Return of normalcy affected both for the short term and the long term.	Preserve animal stock by supplying supplementary feed, vaccination and standard medication such as de-worming for cattle, sheep and goats.
8	Uncontrolled distribution of food.	○ The poorest of the poor do not get the required support. ○ Lead to hoarding by the undeserving and exploitation of the needy.	○ Well thought out distribution plan be prepared and implemented based of reliable data. ○ Community leaders be taken on board for just and timely distribution of food. ○ Minimum necessary sustainable food security for all should be the top priority.
9	Lack of coordination between the relevant sectors/stakeholders.	○ Lack communication and coordination between the various national and international stakeholders can result in duplication of efforts in some areas and leaving gaps elsewhere.	○ Improving the communication and coordination between the various stakeholders within the agriculture sector, as well as outside this sector. ○ Establishment of a well-defined and efficient coordination mechanism at union council level, district level, provincial level and national level.
10	Lack of CBDRM	○ Community which is first one to help itself may not be organized to react with resilience and prudence following a disaster. ○ Lot of avoidable losses suffered.	○ Organizing the community at village and UC level to react resolutely. ○ Educating the community on desired agricultural practice in the face of a disaster. ○ Create DRR agriculture and food security related awareness among the farmers

Non – Farm Livelihood

Possible Shortfalls, their Impact and Proposed Mitigation Measures

S#	Community Infrastructure	Potential Negative DRR Impact	Proposed Mitigation Measures
1.	Exploitation due to non availability of cash for livelihood	○ The affectees are forced to sell their means of livestock and property at throw away prices.	○ Provision of cash support / interest free loans for reviving the non-farm means of livelihood.
2.	Uncontrolled / unjust distribution of food.	○ The poorest of the poor do not get the required support. undeserving and exploitation of the needy.	○ Well thought out distribution plan be prepared and implemented based of reliable data. ○ Community leaders be taken on board for just and timely distribution of food. ○ Minimum necessary sustainable food security for all should be the top priority.
3.	Non availability of tools and implements for nonfarm livelihood.	○ Delay in restoration of livelihood and return to normal life by the community.	○ The needy should be provided support to procure the tools and implements. ○ Rehabilitation of means of nonfarm livelihood should be given due priority.
4.	Lack of coordination between the relevant sectors/stakeholders	○ Lack communication and coordination between the various national and international stakeholders can result in duplication of efforts in some areas and leaving gaps elsewhere.	○ Improving the communication and coordination between the various stakeholders. ○ Establishment of a well-defined and efficient coordination mechanism at union council level, district level, provincial level and national level.
5.	Lack of CBDRM	○ Community which is first one to help itself may not be organized to react with resilience and prudence following a disaster. ○ Lot of avoidable losses suffered.	○ Organizing the community at village and UC level to react resolutely. Educating the community on desired nonfarm livelihood practice in the face of a disaster. ○ Create DRR awareness among the community.

Further Readings & References

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