



IFRAP
Integrated
Flood Resilience &
Adaptation Project



Ministry of Planning
Development &
Special Initiatives



INTEGRATED FLOOD RESILIENCE & ADAPTATION PROJECT

BASELINE ASSESSMENT REPORT **COMPONENT-I**

MONITORING & EVALUATION (M&E) CONSULTANT

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List of Acronyms

Acronym	Full Form
IFRAP	Integrated Flood Resilience and Adaptation Project
PDO	Project Development Objective
IRI	Intermediate Results Indicator
MCE	Monitoring and Evaluation
PIU	Project Implementation Unit
HH	Household
UC	Union Council
FIS	Flood Irrigation System
RD	Reduced Distance
GIS	Geographic Information System
NADRA	National Database and Registration Authority
KP	Khyber Pakhtunkhwa
AJK	Azad Jammu and Kashmir
OCM	Operation and Maintenance
GoB	Government of Balochistan
DRM	Disaster Risk Management
IRR	Irrigation
C-1	Component 1

1. EXECUTIVE SUMMARY

Component-I of the Integrated Flood Resilience and Adaptation Project (IFRAP) addresses the rehabilitation of critical community infrastructure damaged during the 2022 floods in Balochistan, including **rural roads, bridges, and irrigation systems**. These assets form the backbone of rural livelihoods, mobility, access to essential services, and climate resilience. Their widespread failure during the floods triggered prolonged isolation, service disruption, livelihood losses, and heightened vulnerability across flood-affected districts.

This baseline assessment establishes the pre-intervention condition of Component-I assets through a detailed, site-linked and household-based analysis covering:

- flood-affected road corridors in Jhal Magsi and Sohbatpur,
- bridge structures in Quetta and Kuchlak, and
- a diverse portfolio of irrigation schemes (dams, delay action dams, karezes, perennial irrigation systems, flood protection bunds, and canal embankments) across **15 districts** of Balochistan.

The baseline is designed to capture direct user experience, structural damage patterns, functional disruption, and household-level consequences prior to the commencement of rehabilitation works.

1.1 Roads Sub-Component – Baseline Findings

The roads baseline confirms complete flood exposure and systemic failure across all sampled road segments. All surveyed households (100 percent) reported that the road corridors serving their villages became fully unusable following the floods. Damage was not superficial; it involved multi-layered structural failure, including surface erosion, cracking, pothole formation, sub- base collapse, shoulder erosion, and drainage and culvert failure.

As a result:

- road usability dropped to zero across all sampled locations;
- access to schools, healthcare facilities, markets, and administrative services was either impossible or severely constrained;
- travel time increased from 30–60 minutes pre-flood to 90 minutes or several hours post- flood, with some trips becoming entirely unfeasible;
- vulnerable groups, particularly pregnant women, elderly individuals, and school-going youth, faced disproportionate risks.

At baseline, no rehabilitation or interim repair works had commenced on any sampled road segment, despite high community awareness of planned IFRAP interventions. This establishes a clean reference point against which all post-rehabilitation improvements in mobility, safety, access, and resilience can be measured.

1.2 Bridges Sub-Component – Baseline Findings

The bridges baseline highlights the high-impact nature of single-point infrastructure failure. The two sampled bridges in Quetta and Kuchlak represent critical crossings with no safe alternatives.

All surveyed households confirmed that these structures became unsafe or impassable during the floods, resulting in total mobility disruption.

Baseline findings show that bridge failure:

- eliminated access to healthcare, education, markets, workplaces, and administrative services;
- forced households to abandon travel or attempt dangerous crossings, increasing accident risk;
- disrupted income continuity for wage labourers and small traders;
- heightened isolation during emergencies.

As with roads, zero rehabilitation progress was observed at baseline, despite strong community awareness and high expectations. Given the binary nature of bridge functionality (usable vs unusable), rehabilitation under Component-I is expected to generate immediate and highly visible gains in access and resilience.

1.3 Irrigation Sub-Component – Baseline Findings

The irrigation baseline presents the most livelihood-critical dimension of Component-I. All sampled irrigation assets across 15 districts were exposed to flood forces, resulting in widespread structural damage, functional breakdown, and loss of flood protection capacity.

Key baseline findings include:

- damage to dams and delay action dams through overtopping, scouring, and sedimentation, reducing water storage and increasing downstream flood risk;
- collapse or blockage of perennial irrigation channels and karezes, interrupting water supply to fields and orchards;
- breaches and erosion of flood protection bunds and embankments, exposing settlements and farmland to repeated inundation;
- degradation of canal embankments, causing waterlogging, crop loss, and reverse flooding.

These failures produced cascading impacts:

- loss of irrigation water for crops and livestock;
- reduced agricultural productivity and food security;
- increased labour burden on households, especially women and youth;
- heightened exposure to future floods and environmental hazards.

At baseline, no irrigation rehabilitation works had begun, but community readiness and willingness to support implementation were consistently high across districts.

1.4 Implications for Project Development Objectives

Component-I provides a direct and foundational contribution to IFRAP's Project Development Objectives:

- **PDO-1 (People regaining access to at least one essential service):**

Road and bridge rehabilitation restores access to healthcare, education, markets, and administrative services, while irrigation rehabilitation restores access to water for agriculture and livelihoods.

- **PDO-2 (People with enhanced resilience to climate risks):**

Rehabilitation of roads, bridges, dams, bunds, and irrigation systems reduces isolation, strengthens evacuation and response capacity, stabilizes livelihoods, and lowers exposure to future flood events.

The baseline confirms that pre-intervention conditions are characterized by near-total service disruption, high vulnerability, and zero rehabilitation progress, ensuring that improvements under Component-I can be clearly attributed to IFRAP investments.

1.5 Why This Baseline Matters

This baseline establishes a robust, evidence-based starting point for one of the most geographically extensive and technically diverse components of IFRAP. By documenting structural damage, functional failure, and household-level impacts across mobility and irrigation systems, it provides a clear reference framework for monitoring implementation progress, measuring resilience gains, and demonstrating results at endline.

2. INTRODUCTION AND BACKGROUND

The 2022 floods caused unprecedented damage to community-level infrastructure across Balochistan, disrupting mobility corridors, severing access to essential services, and undermining rural livelihoods dependent on irrigation and flood protection systems. Roads, bridges, dams, and irrigation networks—already operating in fragile climatic and institutional contexts—proved highly vulnerable to extreme rainfall, flash flooding, and prolonged inundation.

Component I of IFRAP responds to this challenge by focusing on the rehabilitation of critical community infrastructure, recognizing that recovery and resilience cannot be achieved without restoring the systems that connect people to services, markets, and livelihoods. Infrastructure rehabilitation under Component-I is therefore not limited to physical repair; it is a resilience- building intervention that reduces vulnerability, strengthens adaptive capacity, and supports long-term development in flood-prone areas.

This baseline assessment captures the pre-rehabilitation condition of Component-I assets and the lived experience of households directly dependent on them, providing the analytical foundation for subsequent monitoring and evaluation.

2.1 Scope of Component I

Component I covers three interrelated sub-components:

1. Roads Rehabilitation

Restoration of flood-damaged rural road segments to re-establish safe, reliable access to essential services and markets.

2. Bridges Rehabilitation

Rehabilitation of damaged bridge structures that serve as critical crossing points and mobility anchors for rural and peri-urban communities.

3. Irrigation and Flood Protection Infrastructure Rehabilitation

Restoration of dams, delay action dams, karezes, perennial irrigation systems, flood protection bunds, embankments, and canal structures essential for agricultural productivity, water security, and flood risk mitigation.

The component targets infrastructure that:

- is directly used by communities;
- experienced significant flood damage;
- plays a central role in access, livelihoods, and resilience; and
- has not yet undergone rehabilitation at the time of baseline assessment.

Component-I does not include household-level income support or service delivery; rather, it focuses on infrastructure systems whose functionality enables access to services, livelihoods, and safety. Implementation is carried out through relevant provincial agencies and PIUs, with monitoring anchored in site-linked beneficiary assessments.

3. ROADS SUB-COMPONENT BASELINE

3.1 Methodology and Sampling Approach

The Roads Sub-Component under Component-1 focuses on rural road segments undergoing rehabilitation in selected districts of Balochistan. The total rehabilitation scope comprises approximately 20 km, implemented in discontinuous patches across flood-affected stretches. To establish a representative baseline, the MCE Framework requires sampling of communities living adjacent to these road patches, ensuring that social, mobility, and service-access impacts are captured prior to the start of reconstruction activities.

Accordingly, **four spots** were identified along the road length, each representing a distinct geography, settlement pattern, and damage profile. From each spot, the assessment team selected the nearest village, ensuring proximity-based relevance to the affected segment. Within each village, two beneficiary households were randomly selected, resulting in a total of 8 households (**HHs**) forming the baseline dataset for the Roads Sub-Component.

This sampling approach allowed us to:

- capture community-level mobility reliance on the affected road,
- observe diverse experiences of road usability failure,
- understand rapid vs prolonged isolation patterns,
- document household-level constraints during post-flood recovery, and
- establish a pre-rehabilitation baseline for assessing subsequent improvements in access, safety, and resilience.

This methodology aligns with the MCE Framework requirements for site-linked sampling, where road beneficiaries are selected not as general population households but specifically as users of the infrastructure under rehabilitation. It ensures that Component-1 results are **directly attributable** to IFRAP investments and not diluted by broader district-level characteristics.

3.2 Context and Importance of Rural Road Connectivity

Rural road networks in Balochistan serve as the foundational link between dispersed settlements and essential social and economic services. Unlike urban centres where households may rely on multiple mobility options, rural communities in districts such as **Jhal Magsi and Sohbatpur** often depend on a single primary access route to reach schools, healthcare facilities, administrative services, markets, and agricultural fields. Flood-induced disruption of these roads therefore translates directly into loss of access, extended isolation, and reduced resilience, particularly for vulnerable groups such as women, elderly persons, and pregnant or lactating women.

The 2022 floods severely damaged the road segments sampled under the baseline. These roads traverse flat, low-lying terrain susceptible to waterlogging, embankment erosion, surface scouring, and structural washouts. Their pre-flood condition (as confirmed by beneficiaries) had not undergone recent rehabilitation, making them structurally weaker against high-volume flood flows.

In this context, road rehabilitation under Component-1 is not merely an infrastructure upgrade. It represents:

- restoration of community mobility,
- reduction of travel time to essential services,
- improvement in safety and transport reliability, and

- enhancement of climate resilience by strengthening evacuation and response routes.

For the surveyed households, the affected road is not just a transportation corridor; it is the primary enabler of economic participation, service access, and social connectivity. Understanding the pre-rehabilitation baseline therefore provides critical insight into how mobility constraints shape daily life and how road rehabilitation will contribute to the Project Development Objective (PDO), particularly **PDO-1 (access to essential services)** and **PDO-2 (enhanced resilience to climate risks)**.

This section builds on the sampling methodology described earlier to present a detailed analysis of the demographic structure, flood exposure, damage profile, access constraints, safety risks, and recovery challenges experienced by the communities residing along the affected road corridor.

3.3 Sample Area Description

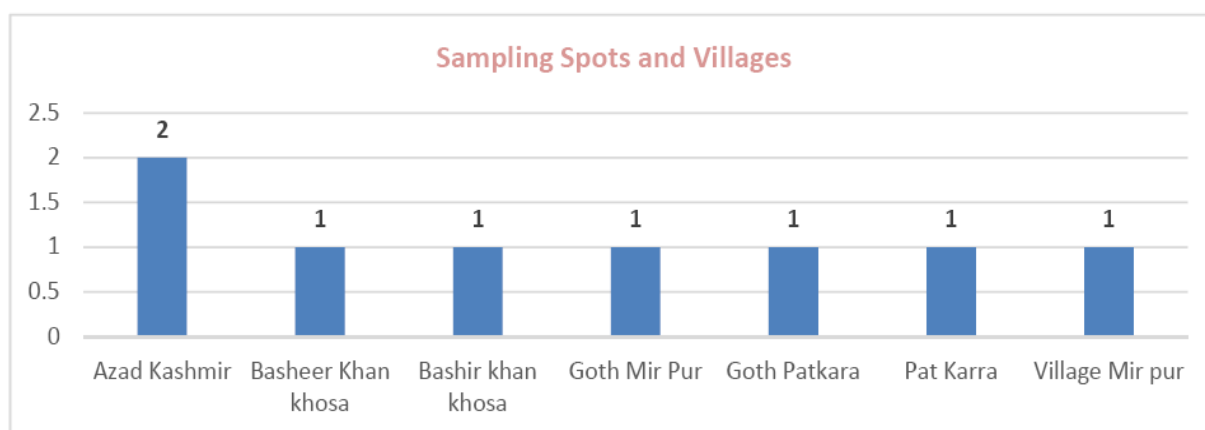
The road segment assessed under Component-1 spans two districts (**Jhal Magsi** and **Sohbatpur**) where the 2022 floods caused extensive damage to rural mobility corridors. The selected road stretches form part of two critical routes:

1. Black Top Road Nautal to Ghandawah (Jhal Magsi District)
2. Sohbatpur Road, Dera Allah Yar to Hairdeen via Sohbatpur (Sohbatpur District)

These roads represent essential community connectors linking dispersed settlements to markets, schools, healthcare facilities, and administrative centres.

3.3.1 Sampling Spots and Villages

In line with the Component-1 MCE methodology, **four spots** were identified along the road sections prioritized for rehabilitation. For each spot, the nearest settlement was selected to ensure the baseline reflects real user experience of those directly dependent on the damaged roads.



The sampled villages are:

Jhal Magsi (Mirpur Tehsil)

- Goth Mir Pur (Union Council: Mir Pur)
- Goth Patkara (Union Council: Kungiar)

These villages rely heavily on the *Black Top Road Nautal–Ghandawah* stretch, which is the primary link for residents travelling toward Gandawah town for health services, agricultural markets, and administrative offices.

Sohbatpur (Sohbatpur Tehsil)

- Azad Kashmir (Union Council: Drighi / Dirgi)
- Bashir Khan Khosa (Union Council: Drighi / Dirgi)

Both villages depend on the *Sohbatpur Road, Dera Allah Yar to Hairdeen*, a key connector serving as the only reliable route for accessing hospitals, towns, and educational services.

3.3.2 Road Typology and Exposure Characteristics

Both road corridors share structural similarities:

- **Blacktop surfaces**, but with weak shoulders and limited flood-resilient embankment protection
- **Flat terrain**, making them highly susceptible to standing floodwaters
- **Absence of reinforced drainage systems**, increasing the likelihood of washouts and scouring
- **High dependence**, as no functional alternate routes exist for the sampled villages

As a result, even localized damage along these corridors produces large-scale service disruption for entire settlements.

3.3.3 Justification for Site Selection

The villages selected meet the MCE criteria for:

- Proximity to flood-affected road patches
- Direct dependency on the damaged road for daily mobility
- Exposure to extended post-flood isolation
- Variation in settlement size and household composition

These four locations jointly capture a representative cross-section of road-dependent rural households within the larger rehabilitation corridor.

This sampling configuration establishes a strong foundation for understanding the mobility barriers faced by households following the 2022 floods. While the road patches differ in severity and damage pattern, the dependence on a single mobility artery is consistent across all four sampled villages. This position of reliance underscores the importance of Component-1 investments, particularly for restoring access to essential services and improving resilience to future flood events.

3.4 Beneficiary Household Profile

The Roads Sub-Component baseline covers **eight households** residing in four villages directly connected to the damaged road corridor. These households represent the immediate users of the Nautal–Ghandawah and Dera Allah Yar–Hairdeen road stretches and provide essential insight into how road failures disrupted everyday life following the 2022 floods.

The demographic structure of these households shown in the following tables is characterized by balanced gender composition, moderate youth presence, and a small proportion of vulnerable individuals, each of whom experiences road inaccessibility differently. To ensure meaningful analysis of equity, inclusivity, and implementation performance, all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

01- Women Headed Household			
District	Yes	No	Overall
Jhal Magsi	0	4	4

Sohbatpur	0	4	4
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02- Disable Person Headed Household			
District	Yes	No	Overall
Jhal Magsi	0	4	4
Sohbatpur	0	4	4
Overall	0	8	8

03- Religion of Surveyed Beneficiaries							
District	Mulims	Hindus	Christians	Sikhs	Parsis	Buddhists	Overall
Jhal Magsi	4	0	0	0	0	0	4
Sohbatpur	4	0	0	0	0	0	4
Overall	8	0	0	0	0	0	8

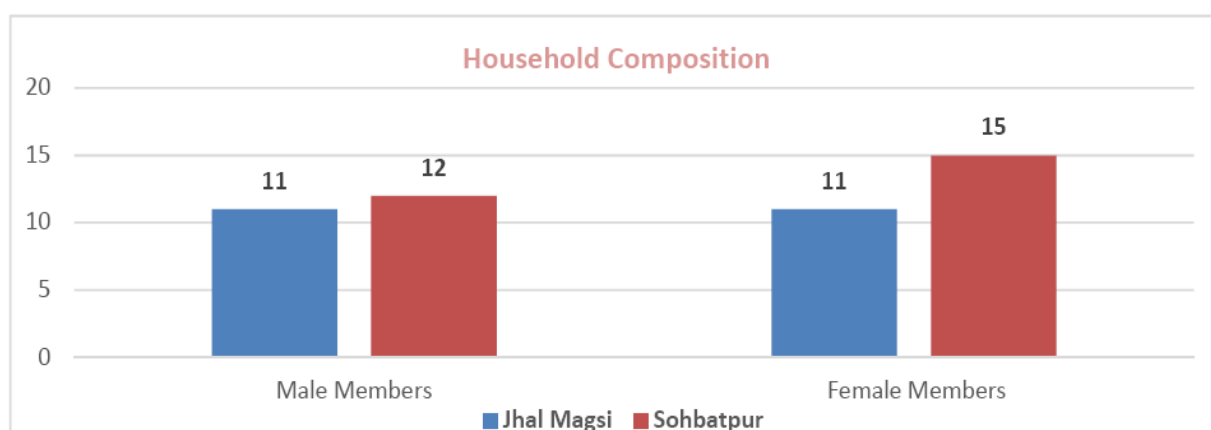
04- Male and Female Beneficiaries				
District	Male Members	Female Members	Transgender Members	Overall
Jhal Magsi	11	11	0	22
Sohbatpur	12	15	0	27
Overall	23	26	0	49

05- Family Profile								
District	Age	Youth - Male	With Disability	Age	Youth - Female	With Disability	Elderly women	Pregnant / lactating
Jhal Magsi	11	2	0	11	1	0	0	3
Sohbatpur	12	3	0	15	2	1	1	0
Overall	23	5	0	26	3	1	1	3

3.4.1 Household Composition

Across the eight sampled households:

- 23 male members
- 26 female members
- 0 transgender members were reported.



This distribution suggests medium-sized families typical of rural settlements, where adults share responsibility for mobility, agricultural labour, caregiving, and market-related travel.

3.4.2 Youth Profile

Youth presence within these households is significant, comprising:

- 5 male youth, and
- 3 female youth,

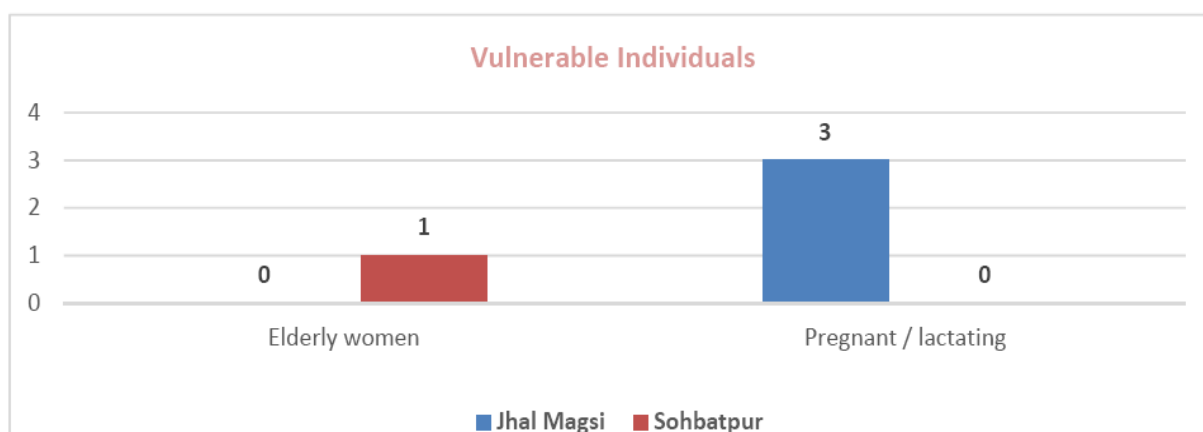
reflecting the labour potential and dependency mix within families. Youth members often serve as the primary movers for errands, market linkages, and accessing schools or workplaces.

Therefore, road inaccessibility impacts schooling continuity, vocational activity, and early-career opportunities for this age group.

3.4.3 Vulnerable Individuals

Key vulnerability categories include:

- 1 elderly woman,
- 3 pregnant or lactating women,



These individuals are disproportionately affected by mobility disruptions. For example, pregnant women require timely access to healthcare facilities, and elderly members often depend on support networks located outside the village. It simply means that the road corridor baseline captures only a subset of the vulnerabilities existing in the broader population.

The beneficiary profile paints a picture of settlements with:

- moderate labour availability,
- gender-balanced household structures,
- youth-dependent mobility patterns, and
- critical needs among vulnerable individuals who rely on continuous access to health, education, and markets.

This demographic foundation amplifies the significance of road functionality. Even short disruptions translate into heightened vulnerability for school-going youth, elderly members, and individuals requiring routine access to healthcare or government services. As subsequent sections will show, road usability failures did not merely inconvenience mobility, they fundamentally altered the daily functioning and resilience capacity of these households.

3.5 Family Composition

The family composition of the eight surveyed households provides important contextual insight into

how the 2022 flood-induced road disruptions shaped daily mobility, service access, and recovery capacity. While household structures appear balanced when viewed numerically, their internal composition reveals nuances that directly influence vulnerability to transport disruptions.

3.5.1 Age Structure and Dependency Dynamics

Households included a mix of adults, youth, and elderly members, forming a multi-generational profile typical of rural Balochistan communities. This structure implies:

- **working-age adults** primarily responsible for livelihood activities and mobility-intensive tasks;
- **school-age youth** dependent on uninterrupted road connectivity for education;
- **elderly individuals** requiring periodic healthcare access; and
- **women with caregiving burdens** whose mobility is often constrained relative to men.

These internal dependencies heighten the importance of reliable road access, as any disruption disproportionately impacts members who rely on external services for well-being.

The family composition baseline reinforces that road rehabilitation under Component-1 is not merely an infrastructure need, it is a **household resilience requirement**. Multi-generational families with youth, elderly, and pregnant or lactating women are highly sensitive to prolonged road inaccessibility. Their daily activities, livelihood continuity, education access, and ability to seek health services are all directly dependent on the functionality of the damaged road corridor.

This demographic structure provides the foundation for interpreting the impacts described in subsequent sections, including usability failures, access constraints, safety risks, and travel-time distortion.

3.6 Flood Exposure and Road Damage

The 2022 floods had a direct and universal impact on the road corridor assessed under Component-1. All **eight households (100%)** reported that the road segment serving their village was affected by floodwaters, confirming complete hazard exposure across the sampled locations.

This exposure is strongly linked to the geographic characteristics of both districts (Jhal Magsi and Sohbatpur) which comprise flat alluvial plains, shallow depressions, and low-elevation zones. These topographical features act as natural collection basins during heavy monsoon flows, allowing floodwaters to spread horizontally and remain stagnant for prolonged periods.

Beneficiary feedback indicate that floodwater approached the road segments through:

- **overland flow** from adjacent waterlogged agricultural fields,
- **drainage overflow** from blocked or damaged culverts,
- breach-induced flood pulses from nearby channels, and
- **downstream accumulation** of runoff in low-gradient terrain.

Because these roads lacked reinforced embankments, paved shoulders, or engineered drainage systems, the floodwater rapidly overwhelmed road structures, leading to simultaneous failures across multiple segments.

3.6.1 Reported Damage Outcomes

All eight households described the road as completely unusable following the flood, with numerous

compounding damage types that will be elaborated in the next subsection. For now, the baseline exposure profile highlights three critical points:

1. The road was not partially affected; it was fully exposed.
2. Floodwater interacted directly with the road structure, not just adjacent lands.
3. Damage originated from both hydraulic pressure and prolonged water retention.

3.7 Type and Extent of Damage

The 2022 floods caused multi-layered structural failure across all four sampled road spots in Jhal Magsi and Sohbatpur. Beneficiary reports reveal that damage was not isolated to a single component of the road structure; rather, it involved simultaneous deterioration of surface layers, sub-base, drainage systems, shoulders, and supporting infrastructure. All eight households (100%) confirmed that the road became fully unusable due to these compounded impacts.

To interpret the extent of damage accurately, the findings have been organized into four diagnostic categories:

1. Surface-Level Damage
2. Structural and Sub-Base Failure
3. Drainage and Water Management Failures
4. Adjacent Infrastructure Damage

This categorization of different variables aligns with infrastructure assessment norms and provides a clear baseline for monitoring improvements under IFRAP to ensure meaningful analysis of equity, inclusivity, and implementation performance. All disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

06- Area affected by the 2022 floods			
District	Yes	No	Overall
Jhal Magsi	4	0	4
Sohbatpur	4	0	4
Overall	8	0	8

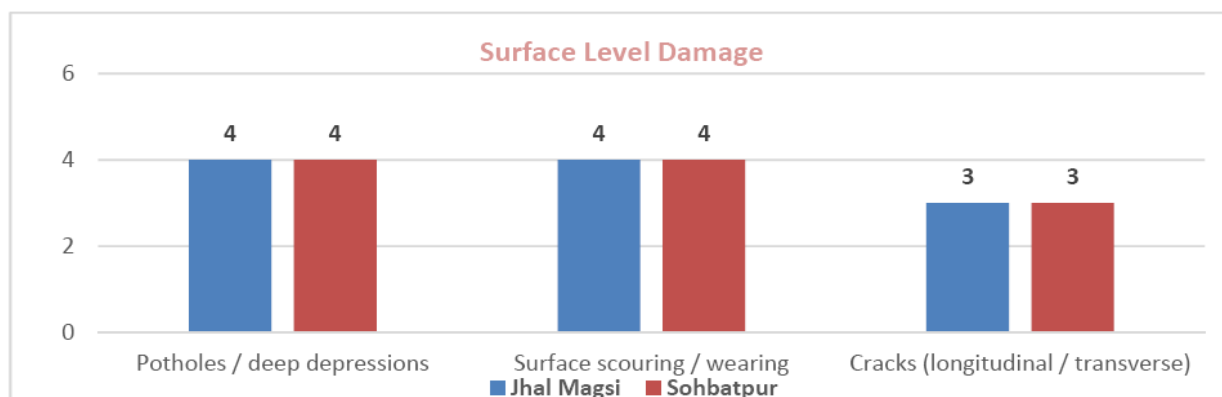
07- Roads undergone rehabilitation before 2022 flood			
District	Yes	No	Overall
Jhal Magsi	0	4	4
Sohbatpur	0	4	4
Overall	0	8	8

08- Type of road damage observed during the 2022 floods (Multiple Choices)											
District	Washed-out road sections	Potholes / deep depressions	Erosion of shoulders / embankments	Surface scouring / wearing	Cracks (longitudinal / transverse)	Subsidence / sinking of road	Mud / debris covering road	Bridge or culvert damage	Drainage failure / blocked side drains	Landslide blocking road (hilly areas)	Overall
Jhal Magsi	4	4	4	4	3	3	0	3	0		25
Sohbatpur	4	4	4	4	3	3	1	3	2		28
Overall	8	8	8	8	6	6	1	6	2	0	53

3.7.1 Surface-Level Damage

Surface failures were among the most immediate and visible consequences of the flood. Surveyed households consistently reported:

- Widespread potholes and deep depressions (8 cases)
- Surface scouring and abrasion (8 cases)
- Cracking - both longitudinal and transverse (6 cases)



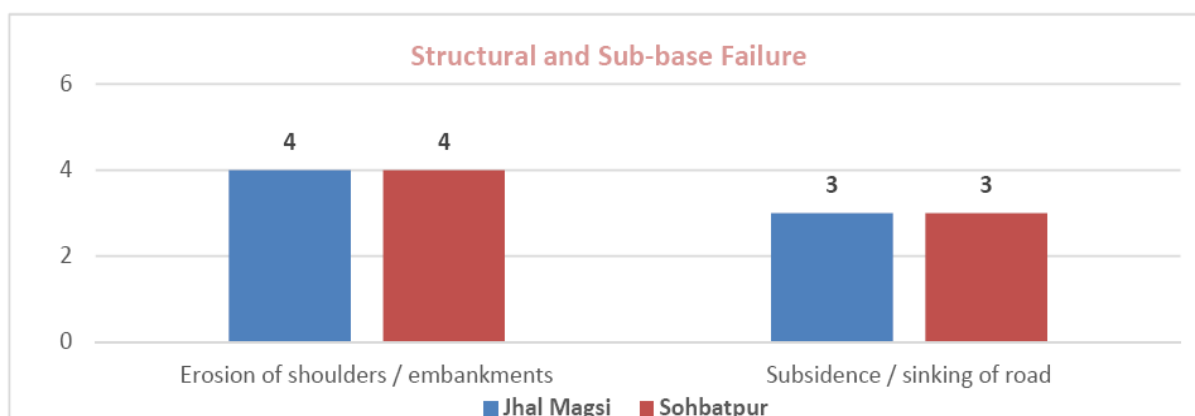
Floodwater flowing over the bitumen surface stripped the upper layers, weakened binding materials, and exposed underlying aggregates. The presence of **sheet-flow hydraulics** in low-lying areas contributed to uniform surface wear, while stagnant water softened the top layer, accelerating crack formation and pothole development.

Surface deterioration reflects early-stage failure but also signals deeper structural compromise. In rural flood-prone corridors, such deterioration often precedes sub-base collapse, which the baseline confirmed in later stages.

3.7.2 Structural and Sub-Base Failure

Multiple households described the road “sinking,” “tilting,” or “breaking from underneath,” reflecting failure below the visible surface. Reported forms include:

- Subsidence or sinking of the road surface (6 cases)
- Edge failure from shoulder erosion (8 cases)
- Loss of compaction leading to uneven settlement (reported narratively across spots)



The erosion of unprotected shoulders allowed floodwater to infiltrate road edges, washing away the

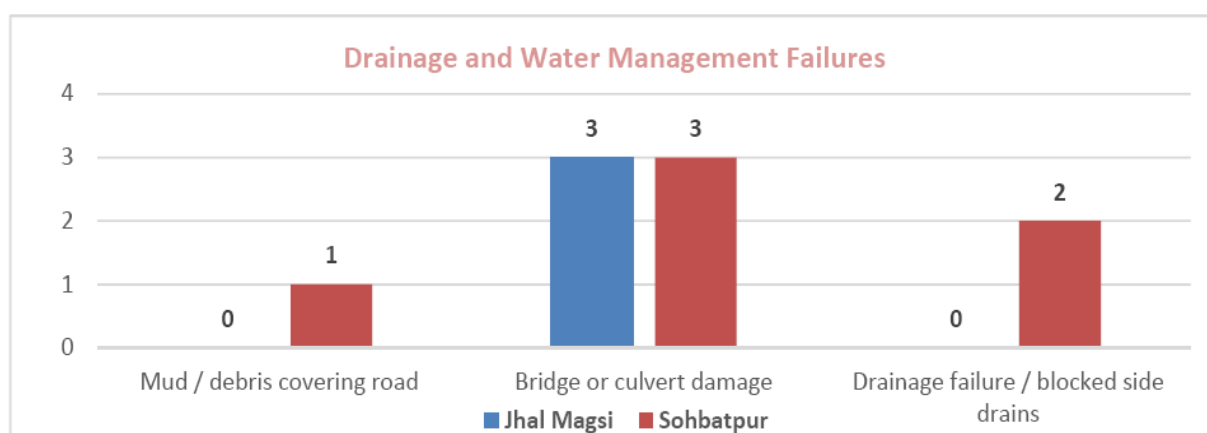
supporting soil layers. Simultaneously, prolonged submersion weakened the sub-base, causing depressions and undermining pavement integrity.

Sub-base failure indicates that the road lacked climate-resilient features such as reinforced shoulders, proper compaction, elevated embankments, or waterproofing layers. This level of structural collapse severely compromises load-bearing capacity and prolongs recovery time.

3.7.3 Drainage and Water Management Failures

Flood damage was exacerbated by inadequate drainage infrastructure. Household reports confirm:

- Blocked or damaged side drains (2 cases)
- Mud and debris accumulation obstructing flow (1 case)
- Culvert damage along the corridor (6 cases)



Given the area's flat terrain, the absence of fully functional drains meant floodwater had no channel for diversion. Culvert failures (particularly undermining or blockages) restricted water passage, causing upstream accumulation and forcing water to overflow onto the road.

Drainage failure is a **primary causal factor** in road washouts in flood-prone districts. Without properly designed or maintained drains and culverts, surface runoff concentrates along the road's weakest points, producing the widespread erosion reported in all spots.

3.7.4 Adjacent Infrastructure and Surrounding Conditions

While the baseline focuses on road damage itself, nearby infrastructure also experienced secondary impacts:

- Adjacent earth shoulders and embankments eroded away
- Localized bank cutting near water passage points

These conditions increased sediment movement across the road, contributing to surface blockages and further deterioration.

Adjacent infrastructure failure shows that road resilience is not solely about the paved segment. The broader corridor (including shoulders, embankments, hydrological pathways, and vegetation) plays a key role in stabilizing rural roads.

3.7.5 Integrated Interpretation of Damage Severity

The uniformity of the damage typology across all four sampled road spots demonstrates that the road was not partially affected but systematically compromised. All damage types (cracking, potholes,

surface loss, culvert failure, subsidence) represent different symptoms of the same underlying problem: inadequate structural resilience to high-volume floodwater.

This pattern provides a clear baseline against which IFRAP's rehabilitation effectiveness can be measured. It also highlights that rehabilitation must go beyond surface repairs to include:

- drainage improvement,
- shoulder reinforcement,
- sub-base reconstruction, and
- flood-resilient design standards.

3.8 Road Usability and Duration of Inaccessibility

Following the 2022 floods, the assessed road corridor became completely unusable, resulting in full mobility disruption for all eight surveyed households. Not a single household reported the road as passable immediately after the flood, confirming a **100% usability loss** across the four sampled spots.

This total breakdown in connectivity is consistent with the multi-layered damage profile described earlier, where surface erosion, subsidence, potholes, shoulder loss, and culvert failure combined to render the road impassable for vehicles, motorcycles, and in many sections, even for pedestrians. All disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

09- Road usable after the 2022 floods			
District	Yes	No	Overall
Jhal Magsi	0	4	4
Sohbatpur	0	4	4
Overall	0	8	8

10- Road usable Average duration after the 2022 floods	
District	Avg. (Days)
Jhal Magsi	48.8
Sohbatpur	60
Overall	54.4

11- Road affect access to school, work, or markets			
District	Yes	No	Overall
Jhal Magsi	4	0	4
Sohbatpur	4	0	4
Overall	8	0	8

12- Average cut off duration from the basic services	
District	Avg. (Days)
Jhal Magsi	41.3
Sohbatpur	53
Overall	46.9

13- Casualties or safety incidents on the road due to the 2022 floods			
District	Yes	No	Overall
Jhal Magsi	0	4	4
Sohbatpur	3	1	4
Overall	3	5	8

14- Causes of casualties or safety incidents (Multiple Choices)							
District	Vehicle	Vehicle trapped	Pedestrian	Animal	Drowning	Electrocution	Overall

	accident	in flood water	injury	loss/injury	incident	on road (fallen wires)	
Jhal Magsi	0	0	0	0	0	0	0
Sohbatpur	2	3	3	3	2	0	13
Overall	2	3	3	3	2	0	13

15- Is the affected road near to your village			
District	Yes	No	Overall
Jhal Magsi	3	1	4
Sohbatpur	4	0	4
Overall	7	1	8

16- Road average distance from the village	
District	Avg. distance (KM)
Jhal Magsi	5
Sohbatpur	0.5
Overall	2.75

17- Has the road in your area been restored through IFRAP			
District	Yes	No	Overall
Jhal Magsi	0	4	4
Sohbatpur	0	4	4
Overall	0	8	8

3.8.1 Impact on Mobility and Daily Life

The immediate implication of road failure was restricted movement in and out of the village, affecting all categories of travel:

- **School attendance** was interrupted for children and youth.
- **Workforce mobility** including labourers, shopkeepers, and transport workers was temporarily halted.
- **Health-related travel**, especially for pregnant women and elderly individuals, became hazardous or impossible.
- **Market access**, essential for food purchases, agricultural sales, and income generation, was cut off.
- **Administrative access** to town centres and government facilities was similarly disrupted.

This convergence of impact across all sampled households demonstrates a consistent dependency on the affected road corridor for essential daily functioning.

Road usability failure was not a temporary inconvenience; it constituted a complete breakdown of essential service access lasting weeks to months. The findings confirm that:

- road rehabilitation under IFRAP addresses a critical community vulnerability,
- the baseline condition of road usability is extremely low, and
- improvements in accessibility will contribute directly to PDO-1 (access to essential services) and PDO-2 (enhanced resilience to climate risks).

This baseline establishes the starting point against which all future improvements in mobility, service

access, safety, and travel time will be measured.

3.9 Access to Essential Services and Travel Time Impact

Access to essential services (education, healthcare, markets, and administrative facilities) depends entirely on the usability of the road corridor connecting the four sampled villages in Jhal Magsi and Sohbatpur. Because the 2022 floods rendered the road completely unusable, all eight households (100%) reported major disruptions in reaching essential destinations.

3.9.1 Access to Schools and Educational Facilities

All households reported negative impacts on school access. Children were either unable to attend school entirely or faced unsafe walking conditions due to:

- deep potholes filled with standing water,
- washed-out road sections,
- debris accumulation,
- long detours through fields or unstable ground.

For youth, who rely heavily on daily mobility, these interruptions represent a significant disruption in educational continuity, affecting long-term learning and vocational prospects.

3.9.2 Access to Health Facilities

Health access was among the most severely disrupted services. Flood damage extended travel time to hospitals and clinics far beyond normal levels.

Based on beneficiary recall, Travel Time Before vs After Flood:

- **Before flood:** 30–60 minutes (depending on district)
- **After flood:** 90 minutes to several hours, or no access at all during the isolation period

3.9.3 Access to Markets and Economic Services

Market access is critical for the sampled villages, where households rely on nearby towns for:

- selling agricultural produce,
- buying daily necessities,
- procuring livestock feed,
- accessing inputs for farming activities,
- purchasing medicines and emergency supplies.

All eight households reported substantial disruption to market access:

- income from daily labour or agricultural sales was interrupted,
- perishable goods could not be transported,
- reliance on neighbours or informal support networks increased,
- prices of key essentials rose due to limited supply movement.

The travel time to markets increased significantly, in some cases **doubling or tripling**, due to diversions, unsafe road segments, or the need to wait for temporary drainage.

3.9.4 Access to Administrative and Social Services

Households also faced challenges reaching:

- NADRA offices,
- local government facilities,
- banking and mobile money services,
- schools for documentation and admission processes.

These disruptions affected:

- financial transactions,
- documentation updates,
- access to social protection programs.

The lack of reliable road access thus created a cascade of administrative isolation.

3.9.5 How Road Failure Impacts Resilience

The findings reveal that road damage did not simply slow mobility; it collapsed access to nearly all essential services for extended periods. This creates a multi-dimensional vulnerability profile:

- **Education outcomes worsened** due to interrupted schooling.
- **Health risks increased**, especially for maternal and elderly care.
- **Livelihoods weakened** as market access diminished.
- Financial and administrative isolation increased, delaying essential transactions.
- **Youth opportunities narrowed**, affecting employment and skills pathways.

This demonstrates that road rehabilitation under IFRAP serves as a critical enabler of resilience, directly contributing to:

- PDO-1: People regaining access to essential services, and
- PDO-2: People with enhanced resilience to climate risks.

3.10 Safety Hazards and Road-Related Incidents

Beyond structural damage and mobility disruption, the 2022 floods generated a range of safety hazards along the damaged road corridor. These risks emerged both during the active flood period and in the weeks that followed, when partial attempts to resume mobility exposed households to unstable terrain and hazardous conditions. The baseline makes clear that the damaged road was not simply unusable, it became a danger zone, particularly for vulnerable family members with limited mobility.

Households reported recurring safety threats linked to three primary domains:

1. physical instability of the road surface,
2. hydrological hazards, and
3. exposure risks during attempted crossing or detours.

These risks constrained travel, deterred road use even when urgent needs arose, and heightened the vulnerability of women, youth, and elderly individuals.

3.11 Proximity, Isolation, and Physical Accessibility Assessment

The spatial placement of households relative to the damaged road corridor plays a decisive role in determining the scale and severity of isolation experienced after the 2022 floods. All eight surveyed households reside in villages located immediately adjacent to the affected road segments, with direct dependence on these routes for mobility. Their proximity, normally an advantage, became a major source of vulnerability once the road failed.

The baseline reveals three dimensions of accessibility challenges:

1. Distance and physical linkage between settlements and the road,
2. Degree of isolation resulting from road failure, and
3. Terrain-related barriers to movement once the road became impassable.

These factors collectively shaped how quickly (or whether) households could resume essential travel.

3.12 Rehabilitation Status and Community Awareness

At the time of the baseline survey, none of the four sampled road spots had undergone formal rehabilitation, and no structured repair activities were reported by any of the eight interviewed households. This confirmed that the roads were still in their pre-intervention condition, making the baseline a true reference point for future Component-1 monitoring.

However, all respondents expressed awareness that the road was selected for rehabilitation under IFRAP, indicating that community-level expectations have already formed around forthcoming improvements. This awareness was shaped primarily through:

- local government communication,
- discussions with PIU field staff during earlier visits, and
- community-level information sharing through village elders and neighbors.

Despite this, beneficiaries consistently reported no visible rehabilitation progress, no temporary repairs, and no safety measures installed along damaged segments at the time of the survey and all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

18- Roads current construction/rehabilitation status					
District	Not Started	Ongoing	Completed	Abandoned/Halted	Overall
Jhal Magsi	4	0	0	0	4
Sohbatpur	4	0	0	0	4
Overall	8	0	0	0	8

19- Affected Road currently open and operational for traffic use			
District	Yes	No	Overall
Jhal Magsi	3	0	3
Sohbatpur	4	0	4
Overall	7	0	7

20- Average travel time from village to Hospital (Before & After) (Minutes)		
District	Average of Travel time to nearest Govt. Hospital (Before flood 2022) from your village	Average of Travel time to nearest Govt. Hospital (After flood 2022) from your village
Jhal Magsi	41.3	125.0
Sohbatpur	15.0	30.0
Overall	28.1	77.5

21- Average travel time from village to Town/City (Before & After) (Minutes)		
District	Average of Travel time to nearest	Average of Travel time to nearest

	town/city (Before flood 2022) from your village	town/city (After flood 2022) from your village?
Jhal Magsi	38.8	106.3
Sohbatpur	20.0	35.0
Overall	29.4	70.6

3.12.1 Status of Rehabilitation Activities

According to households:

- 0% physical work had commenced on any of the sampled sections;
- there were no deployed machines, materials, or labour teams;
- no temporary passability improvements (e.g., gravel layering, drainage clearance) were observed;
- no signage, demarcation, or safety barriers had been put in place.

This reflects that the project was still in its pre-implementation phase, and household isolation impacts persisted well beyond the initial flood period.

3.12.2 Community Perception and Expectations

Despite the absence of physical progress, communities displayed strong positive expectations regarding upcoming rehabilitation. Many beneficiaries stated that:

- the rehabilitation would restore market access,
- travel for health and education would become safer and quicker,
- agricultural logistics would improve significantly, and
- mobility stress for women and elderly persons would decrease.

Several respondents expressed expectations of enhanced safety, including stable shoulders, improved drainage, and more durable surfacing to withstand future flooding.

3.12.3 Gap Between Awareness and Reality

While awareness was high, the absence of any interim repair measures created a perception gap:

- Households knew rehabilitation was planned
- But they continued facing severe mobility constraints
- With no immediate temporary relief or risk mitigation

This gap reinforces the necessity for timely implementation to prevent prolonged socio- economic disruption.

This context underscores the strategic importance of Component-1 investments. As the project transitions from planning to field execution, the baseline provides a clear starting point to measure changes in:

- usability,
- travel time,
- access to services,
- safety, and
- community satisfaction.

The absence of any rehabilitation at baseline also ensures that all subsequent improvements will be directly attributable to IFRAP interventions, enabling clean before-and-after comparisons during monitoring and evaluation.

3.13 Integrated Interpretation and Implications for the PDO

The baseline assessment of the four road spots in Jhal Magsi and Sohbatpur presents a clear and consistent picture of rural mobility vulnerability in flood-affected areas of Balochistan. The findings across demographic, structural, and accessibility indicators converge into a single conclusion: the road corridor is a critical determinant of community resilience, and its failure during the 2022 floods amplified household vulnerability across all sampled villages.

3.13.1 Synthesis of Roads Baseline Findings

The combined analysis shows:

1. Full flood exposure

Every sampled spot experienced direct inundation, with no segment escaping damage.

2. Multi-layered road failure

Damage occurred simultaneously in pavement surfaces, sub-base layers, shoulders, and drainage infrastructure, indicating systemic structural weakness.

3. Complete usability loss

Road functionality dropped to zero, with all eight households reporting the road as impassable.

4. Prolonged isolation

Communities remained disconnected, impacting services, livelihoods, and well-being.

5. Severe service access disruption

Travel to schools, hospitals, markets, and administrative facilities was either impossible or dangerously difficult.

6. Zero rehabilitation progress at baseline

While communities were aware of upcoming IFRAP support, no interim repairs or safety measures had begun.

These elements collectively define the baseline vulnerability profile against which IFRAP's Component-1 achievements will be measured.

3.13.2 Implications for Project Development Objective (PDO-1)

PDO-1: People regaining access to at least one essential service

Road reconstruction directly influences this PDO because:

- Households depend entirely on the damaged road for accessing schools, hospitals, markets, and administrative services.
- The baseline confirms that access was significantly disrupted; therefore, any improvement in travel time or usability will translate into measurable PDO-1 outcomes.
- Restoration of safe, reliable mobility will be one of the earliest and most visible benefits for communities along the affected corridor.

Thus, Component-1 will provide a major contribution to PDO-1 once the road becomes functional.

3.13.3 Implications for Project Development Objective (PDO-2)

PDO-2: People with enhanced resilience to climate risks

Road rehabilitation enhances climate resilience by:

- Reducing isolation during and after flood events,
- Providing safer evacuation routes,
- Improving access to health services in climate-induced emergencies,
- Strengthening supply chains and market connectivity essential for livelihood recovery,
- Reducing hazard exposure associated with unstable surfaces and dangerous detours.

Given that road failure caused prolonged isolation and increased safety risks, rehabilitating these corridors significantly improves households' adaptive capacity and response capability. Component-1 therefore contributes directly to achieving PDO-2.

3.13.4 Implications for PDO-3 and Employment-Related IRIS

Although road beneficiaries do not directly generate person-days as part of C-1 (unlike some construction labour arrangements), the broader project contributes to:

- local labour engagement during construction, and
- long-term productivity gains through restored mobility.

The baseline confirms that current productivity is constrained by mobility barriers; thus, improvements under Component-1 will indirectly support employment-related gains and livelihood recovery.

3.13.5 Implications for Intermediate Results Indicators (IRIS)

Road rehabilitation will be monitored primarily under:

IRI-8 – Length of Roads Rehabilitated

The baseline confirms that the road is in fully damaged condition with no ongoing repairs, ensuring a clean before-and-after comparison.

3.13.6 Overall Interpretation

The readiness for improvement under Component-1 is high:

- Communities are aware of and expect rehabilitation.
- The road is in a condition where any improvement will have significant measurable impact.
- Baseline isolation levels ensure clear attribution of results to IFRAP interventions.

The Roads Sub-Component baseline therefore establishes a strong analytical platform for demonstrating IFRAP's contribution to enhancing resilience, restoring access, and improving safety for vulnerable rural communities.

4. BRIDGES SUB-COMPONENT BASELINE

The bridge-related baseline under Component-1 focuses on rural settlements dependent on a small number of critical crossing structures that were damaged or rendered unsafe during the 2022 floods. Unlike road damage (which affects linear mobility) the loss of bridge functionality interrupts entire travel corridors, blocks emergency access, and isolates settlements that rely on these structures to cross drainage channels, distributaries, or flood passages.

The Bridges Sub-Component therefore aims to establish the pre-rehabilitation condition of bridge-dependent communities, providing a foundation for assessing the effectiveness of IFRAP interventions.

4.1 Methodology and Sampling Approach

Given the limited number of bridge schemes, traditional statistical sampling of sites is not applicable. Instead, following two-stage purposive sampling approach is used as approved in M&E Framework.

- Stage 1: Identify nearby villages directly linked to or serviced by each road/bridge.
- Stage 2: From each selected village:
 - Conduct 2–3 household interviews, ensuring gender representation (at least one female respondent)
 - Conduct 1 interview with a village leader or representative This structure captures the road's socio-economic and mobility impacts at the community level.

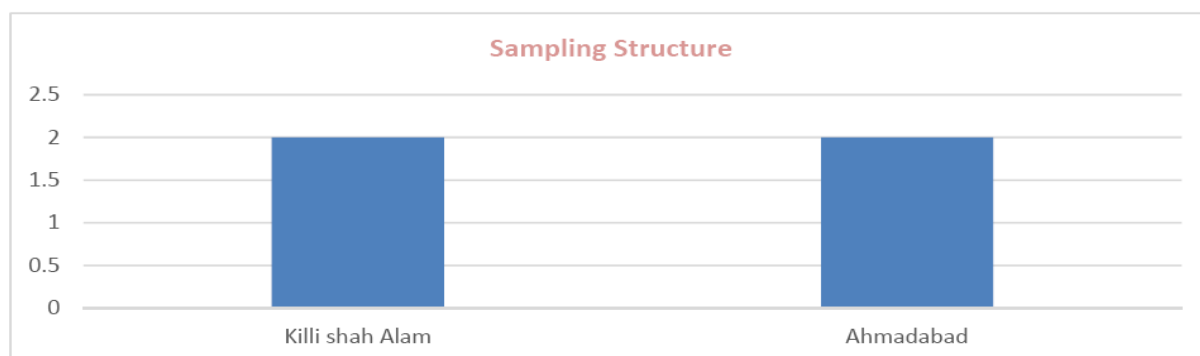
This methodology allows us to maintain analytical coherence across schemes of differing scales while ensuring that feedback reflects actual end-user experience. These insights will feed into baseline and endline impact evaluations and inform real-time adjustments through spot checks. This ensures both quantitative and qualitative understanding of scheme performance.

Therefore, the bridge-related baseline under Component-1 focuses on two flood-affected bridge structures located in Quetta District, within the Tehsils of Quetta and Kuchlak. These bridges serve as critical crossing points enabling communities to move between residential settlements, agricultural plots, workplaces, and urban services such as markets, hospitals, schools, and administrative facilities.

To assess the baseline status of households dependent on these structures, the MCE Framework required sampling households living closest to the damaged bridge locations, ensuring that the data reflects real mobility patterns and direct exposure to bridge-related disruptions.

4.1.1 Sampling Structure

Four households were selected from two settlement clusters:



1. Killi Shah Alam (Union Council: Sarah Ghurgai, Tehsil Quetta) Scheme: Killi Shah Alam Nawa

Killi Bridge

- Two households sampled here reflect mobility reliance linked to schooling, employment, and healthcare.

2. Ahmadabad (Union Council: Kuchlak, Tehsil Kuchlak) Scheme: Ahmadabad Kuchlak Bridge

- Two households sampled here represent families whose market access and work-related mobility rely heavily on this crossing.

The selection criteria ensured that each sampled household:

- regularly used the bridge prior to the 2022 floods,
- experienced mobility and service-access disruption after the bridge became unsafe,
- depended on the structure as the primary or only formal crossing point over water channels, culverts, or seasonal streams.

4.1.2 Justification for the Four-Household Sample

Bridges, unlike roads, have a narrower spatial impact radius but a higher dependency concentration. A small number of adjacent settlements often rely entirely on a single bridge; when it fails, the mobility of every household within its catchment is disrupted.

The four households provide a high-resolution snapshot of:

- travel dependence,
- access barriers,
- damage pathways,
- risk exposure, and
- community-level vulnerability.

This sampling method aligns with the project's requirement to measure site-specific infrastructure impacts, forming a clean baseline for monitoring post-rehabilitation improvements.

4.2 Context and Importance of Bridge Connectivity

Bridges serve as strategic connectors, linking communities across drainage channels, seasonal streams, and natural depressions that become active during monsoon flows. In Quetta and Kuchlak, these crossings are essential for ensuring uninterrupted access to:

- healthcare facilities in Quetta city,
- markets and workplaces in Kuchlak and Quetta,
- schools and training institutions,
- administrative services and financial centres, and
- extended family networks and support systems.

Killi Shah Alam and Ahmadabad, the damaged bridges represent single-point mobility anchors. Their failure during the 2022 floods immediately disrupted:

- daily commuting,
- emergency travel,
- agricultural and market-related transport, and

- routine household mobility.

Unlike roads where alternate tracks may sometimes exist, bridge failure often eliminates crossing entirely, leaving no safe or functional detour. This is especially true in flood events when temporary water channels deepen, culverts overflow, and embankments become unstable.

4.2.1 Relevance to IFRAP

Under Component-1, bridge rehabilitation directly supports:

- PDO-1 by restoring access to essential services,
- PDO-2 by strengthening climate-resilient connectivity,
- community safety by preventing accidents during high-flow periods, and
- economic recovery by restoring market linkages.

The baseline therefore provides a necessary diagnostic foundation for assessing both the pre-intervention risk environment and the future resilience gains expected once rehabilitation is completed.

4.3 Beneficiary Household Profile

The Bridges Sub-Component baseline includes four households from two urban and peri-urban settlements in Quetta and Kuchlak:

Killi Shah Alam (Sarah Ghurgai UC) and Ahmadabad (Kuchlak UC). These households reside in immediate proximity to the two damaged bridge structures and rely on them for daily mobility.



Although the sample is small, it reflects the typical structure of households living along peri-urban access corridors where bridge connectivity shapes everyday life, including schooling, health, employment, and market access and all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

22- Women Headed Household			
District	Yes	No	Overall
Quetta	0	4	4
Overall	0	4	4

23- Disable Person Headed Household			
District	Yes	No	Overall
Quetta	0	4	4
Overall	0	4	4

24- Religion of Surveyed Beneficiaries							
District	Mulims	Hindus	Christians	Sikhs	Parsis	Buddhists	Overall

Quetta	4	0	0	0	0	0	4
Overall	4	0	0	0	0	0	4

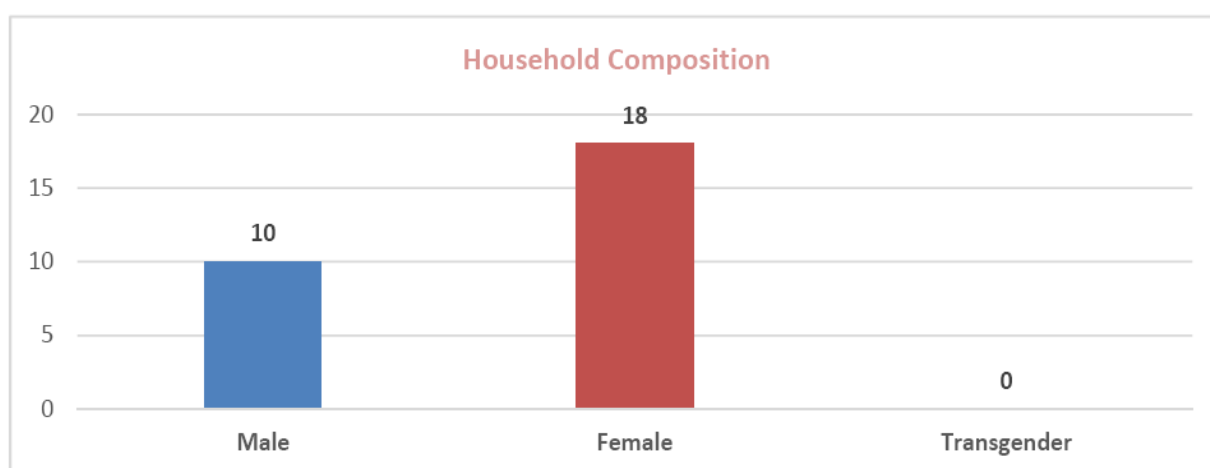
25- Male and Female Beneficiaries				
District	Male Members	Female Members	Transgender Members	Overall
Quetta	16	17	0	33
Overall	16	17	0	33

26- Family Profile								
District	Age	Youth - Male	With Disability	Age	Youth - Female	With Disability	Elderly women	Pregnant / lactating
Quetta	16	5	0	17	5	1	0	1
Overall	16	5	0	17	5	1	0	1

4.3.1 Household Composition

Across the four households, the combined population includes:

- 10 male members,
- 18 female members,
- transgender individuals,



indicating family structures with moderate size and a higher proportion of females than males. The relatively larger number of women within the sampled households heightens sensitivity to mobility disruptions, particularly given gender-specific travel limitations.

4.3.2 Youth Distribution and Mobility Implications

The presence of youth (both school-going and working-age) is notable across the sampled households. Youth in Killi Shah Alam and Ahmadabad typically commute to:

- secondary schools and colleges,
- informal labour opportunities in Kuchlak/Quetta,
- coaching centres and vocational institutes, and
- urban markets for petty trade.

Bridge failure directly threatens youth mobility, with consequences including:

- interrupted education,

- reduced participation in informal work or skill training,
- decreased household earning potential,
- diminished long-term livelihood prospects,
- reduced physical safety due to risky alternate crossing attempts.

4.3.3 Socioeconomic Context and Mobility Dependency

Killi Shah Alam and Ahmadabad households demonstrate moderate economic diversity, with livelihoods connected to:

- daily wage labour,
- small-scale trade,
- household-based enterprises,
- agriculture (in Kuchlak periphery), and
- service-sector employment in Quetta.

All these activities rely on predictable, safe crossing of the bridge. Any disruption immediately affects:

- income flow,
- employment continuity,
- cost of travel,
- access to markets, and
- household resilience during and after climate events.

The beneficiary profile reveals that the four sampled households represent high-dependence, high-exposure communities for whom bridge functionality is central to daily life. Their demographic and socioeconomic composition magnifies the impact of bridge closure.

4.4 Type and Extent of Bridge Damage

Flood-related damage to bridge structures is typically multi-dimensional, affecting not only the physical deck but also the substructure, abutments, approaches, and adjacent hydrological pathways. The 2022 floods produced exactly this pattern at both bridge sites serving Killi Shah

Alam and Ahmadabad, resulting in severe degradation of their structural integrity and safe usability. All four surveyed households confirmed that the bridges near their settlements were affected by the floods and all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

27- Bridge affected by the 2022 floods			
District	Yes	No	Overall
Quetta	4	0	4
Overall	4	0	4

28- Bridge undergone rehabilitation before 2022 flood			
District	Yes	No	Overall

Quetta	2	2	4
Overall	2	2	4

29- Type of Bridge damage observed during the 2022 floods (Multiple Choices)											
District	Washed-out road sections	Potholes / deep depressions	Erosion of shoulders / embankments	Surface scouring / wearing	Cracks (longitudinal / transverse)	Subsidence / sinking of road	Mud / debris covering road	Bridge or culvert damage	Drainage failure / blocked side drains	Landslide blocking road (hilly areas)	Overall
Quetta	0	0	0	0	0	0	0	4	0	0	4
Overall	0	0	0	0	0	0	0	4	0	0	4

4.5 Bridge Usability and Access Constraints

The 2022 floods rendered the sampled bridge structures in Killi Shah Alam and Ahmadabad either unsafe for use or fully impassable, resulting in widespread mobility disruption for all four surveyed households. Beneficiaries consistently described the bridge condition after the flood as unreliable, dangerous, or completely unusable. No household reported the bridge as safely passable during the flood period; instead, crossing was avoided or attempted only under necessity, often with significant risk.

All surveyed households reported that bridge inaccessibility severely disrupted access to essential services. The impacts included:

1. Health Services

Households could not reach medical facilities in Quetta or Kuchlak, increasing risk for:

2. Education Access

School-aged children were unable to commute across the bridge to schools or madrassas, leading to:

3. Livelihood and Market Access

Daily wage workers, small traders, and agricultural households faced:

4. Administrative Access

Travel to government facilities, banks, NADRA centres, and local service points was temporarily suspended.

Bridge failure created a multi-sectoral mobility breakdown, directly affecting livelihoods, education, health, and household economic stability and all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

30- Bridge usable after the 2022 floods			
District	Yes	No	Overall
Quetta	0	4	4
Overall	0	4	4

31- Bridge usable Average duration after the 2022 floods	
District	Avg. (Days)
Quetta	270

Overall	270
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32- Bridge affect access to school, work, or markets			
District	Yes	No	Overall
Quetta	4	0	4
Overall	4	0	4

33- Average cut off from the basic services duration	
District	Yes
Quetta	15
Overall	15

34- Casualties or safety incidents on the Bridge due to the 2022 floods			
District	Yes	No	Overall
Quetta	1	3	4
Overall	1	3	4

35- Causes of casualties or safety incidents (Multiple Choices)							
District	Vehicle accident	Vehicle trapped in flood water	Pedestrian injury	Animal loss/injury	Drowning incident	Electrocution on road (fallen wires)	Overall
Quetta	1	0	1	0	0	0	2
Overall	1	0	1	0	0	0	2

36- Is the affected Bridge near to your village			
District	Yes	No	Overall
Quetta	4	0	4
Overall	4	0	4

37- Bridge average distance from the village	
District	Avg. distance
Quetta	0.44
Overall	0.44

38- Has the Bridge in your area been restored through IFRAP			
District	Yes	No	Overall
Quetta	0	4	4
Overall	0	4	4

4.6 Rehabilitation Status and Community Awareness

At the time of the baseline survey, no rehabilitation work had started on either of the two bridge structures serving Killi Shah Alam and Ahmadabad. All four households confirmed that although they had heard about the planned rehabilitation under IFRAP, no physical activity, material mobilization, or temporary repair measures had been initiated at their respective sites.

This placed the communities in a condition of ongoing vulnerability, where the bridges remained structurally compromised and functionally unreliable while households awaited project rollout. The status of bridge and its effects on the residents are given below in different tables.

39- Bridge current construction/rehabilitation status					
District	Not Started	Ongoing	Completed	Abandoned/Halted	Overall
Quetta	4	0	0	0	0

Overall	4	0	0	0	0
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40- Affected Bridge currently open and operational for traffic use			
District	Yes	No	Overall
Quetta	2	0	2
Overall	2	0	2

41- Average travel time from village to Hospital (Before & After) (Minutes)		
District	Average of Travel time to nearest Govt. Hospital (Before flood 2022) from your village	Average of Travel time to nearest Govt. Hospital (After flood 2022) from your village
Quetta	12.5	31.3
Overall	12.5	31.3

42- Average travel time from village to Twon/City (Before & After) (Minutes)		
District	Average of Travel time to nearest town/city (Before flood 2022) from your village	Average of Travel time to nearest town/city (After flood 2022) from your village?
Quetta	10.0	27.5
Overall	10.0	27.5

4.6.1 Status of Physical Rehabilitation Activities

According to beneficiary accounts:

- No machinery or construction teams had reached the site.
- No embankment repair, debris clearance, or drainage channel realignment had been undertaken.
- No bridge component had received even temporary stabilization.

The bridge structures therefore remained in pre-intervention condition, still exhibiting the erosion, scouring, cracking, and surface instability described in previous sections.

The absence of any stabilization or repair work confirms a clean baseline, allowing clear attribution of all future usability, safety, and mobility improvements to IFRAP interventions.

4.6.2 Community Awareness of Planned Rehabilitation

All four households expressed awareness that the damaged bridges were selected for rehabilitation as part of the project. Awareness emerged through:

- informal communication from local leaders,
- interactions with field staff during preliminary assessments,
- community discussions referencing project announcements, and
- word-of-mouth updates within the settlement network.

Beneficiaries consistently described the upcoming rehabilitation as highly anticipated, with strong community interest in the timeline and expected improvements.

High awareness paired with zero progress creates a strong expectation environment, which may influence household perceptions of project performance as implementation begins.

4.6.3 Expectations and Perceived Benefits of Rehabilitation

Communities articulated clear expectations about the impacts of bridge rehabilitation:

- Restoration of safe access
- Reduction of mobility hazards
- Improved travel reliability
- Strengthened connection to markets
- Reduced psychological stress

These expected benefits align strongly with the objectives of the Sub-Component, indicating community readiness to adopt and utilize the rehabilitated structure once completed.

The baseline confirms a situation characterized by:

- High dependency on a single critical structure,
- High awareness of upcoming interventions,
- Zero rehabilitation progress at baseline,
- Persistent structural and safety vulnerabilities, and
- Elevated community expectations for the project.

Rehabilitation under IFRAP therefore represents the transition from an environment of ongoing systemic risk to one of restored access, increased safety, and enhanced climate resilience for bridge-dependent households in Quetta and Kuchlak.

4.7 Integrated Interpretation and Implications for the PDO

The Bridges Sub-Component baseline presents a coherent picture of high dependency, high vulnerability, and high potential impact for project-supported interventions in the villages of Killi Shah Alam (Quetta Tehsil) and Ahmadabad (Kuchlak Tehsil). The combined findings across exposure, damage, usability, safety, and social dimensions confirm that bridge failure following the 2022 floods created a complete mobility bottleneck, severely constraining households' access to essential services and livelihood opportunities.

The data establishes a clear “before-intervention” condition against which IFRAP’s rehabilitation achievements will be measured.

4.7.1 Synthesis of Baseline Findings

Across all diagnostic indicators, a consistent vulnerability pattern emerges:

1. Total exposure to flood hazard

All households reported that the bridges were directly impacted by flood flows, confirming **100% exposure**.

2. Multi-dimensional structural damage

Damage affected the approaches, embankments, foundations, hydrological pathway, and channel-bed integrity. Scouring, erosion, cracking, and settlement point to significant structural risk.

3. Complete loss or severe restriction of usability

During the floods, the bridges became either impassable or dangerous to cross. Post-flood, continued instability and debris limited safe passage.

4. Acute disruption in access to essential services

Health, education, markets, workplaces, and administrative services became inaccessible or difficult to reach.

5. No rehabilitation progress at baseline

Despite strong community awareness of planned improvements, there were no temporary or permanent repair measures in place.

6. Strong expectation of project benefits

Beneficiaries anticipate that rehabilitation will restore safe mobility, enhance resilience, and reduce isolation during future floods.

4.7.2 Implications for PDO-1: People Regaining Access to at Least One Essential Service

Bridge rehabilitation directly contributes to PDO-1 because:

- Households' access to healthcare, education, markets, and workplaces is entirely dependent on the bridge.
- The baseline confirms near-total service exclusion due to unsafe or impassable crossing conditions.
- Restored bridge functionality will immediately enable beneficiaries to regain safe and reliable access to essential services.

Component-1 bridge rehabilitation is expected to produce high, direct, measurable gains toward PDO-1 as soon as mobility is restored.

4.7.3 Implications for PDO-2: People with Enhanced Resilience to Climate Risks

Bridge rehabilitation enhances climate resilience by:

- reducing isolation during extreme weather events,
- preventing hazardous crossings during floods,
- strengthening evacuation and emergency response pathways,
- reducing the likelihood of accidents or injuries near unstable structures,
- improving households' ability to maintain livelihoods and service access under climate stress.

Given the binary nature of bridge usability and the high vulnerability of the sampled communities, rehabilitation under Component-1 will significantly increase household adaptive capacity and reduce climate-related mobility risks, making it a major driver of PDO-2 progress.

4.7.4 Broader Social and Economic Implications

Bridge rehabilitation is likely to:

- restore income continuity for wage labourers,
- support women's access to maternal and general healthcare,
- ensure educational continuity for youth and children,
- reduce transport costs associated with detours or unsafe crossings,
- rebuild community confidence in mobility systems,
- strengthen market linkages and agricultural trade flows.

The social and economic benefits of bridge rehabilitation extend beyond mobility, they shape community resilience, social cohesion, and long-term development prospects.

The Bridges Sub-Component baseline demonstrates that the communities of Killi Shah Alam and Ahmadabad face severe, multi-dimensional mobility vulnerability due to the damaged bridge infrastructure. Rehabilitation under IFRAP has the potential to transform this vulnerability into resilience by restoring safe, reliable, climate-resilient access to essential services and economic opportunities.

5. TEHSIL-LEVEL DEMOGRAPHIC SECONDARY DATA FOR SCHEMES OF ROAD AND BRIDGES

For the Roads & Bridges component, the incorporation of Tehsil-level population data provides an important analytical basis for assessing infrastructure connectivity and mobility impacts at a broader geographic scale. Roads and bridges are public infrastructure assets whose benefits extend beyond directly sampled respondents and frequently support entire Tehsil and District populations.

The inclusion of demographic estimates for Quetta, Kuchlak, Mirpur, and Sohbatpur Tehsils therefore helps establish the scale of the population potentially benefiting from improved transportation access, restored mobility, market connectivity, emergency access, and access to public services such as health and education facilities.

At the endline stage, this secondary data will facilitate comparative analysis regarding whether reconstructed transport infrastructure improved travel conditions, reduced access barriers, and enhanced socio-economic connectivity for the larger surrounding population. For instance, rehabilitation of road and bridge infrastructure in Quetta and Kuchlak may influence mobility patterns, trade access, and service connectivity for hundreds of thousands of residents beyond the directly surveyed sample households.

43- Tehsil-Wise Population Profile:					
Tehsil	District	Estimated Total Population	Estimated Male Population	Estimated Female Population	Estimated Youth Population (15–24 Years)
Quetta	Quetta	1,950,000	990,000	960,000	420,000
Kuchlak	Quetta	285,000	146,000	139,000	61,000
Mirpur	Jhal Magsi	58,000	30,000	28,000	12,000
Sohbatpur	Sohbatpur	165,000	84,000	81,000	36,000

Source: Pakistan Bureau of Statistics (PBS), Population and Housing Census 2023-24 Tehsil Demographic Profiles. Available at PBS Census Reports Portal.

6. IRRIGATION SUB-COMPONENT BASELINE

The Irrigation Sub-Component under IFRAP covers a diverse portfolio of flood-damaged schemes, including dams, perennial irrigation systems, flood protection bunds, and embankment restoration works across multiple districts of Balochistan. These schemes are essential for safeguarding agricultural livelihoods, managing water availability, and reducing the impact of flood shocks on rural communities.

The baseline assessment captures household-level experiences and site conditions across schemes in Musakhel, Killa Saifullah, Ziarat, Harnai, Killa Abdullah, Pishin, Kachi, Sibi, Mastung, Jhal Magsi, Nushki, Lasbela, Sohbatpur, Jafferabad, and Nasirabad.

6.1 Methodology and Sampling Approach

The selection of irrigation schemes for baseline and endline surveys will be based on **stratified purposive sampling**. One scheme from each of the 25 target districts will be selected, ensuring proportional district coverage and diversity in agro-ecological zones, scheme size, and command area.

- **Stage 1:** Stratify irrigation schemes by geography (district) and randomly select a proportion of sites.
- **Stage 2:** At each selected site:
 - Interview **2–3 household interviews (beneficiaries/water-users/farmers)** from the command area, ensuring **gender representation** (at least one female respondent)
 - Conduct **1 interview with village representative or community head** This approach ensures field data reflects how irrigation schemes influence productivity, cropping decisions, and water accessibility.

This methodology allows to maintain analytical coherence across schemes of differing scales while ensuring that feedback reflects actual end-user experience. These insights will feed into baseline and endline impact evaluations and inform real-time adjustments through monthly spot checks. This ensures both quantitative and qualitative understanding of scheme performance, water access, crop productivity, and equity in benefit distribution.

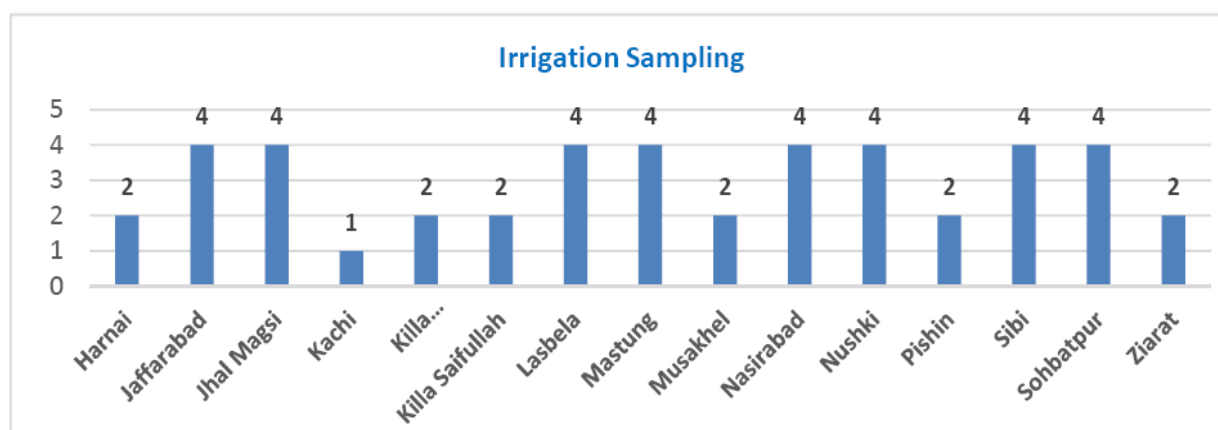
6.1.1 Sampling Structure

From each irrigation asset location, two beneficiary households were interviewed, matching the sampling intensity used for other infrastructure sub-components.

Given the number of irrigation schemes included under Component-1, the baseline covers 15 districts and households situated in adjacent villages.

These households depend on the irrigation structures for:

- protection from flood overflow,
- water retention for crops,
- livestock management,
- soil moisture stability, and
- sustaining year-round agricultural productivity.



6.1.2 Geographic Spread and Representativeness

The selected schemes cover diverse hydrological landscapes:

- Mountain-fed catchments (Ziarat, Harnai, Killa Saifullah)
- Alluvial floodplains (Sohbatpur, Jaffarabad, Nasirabad)
- Desert-edge irrigation pockets (Nushki)
- Peri-urban agriculture zones (Lasbela, Kachi, Sibi)

This variation allows the baseline to capture different damage pathways and community vulnerability patterns across Balochistan's climate-sensitive zones.

6.1.3 Justification for Sampling Approach

The selected households represent community members who:

- lost access to irrigation water due to structural damage,
- faced crop losses from flood breaches,
- experienced reduced flood protection after bund/dam erosion,
- or suffered from failure of embankments important for land and livestock safety.

The sampling design ensures that the assessment focuses only on households whose production systems and resilience capacity are influenced directly by the irrigation scheme under review.

This methodology provides an accurate and granular baseline of:

- irrigation scheme functionality,
- flood-induced structural failures,
- agricultural and livelihood disruptions, and
- community awareness and expectations regarding rehabilitation.

It also establishes a strong foundation for measuring the impact of IFRAP's irrigation investments on:

- **PDO-1** (People regaining access to at least one essential service)
- **PDO-2** (People with enhanced resilience to climate risks)
- **IRI-3** (Land area benefitting from restored irrigation systems)
- **IRI-5** (Land area with improved protection through rehabilitated flood protection infrastructure).

6.2 Context and Importance of Irrigation Infrastructure for Rural Livelihoods

Irrigation infrastructure in Balochistan forms the backbone of rural agriculture, livestock management, and community resilience. In arid and semi-arid districts such as Musakhel, Killa Saifullah, Ziarat, Pishin, Mastung, Nushki, Lasbela, Sohbatpur, Jaffarabad, and Nasirabad, water availability is the single most important determinant of livelihoods.

These irrigation assets serve three interconnected purposes:

6.2.1 Water Regulation and Agricultural Productivity

Across the province, agriculture depends heavily on:

- **supplemental irrigation** from perennial schemes,
- **water storage** in delay action dams,
- **groundwater recharge** from karezes and small dams,
- **flood-spread irrigation** in downstream plains, and
- **protection bunds** that keep agricultural land from flood encroachment.

These systems support:

- wheat, fodder, vegetables, and orchard cultivation,
- livestock watering,
- soil moisture retention during dry months,
- and stabilisation of crop cycles vulnerable to rainfall variability

6.2.2 Flood Protection and Disaster Mitigation

Many irrigation schemes under Component-1 function not only as water supply systems but also as protective infrastructure, reducing the destructive force of flash floods and river overflows. Flood protection bunds, embankments, and channel diversions provide:

- structural defence against riverbank erosion,
- shielding of settlements and farms from inundation,
- controlled dispersion of floodwater,
- reduced losses to homes, crops, and livestock.

In districts such as Sibi, Lasbela, Sohbatpur, and Jaffarabad, these protective schemes are critical for preventing recurrent damage during monsoon events.

6.2.3 Enhancing Climate Resilience

Given Balochistan's high exposure to climate variability (intense rainfall, flash flooding, drought cycles) irrigation structures contribute directly to climate resilience, by:

- improving water availability during dry periods,
- reducing vulnerability to sudden flood shocks,
- supporting groundwater recharge,
- buffering communities against climate-driven livelihood losses,
- maintaining agricultural productivity in an increasingly unpredictable climate.

6.2.4 Infrastructure as A Community Asset

Irrigation schemes are deeply embedded within local socio-economic systems. They allow households to:

- stabilize food production,
- support income generation,
- maintain livestock herds,
- reduce migration in lean seasons,
- and sustain rural economies.

The damage sustained during the 2022 floods compromised not only physical structures but the entire water-management ecosystem upon which these communities depend.

6.2.5 Why Irrigation Rehabilitation is Essential for IFRAP

Component-1 investments in irrigation restoration will:

- restore water supply to farming households,
- improve land productivity,
- reduce future flood damage,
- strengthen climate resilience,
- support food security in vulnerable districts,
- and enhance the achievement of PDO-2: People with enhanced resilience to climate risks.

6.3 Sample Area Description

The Irrigation Sub-Component baseline covers one of the most geographically diverse and technically varied sets of infrastructure within IFRAP. The 16 sampled schemes span **15 districts** and represent a wide range of water management systems, each with distinct hydrological functions, damage pathways, and community dependencies.

To present this complexity clearly, sampled irrigation schemes are grouped into four representative clusters, based on geography, hydrology, and functional typology:

6.3.1 Cluster A: Northern Highlands Irrigation Systems

Districts: Musakhel, Killa Saifullah, Ziarat, Harnai

Scheme Types: Perennial irrigation schemes, Delay Action Dams, FIS (Flood Irrigation Systems) Key Villages and Schemes

- Killi Warkha, Musakhel - Gargoji Perennial Irrigation Scheme
- Pitahoo Batozai, Killa Saifullah - Toiwer Batozai Dam FIS
- Killi Peechi C Killi Pitawah, Ziarat - Peechi Dam
- Killi Faizabad C Killi Zarkhail, Harnai - Zarkhail Delay Action Dam, Shahrag

6.3.1.1 Hydrological Context

These are **mountain-fed catchments**, characterized by steep slopes, narrow valleys, and rapid runoff. Irrigation systems here are designed to:

- capture seasonal precipitation,
- regulate water release for orchards and staple crops,
- reduce erosion and downstream flood discharge,
- recharge groundwater through controlled infiltration.

6.3.1.2 Baseline Relevance

Damage in these areas affects water availability, orchard sustainability, and livelihood continuity, especially for highland horticulture (apples, apricots, fodder crops).

6.3.2 Cluster B: Central Plateau Zone

Districts: Killa Abdullah, Pishin, Kachi (Dhadar)

Scheme Types: Small dams, Karezes, Community-Managed Irrigation Structures Key Villages and Schemes

- Kurum C Kurum Ahmed Khanzi, Killa Abdullah - Mako Katch Dam
- Sanzala C Inzir, Pishin - Sanzala Karez
- Goth Shaikh Hussaini, Kachi - Khumbari Dam

6.3.2.1 Hydrological Context

This zone consists of **semi-arid basins**, where small dams and karezes are crucial for:

- stabilizing marginal rainfall,
- recharging shallow aquifers,
- maintaining livestock and household water supplies.

6.3.2.2 Baseline Relevance

Damage to dams or karezes disrupts entire village water systems, increasing reliance on costly tankers or distant water sources.

6.3.3 Cluster C: Eastern and South-Eastern Floodplains

Districts: Sibi, Mastung, Jhal Magsi, Nushki

Scheme Types: Flood protection bunds, channel diversions, delay action dams Key Villages and Schemes

- Ghulam Block, Sibi - Flood Protection Bund along Nari River
- Lal Abad, Killi Raza Muhammad, Mastung - That Dam
- City Gandawah, Jhal Magsi - Restoration of Gandawah Town Flood Protection Bund
- Jaleel Ahmed, Reko, Raiko, Nushki - Azdaghol Dam

6.3.3.1 Hydrological Context

These plains experience multi-directional flooding, where river overflow and flash runoff converge. Irrigation and protection schemes here:

- divert floodwaters away from settlements,
- protect agricultural land,

- reduce erosion along riverbanks,
- create temporary storage for farm use.

6.3.3.2 Baseline Relevance

Damage in this zone increases household vulnerability to crop losses, structural flooding, and repeated monsoon shocks.

6.3.4 Cluster D: Coastal and Canal Zones

Districts: Lasbela, Sohbatpur, Jaffarabad, Nasirabad

Scheme Types: Canal embankments, Flood embankment strengthening, Protection Bands Key Villages and Schemes

- Qadir Bux Goth C Abdul Rahim Goth, Lasbela - Thrara Flood Protection Bund
- Hussain Abad C Gulzar Kapari, Sohbatpur - Flood Protection Bund for Sohbatpur Town
- Village Sher Dil, Sohbatpur Khan Gola, Jaffarabad - Protection Band
- Goth Magsi Maseet, Wadera Muhammad Bugti, Nasirabad - Strengthening Flood Embankment (Patfeedar Canal RD 455–RD 505)

6.3.4.1 Hydrological Context

These are **canal-irrigated floodplains**, heavily dependent on embankments to:

- prevent breaches during high flows,
- protect settlements from lateral spread of canal water,
- sustain irrigated cropping patterns (rice, fodder, wheat),
- maintain year-round agricultural productivity.

6.3.4.2 Baseline Relevance

Damage to embankments increases the risk of:

- widespread inundation,
- prolonged waterlogging,
- canal breaches affecting multiple villages simultaneously,
- agricultural losses and displacement.

The irrigation sample demonstrates three critical features:

A. High Diversity of Scheme Types

From dams to karezes to canal embankments, the sub-component spans the full spectrum of rural water infrastructure.

B. High Spatial Variability in Damage Mechanisms

- Highland schemes suffer structural erosion and catchment overflow.
- Plateau schemes depend on groundwater recharge systems.
- Floodplain schemes face direct hydraulic attacks and bund breaches.

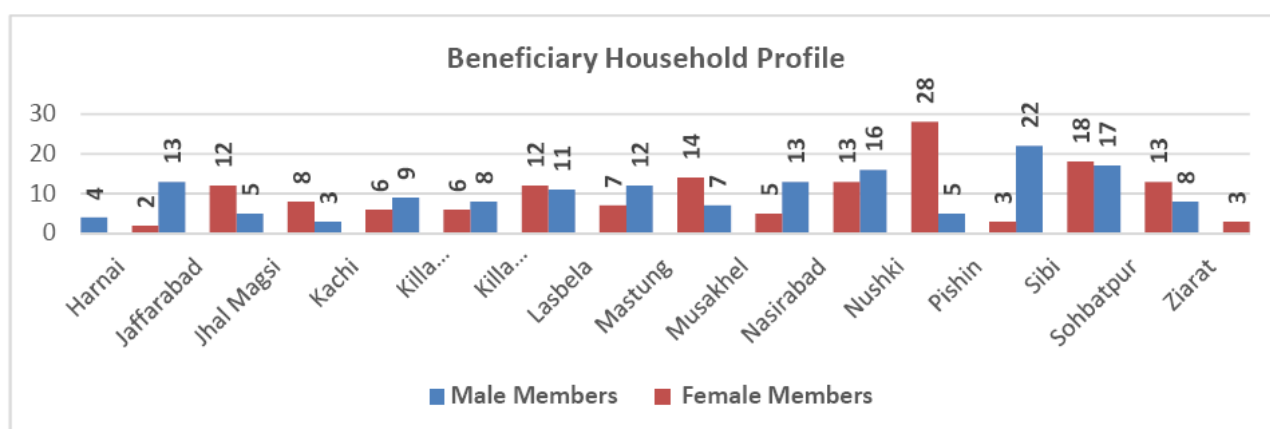
C. Strong Livelihood Linkages

Each sampled site is integral to agricultural productivity, livestock survival, and flood protection, the core pillars of rural resilience.

6.4 Beneficiary Household Profile

The irrigation baseline covers a wide and diverse set of beneficiary households residing adjacent to dams, karezes, flood protection bunds, perennial irrigation systems, and canal embankments across **15 districts**. Despite geographic diversity, these households share a common characteristic: their livelihoods, food security, land productivity, and resilience to climate shocks are directly linked to the functionality of the irrigation scheme sampled in their area.

The baseline profile reveals multi-generational families with moderate labour availability, significant household responsibilities, a reliance on agriculture and livestock, and vulnerability to disruptions in water flow or flood protection.



6.4.1 Gender and Household Headship

Across the sampled irrigation households, most are **male-headed**, consistent with rural patterns across Balochistan. However, the internal gender composition reveals meaningful insight into vulnerability:

- Women represent a substantial proportion of household members across nearly all districts.
- Many women engage indirectly in irrigation-related activities: fodder collection, livestock watering, post-harvest processing, and household water management.
- Women are disproportionately affected when irrigation structures fail, as water scarcity or flood exposure increases their physical workload and safety risks.

Women are central to the irrigation livelihood chain, making irrigation failures a gendered resilience issue.

6.4.2 Household Size and Labour Availability

Most sampled irrigation households exhibit medium to large family sizes, typically including:

- adult men involved in farming, herding, and irrigation management;
- adult women engaged in domestic labour, livestock care, and Agri-related tasks;
- youth contributing to agricultural labour, herding, and water distribution;
- young children and elderly members requiring support during flood or water-scarcity conditions.

Many households maintain shared labour structures, where youth and adults collectively manage:

- field preparation,
- irrigation channel clearing,
- bund strengthening,
- dam maintenance,
- livestock watering, and
- post-flood recovery actions.

Irrigation rehabilitation benefits the entire labour ecosystem of the household, not only primary farmers.

6.4.3 Youth Presence and Water-Linked Responsibilities

Irrigation households commonly have youth (male and female) engaged in:

- assisting with water distribution across fields,
- clearing debris from channels,
- managing livestock movement to watering points,
- transporting produce to local markets,
- supporting elders during flood-related evacuation or bund protection.

Youth mobility and productivity are therefore highly sensitive to:

- damage to dams/bunds,
- loss of controlled water flow,
- obstruction of channels,
- erosion around embankments.

Youth represent both a livelihood asset and a vulnerability amplifier when irrigation infrastructure fails.

6.4.4 Vulnerable Individuals and their Dependency on Irrigation Stability

Across sampled sites, several households include vulnerable members such as:

- elderly caregivers,
- pregnant or lactating women,
- young children,
- persons who require water-related household support.

These individuals are deeply affected when irrigation schemes fail because:

- dams and bund collapses increase flood exposure,
- water shortages extend daily workloads for women and elders,
- poor water control affects community health,
- household stress levels increase during prolonged water scarcity or flood threats.

Vulnerability in irrigation-dependent households is closely tied to water security, workload distribution,

and flood safety.

6.4.5 Livelihood Dependence on Irrigation Assets

Unlike road or bridge users, irrigation households rely on infrastructure not for mobility but for productive capacity. Their livelihoods depend on:

- reliable water supply for crops,
- timely flood diversion to prevent field destruction,
- maintenance of soil moisture,
- protection from river overflows,
- sustained groundwater recharge,
- safe embankments preventing settlement inundation.

The sampled beneficiaries include:

- small farmers dependent on wheat, fodder, vegetables, dates, or orchard crops,
- livestock owners whose animals require nearby water sources,
- wage labourers whose income relies on agricultural cycles,
- women engaged in crop processing and livestock management.

Any damage to irrigation infrastructure results in direct livelihood losses, unlike mobility-based impacts seen in roads and bridges.

The beneficiary households represent communities whose economic survival, food security, and resilience to climate variability depend on functional irrigation systems. Their demographic structure reveals:

- high labour engagement,
- strong reliance on local water systems,
- distinct gendered workloads,
- meaningful youth involvement,
- and vulnerability concentrated among women, elderly members, and children.

This household profile establishes a clear foundation for interpreting the damage pathways, agricultural losses, water shortages, and flood risks assessed in subsequent irrigation baseline sections.

6.5 Family Composition and Vulnerability Characteristics

The family composition of irrigation-dependent households across the 15 sampled districts reflects multi-generational structures where agriculture, livestock rearing, and flood protection form the core of household livelihoods. These families are larger, more labour-intensive, and more directly exposed to climate variability compared to road or bridge users. Their vulnerability profile is shaped by three interlinked factors:

1. Dependence on irrigation infrastructure,
2. Exposure to flood or water-scarcity risks, and
3. Internal household composition (gender, age, labour distribution).

To ensure meaningful analysis of equity, inclusivity, and implementation performance, all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and

visualization as shown in the following tables.

44- Women Headed Household			
District	Yes	No	Overall
Harnai	0	2	2
Jaffarabad	0	4	4
Jhal Magsi	1	3	4
Kachi	0	1	1
Killa Abdullah	0	2	2
Killa Saifullah	0	2	2
Lasbela	0	4	4
Mastung	0	4	4
Musakhel	0	2	2
Nasirabad	0	4	4
Nushki	0	4	4
Pishin	0	2	2
Sibi	0	4	4
Sohbatpur	2	2	4
Ziarat	0	2	2
Overall	3	42	45

45- Disable Person Headed Household			
District	Yes	No	Overall
Harnai	0	2	2
Jaffarabad	0	4	4
Jhal Magsi	0	4	4
Kachi	0	1	1
Killa Abdullah	0	2	2
Killa Saifullah	0	2	2
Lasbela	0	4	4
Mastung	0	4	4
Musakhel	0	2	2
Nasirabad	0	4	4
Nushki	0	4	4
Pishin	0	2	2
Sibi	0	4	4
Sohbatpur	0	4	4
Ziarat	0	2	2
Overall	0	45	45

46- Religion of Surveyed Beneficiaries							
District	Muslims	Hindus	Christians	Sikhs	Parsis	Buddhists	Overall
Harnai	2	0	0	0	0	0	2
Jaffarabad	4	0	0	0	0	0	4
Jhal Magsi	4	0	0	0	0	0	4
Kachi	1	0	0	0	0	0	1
Killa Abdullah	2	0	0	0	0	0	2
Killa Saifullah	2	0	0	0	0	0	2
Lasbela	4	0	0	0	0	0	4
Mastung	4	0	0	0	0	0	4
Musakhel	2	0	0	0	0	0	2
Nasirabad	4	0	0	0	0	0	4
Nushki	4	0	0	0	0	0	4
Pishin	2	0	0	0	0	0	2
Sibi	4	0	0	0	0	0	4
Sohbatpur	4	0	0	0	0	0	4
Ziarat	2	0	0	0	0	0	2
Overall	45	0	0	0	0	0	45

47- Male and Female Beneficiaries				
District	Male Members	Female Members	Transgender Members	Overall
Harnai	4	2	0	6
Jaffarabad	13	12	0	25
Jhal Magsi	5	8	0	13
Kachi	3	6	0	9
Killa Abdullah	9	6	0	15
Killa Saifullah	8	12	0	20
Lasbela	11	7	0	18
Mastung	12	14	0	26
Musakhel	7	5	0	12
Nasirabad	13	13	0	26
Nushki	16	28	0	44
Pishin	5	3	0	8
Sibi	22	18	0	40
Sohbatpur	17	13	0	30
Ziarat	8	3	0	11
Overall	153	150	0	303

48- Family Profile									
District	Age	Youth - Male	With Disability	Age	Youth - Female	With Disability	Widow	Elderly women	Pregnant / lactating
Harnai	4	0	0	2	0	0	0	0	1
Jaffarabad	13	2	0	12	2	0	0	0	2
Jhal Magsi	5	4	0	8	3	0	0	1	1
Kachi	3	0	0	6	2	0	0	1	1
Killa Abdullah	9	0	0	6	1	0	0	0	1
Killa Saifullah	8	0	0	12	1	0	0	1	1
Lasbela	11	4	0	7	0	0	0	0	0
Mastung	12	0	0	14	0	0	0	0	0
Musakhel	7	1	0	5	1	0	0	0	1
Nasirabad	13	1	0	13	1	0	1	1	2
Nushki	16	0	0	28	0	0	0	0	0
Pishin	5	0	0	3	1	0	0	0	0
Sibi	22	2	0	18	2	0	0	0	1
Sohbatpur	17	2	0	13	3	0	0	0	0
Ziarat	8	3	0	3	1	0	0	1	0
Overall	153	19	0	150	18	0	1	5	11

6.5.1 Age Structure and Intra-Household Dependencies

The sampled households display a full spectrum of age groups:

- active adult farmers and labourers,
- youth assisting in agriculture and livestock care,
- school-aged children,
- elderly family members with limited mobility.

This structure creates a high dependency ratio, where:

- adults must maintain irrigation cycles and flood protection functions,
- youth provide essential field labour,
- elderly and children increase household care burdens during disruptions.

Any damage to irrigation schemes disrupts labour distribution, increases household workload, and reduces adaptive capacity for all age groups.

6.5.2 Gender Composition and Irrigation-Linked Responsibilities

Women play a central but often under-recognized role in irrigation-based livelihoods. Across the

sampled villages, women are responsible for:

- livestock watering and feeding,
- washing and water collection for domestic tasks,
- fodder collection from irrigated plots,
- assisting in transplanting, harvesting, and post-harvest cleaning,
- supporting bund repair and debris removal during emergencies,
- managing household water shortages when irrigation flows decline.

When irrigation structures fail, women face:

- increased physical labour,
- reduced access to safe water,
- greater safety risks near damaged embankments or flooded areas,
- mental stress linked to food security and household survival.

Irrigation failures create gendered vulnerability, increasing workload, exposure, and health risks for women.

6.5.3 Youth Labour and Climate Vulnerability

Youth in irrigation-dependent households carry significant productive responsibilities:

- clearing silt from channels,
- guarding livestock near dam or karez peripheries,
- preparing fields for irrigation release,
- managing crop watering rotations,
- protecting bunds during high-flow periods.

Youth also assist in emergency responses, reinforcing bunds, guiding water diversion, and relocating livestock.

When irrigation structures are damaged:

- labour demands on youth increase sharply,
- school attendance declines during critical agricultural cycles,
- exposure to flood hazards rises, particularly in bund and channel zones,
- income-generating opportunities decrease due to reduced farm productivity.

Youth vulnerability is directly tied to irrigation stability; disruptions reduce educational continuity and increase hazardous labour exposure.

6.5.4 Livelihood Vulnerability Driven by Water Dependence

Family vulnerability is tightly linked to agricultural reliance. Households depend on irrigation for:

- crop cycles (wheat, fodder, vegetables, orchards),
- livestock productivity,
- soil moisture maintenance,

- flood protection of farmland and homes,
- year-round food security.

Damage to irrigation infrastructure causes:

- crop losses
- livestock stress
- decreased fodder availability
- reduced income from markets
- higher reliance on external food purchases
- indebtedness due to crop failure

Vulnerability in irrigation households is multiplier in nature: when irrigation fails, multiple livelihood components fail simultaneously.

The family composition of irrigation-dependent households demonstrates:

- strong dependence on water systems,
- multi-generational labour sharing,
- gender-specific workloads,
- youth labour, and
- climate-sensitive livelihood patterns.

Irrigation failures therefore exert whole-household impacts, affecting food security, income, water availability, livestock survival, and physical safety. This demographic profile provides the foundation for interpreting flood exposure, damage typology, and agricultural disruption in the next sections.

6.6 Flood Exposure and Impact on Irrigation Infrastructure

The 2022 floods exposed every irrigation asset in the sample to high-intensity hydrological forces, resulting in widespread structural failure, reduced water storage capacity, compromised flood protection, and disrupted agricultural water supply. All sampled households across the 15 districts confirmed that their irrigation scheme was affected by the floods, establishing near- universal exposure across all scheme types.

Unlike roads and bridges, where infrastructure serves primarily mobility, the irrigation schemes sampled serve water regulation, flood mitigation, and livelihood protection. As a result, the flood impacts were multi-dimensional, affecting not only the physical infrastructure but also the broader hydrological and livelihood systems.

6.6.1 Nature of Flood Exposure Across Hydrological Zones

The baseline reveals distinct exposure patterns in four geographic clusters:

6.6.1.1 Northern Highlands (Musakhel, Killa Saifullah, Ziarat, Harnai)

- Rapid runoff from steep catchments
- Sudden surges in water inflow into dams and perennial channels
- High sediment loads carried into dam reservoirs
- Scouring and erosion around channel inlets

Exposure here was flash-flood oriented, causing sudden mechanical stress on structures.

6.6.1.2 Central Plateau (Killa Abdullah, Pishin, Kachi)

- Moderate but continuous runoff
- Damage concentrated on small dams and karezes
- Inflow channels clogged with debris
- Decline in groundwater recharge potential

Exposure here was prolonged rather than sudden, degrading structural capacity.

6.6.1.3 Eastern and South-Eastern Floodplains (Sibi, Mastung, Jhal Magsi, Nushki)

- Water accumulation from multiple upstream flows
- Breaching of bunds and embankments
- River overflows (Nari River, Gandawah areas)
- Standing water causing embankment slippage

Exposure here was wide-spread and sustained, amplifying bund failure.

6.6.1.4 Coastal and Canal Zones (Lasbela, Sohbatpur, Jaffarabad, Nasirabad)

- High-volume canal overflow
- Embankment failures
- Reverse flows pushing water into settlements
- Prolonged stagnation affecting soil and embankments

Exposure here was both flood and canal backflow related, creating complex risk environments.

The irrigation infrastructure was not exposed in a uniform manner, each hydrological zone experienced a unique flood dynamic, making rehabilitation needs highly site-specific.

6.6.2 Community-Reported Impact on Irrigation Functionality

Across all sampled villages, households consistently reported:

- disruption of water flow into fields,
- blockage of channels,
- loss of storage capacity in dams due to sedimentation,
- breaches in flood protection bunds,
- erosion of embankments,
- destruction of karez galleries,
- overflow from canals into farmland,
- weakening of dam walls or protection bands.

These impacts vary by scheme type but share the same overall consequence: a fundamental breakdown of rural water regulation systems.

6.6.3 Direct Flood Impacts on Different Scheme Types

6.6.3.1 Dams and Delay Action Dams

- excessive inflow causing overtopping
- scouring at toe or embankment
- sediment accumulation reducing reservoir volume
- cracks in spillway or outlet systems

Implication: Reduced water availability for crops; increased flood risk downstream.

6.6.3.2 Perennial Irrigation Schemes

- channel erosion and widening
- blockage by debris
- diversion of water flow
- collapse of lined or unlined channels

Implication: Inconsistent irrigation supply; water loss; reduced cropping cycles.

6.6.3.3 Karezes

- collapse of mother wells and galleries
- debris intrusion blocking flow
- reduction in seepage-based recharge

Implication: Loss of a centuries-old water system supporting orchards and groundwater.

6.6.3.4 Flood Protection Bunds and Embankments

- breaches caused by overtopping
- erosion along riverbanks
- structural weakening from prolonged saturation
- slippage or sinking of embankment walls

Implication: Increased flood vulnerability of settlements and farmland.

6.6.3.5 Canals and Diversion Channels

- cracks on retaining walls
- collapse of berms
- silt deposits reducing carrying capacity
- reverse flooding into villages

Implication: Waterlogging; crop destruction; land degradation.

6.6.4 Livelihood-Level Exposure

Flood exposure to irrigation assets resulted in:

- crop losses (wheat, fodder, orchards),

- livestock stress due to lost water sources,
- reduced groundwater recharge,
- increased agricultural input costs,
- loss of season-specific income,
- higher dependency on external food purchases,
- heightened fear of repeated flooding,
- erosion of productive land,
- increased indebtedness among small farmers.

Flood damage to irrigation infrastructure directly undermines household resilience, unlike mobility assets where impacts are indirect.

6.6.5 Compounding Risk Factors Observed Across Sites

Households reported additional compounding risks:

- breached bunds leading to secondary flooding,
- dam overflows forcing emergency livestock relocation,
- broken channels causing unregulated water intrusion into homes,
- sediment deposits increasing labour burden for clearing,
- damaged karezes reducing perennial water supply.

Irrigation failures create parallel crises: water scarcity in dry months and heightened flood vulnerability during rains.

6.6.6 Overall Flood Exposure Interpretation

The irrigation baseline demonstrates:

- 100% exposure across sampled sites,
- multi-layered structural damage,
- water regulation failures,
- flood protection breakdown, and
- direct livelihood losses.

Irrigation systems serve, water supply, flood protection, land stabilization, groundwater recharge. Therefore, flood exposure multiplies vulnerabilities across all livelihood dimensions.

Irrigation rehabilitation under IFRAP will therefore produce significant and measurable improvements in climate resilience, agricultural productivity, and household stability.

6.7 Type and Extent of Damage to Irrigation Infrastructure

Flood impacts on irrigation systems were multi-layered, affecting structural integrity, water conveyance pathways, storage capacity, and flood protection functions. Irrigation damage compromises water access, agricultural productivity, and household resilience. Each scheme type (dams, bunds, karezes, perennial irrigation systems, and canal embankments) exhibited distinct damage patterns driven by hydrological exposure, structural design, and local terrain.

49- Area affected by the 2022 floods			
District	Yes	No	Overall
Harnai	2	0	2
Jaffarabad	4	0	4
Jhal Magsi	4	0	4
Kachi	1	0	1
Killa Abdullah	2	0	2
Killa Saifullah	2	0	2
Lasbela	4	0	4
Mastung	4	0	4
Musakhel	2	0	2
Nasirabad	4	0	4
Nushki	4	0	4
Pishin	2	0	2
Sibi	4	0	4
Sohbatpur	4	0	4
Ziarat	2	0	2
Overall	45	0	45

50- Scheme undergone rehabilitation before the 2022 floods			
District	Yes	No	Overall
Harnai	0	2	2
Jaffarabad	2	2	4
Jhal Magsi	0	4	4
Kachi	0	1	1
Killa Abdullah	0	2	2
Killa Saifullah	2	0	2
Lasbela	2	2	4
Mastung	0	4	4
Musakhel	2	0	2
Nasirabad	0	4	4
Nushki	0	4	4
Pishin	1	1	2
Sibi	3	1	4
Sohbatpur	0	4	4
Ziarat	2	0	2
Overall	14	31	45

51- Type of damage occurred to the Irrigation scheme					
District	Breach	Sedimentation	Structural damage	Other	Overall
Harnai	0	2	0	0	2
Jaffarabad	4	0	0	0	4
Jhal Magsi	0	0	4	0	4
Kachi	0	0	1	0	1
Killa Abdullah	2	0	0	0	2
Killa Saifullah	1	0	1	0	2
Lasbela	4	0	0	0	4
Mastung	4	0	0	0	4
Musakhel	0	0	2	0	2
Nasirabad	4	0	0	0	4
Nushki	0	0	0	4	4
Pishin	2	0	0	0	2
Sibi	2	2	0	0	4
Sohbatpur	4	0	0	0	4
Ziarat	0	0	2	0	2
Overall	27	4	10	4	45

52- Any immediate risks to villagers due to dame of scheme			
District	Yes	No	Overall
Harnai	2	0	2
Jaffarabad	4	0	4
Jhal Magsi	4	0	4
Kachi	1	0	1

52- Any immediate risks to villagers due to dame of scheme			
District	Yes	No	Overall
Killa Abdullah	2	0	2
Killa Saifullah	2	0	2
Lasbela	4	0	4
Mastung	4	0	4
Musakhel	1	1	2
Nasirabad	4	0	4
Nushki	0	0	0
Pishin	2	0	2
Sibi	4	0	4
Sohbatpur	4	0	4
Ziarat	2	0	2
Overall	40	1	41

6.7.1 Structural Damage to Dams and Delay Action Dams

Dams and delay action dams are critical for storing rainfall, regulating flows, and recharging groundwater. Structural damage to these assets has immediate consequences: reduced storage capacity, increased flood risk, and unreliable water supply for farming.

Observed Damage Patterns

- Overtopping during peak floods, causing erosion on the downstream face
- Scouring at the dam toe, weakening foundation stability
- Cracks forming on spillways, outlet channels, or embankments
- Sediment deposition reducing reservoir depth and volume
- Embankment slippage due to prolonged saturation
- Damage to side protection walls and reinforcement structures Affected Sites Include:
- Peechi Dam (Ziarat)
- Zarkhail Delay Action Dam (Harnai)
- Mako Katch Dam (Killa Abdullah)
- Azdaghol Dam (Nushki)
- Khumbari Dam (Kachi)
- That Dam (Mastung)

These forms of damage diminish water availability, reduce reservoir lifespan, and increase vulnerability to future flood events. Farmers relying on dam-fed irrigation face delayed crop cycles, reduced yields, and greater uncertainty in water allocation.

6.7.2 Damage to Perennial Irrigation Systems and Channels

Perennial irrigation systems and lined/unlined channels deliver water directly to agricultural fields. Their failure interrupts water timing and distribution, a critical determinant of crop survival in arid environments.

Observed Damage Patterns

- Channel widening and bank erosion from high-velocity flows
- **Breakage of lined sections**, causing leakage and water loss
- Blockage from silt and debris, stopping water conveyance

- Undermining at cross-drainage points
- Diversion of flow into unintended areas, damaging fields or homes

Affected Sites Include:

- Toiwer Batozai Dam (Killa Saifullah)
- Gargoji Perennial Irrigation Scheme (Musakhel)

Damage to perennial channels leads to irregular irrigation cycles, crop water stress, and higher labour demand for manual clearance. Farmers lose control over water scheduling, reducing productivity and increasing financial risk.

6.7.3 Severe Damage to Karezes (Underground Irrigation Systems)

Karezes are ancient gravity-fed underground irrigation systems essential for groundwater recharge and steady water delivery. They are highly vulnerable to sedimentation and structural collapse during floods.

Observed Damage Patterns

- Collapse of mother wells
 - Blockage of galleries by silt, stones, and debris
 - Reduced seepage flow due to sediment intrusion
 - Cracking of surface shafts
 - Complete flow stoppage in extended sections
- Affected Sites Include:
- Sanzala Karez (Pishin)

Karez damage disrupts entire village water systems. Restoring karezes requires specialized labour, and failure to rehabilitate reduces perennial water availability, harming orchards, livestock, and household water security.

6.7.4 Breaches and Erosion In Flood Protection Bunds S Embankments

Bunds and embankments prevent rivers, nullahs, or canal overflows from inundating settlements and farmland. Damage to these structures removes the primary protection against recurring floods.

Observed Damage Patterns

- Bund breaches from overtopping
 - Erosion along riverbanks weakening structural integrity
 - Slumping or settling from prolonged saturation
 - Cracks forming due to uneven loading from flood pressure
 - Scouring at the base, leaving sections unsupported
- Affected Sites Include:
- Flood Protection Bund, Nari River (Sibi)
 - Flood Protection Bunds for Sohbatpur Town
 - Gandawah Town Flood Protection Bund (Jhal Magsi)
 - Thrara Flood Protection Bund (Lasbela)
 - Protection Bands (Jaffarabad)

Bund failures expose villages to direct flood intrusion. Households reported fear of future floods, loss of farmland, and emergency livestock relocation, signalling high vulnerability until rehabilitation is completed.

6.7.5 Damage to Canal Systems and Diversion Channels

Canal embankments and diversion channels regulate water distribution and prevent uncontrolled flows. Their failure often leads to waterlogging, crop destruction, and erosion of settlement edges.

Observed Damage Patterns

- Cracks in canal embankments
- Collapse of berms and retaining walls
- Sedimentation reducing carrying capacity
- Reverse flooding from canal overtopping
- Diversion channels blocked or altered by deposit loads
- Restoration of Lasbela Canal (Lasbela)
- Patfeedar Canal Flood Embankment (Nasirabad)

Damage reduces irrigation command area, increases water losses, and raises the risk of canal-related flooding, affecting both upstream and downstream users.

6.7.6 Functional Impairments Across all Scheme Types

Beyond structural damage, irrigation infrastructure also experienced functional impairments, which affect the daily agricultural routines of households.

Reported Impacts

- Reduced water flow into command areas
- Delayed delivery of irrigation water
- Loss of flood diversion capacity
- Increased labour burden for clearing silt and debris
- Unregulated water spread, damaging crops
- Reduced ability to protect settlements from secondary floods

Functional disruption is often more immediately damaging than structural loss, as it directly affects crop cycles, household livelihoods, and community resilience.

6.7.7 Overall Interpretation of Damage Severity

Flood impacts on irrigation infrastructure were:

- Multi-systemic, affecting storage, conveyance, protection, and recharge
- Geographically widespread, across 15 districts
- Functionally disruptive, undermining water security and agriculture
- Socioeconomically damaging, reducing yields, income, and food availability

Damage to irrigation assets therefore represents a direct threat to **PDO-2** (resilience to climate risks) because households cannot adapt effectively without stable water systems. Rehabilitation under

IFRAP will restore:

- structural stability,
- water availability,
- flood protection,
- agricultural viability,
- and community resilience.

6.8 Irrigation Usability, Water Access Disruption, and Agricultural Impact

Flood-induced damage to irrigation infrastructure produced widespread usability failures, directly affecting water access, crop productivity, livestock management, and household survival strategies. Unlike mobility systems, where temporary adaptation may still allow limited access, irrigation failures have no substitute. Without functional dams, channels, karezes, or bunds, communities lose control over the single most critical input for their livelihoods and that is “**water**”.

The baseline findings indicate that the 2022 floods led to systemic disruption of irrigation functionality across all scheme types and geographic clusters and all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

53- Beneficiaries owned agricultural land			
District	Yes	No	Overall
Harnai	2	0	2
Jaffarabad	4	0	4
Jhal Magsi	2	2	4
Kachi	1	0	1
Killa Abdullah	2	0	2
Killa Saifullah	2	0	2
Lasbela	4	0	4
Mastung	4	0	4
Musakhel	2	0	2
Nasirabad	0	4	4
Nushki	4	0	4
Pishin	2	0	2
Sibi	4	0	4
Sohbatpur	4	0	4
Ziarat	2	0	2
Overall	39	6	45

54- Agricultural land affected by flood water			
District	Yes	No	Overall
Harnai	0	2	2
Jaffarabad	4	0	4
Jhal Magsi	2	0	2
Kachi	1	0	1
Killa Abdullah	2	0	2
Killa Saifullah	2	0	2
Lasbela	4	0	4
Mastung	4	0	4
Musakhel	2	0	2
Nasirabad	0	0	0
Nushki	4	0	4
Pishin	2	0	2
Sibi	4	0	4
Sohbatpur	4	0	4
Ziarat	2	0	2
Overall	37	2	39

55- Duration to resume farming after floods (Days)		
District	No. of cases	Avg. Days
Harnai	0	0
Jaffarabad	4	145
Jhal Magsi	2	53
Kachi	1	120
Killa Abdullah	2	205
Killa Saifullah	2	228
Lasbela	4	68
Mastung	4	30
Musakhel	2	85
Nasirabad	0	0
Nushki	4	281
Pishin	2	530
Sibi	4	545
Sohbatpur	4	730
Ziarat	2	105
Overall	37	263

56- Agriculture land affected by flood 2022			
District	No. of cases	Total Agriculture Land of Beneficiaries	Total land affected by flood
Harnai	2	9	0
Jaffarabad	4	20	20
Jhal Magsi	2	35	30
Kachi	1	40	40
Killa Abdullah	2	19	17
Killa Saifullah	2	19	13
Lasbela	4	42	37
Mastung	4	70	35
Musakhel	2	24	4
Nasirabad	0	0	0
Nushki	4	70	50
Pishin	2	5	4
Sibi	4	43	43
Sohbatpur	4	39	39
Ziarat	2	28	6
Overall	39	463	338

57- Source of water used for cultivating land after flood 2022			
District	Total cultivated land	Irrigation area	Rain-fed area
Harnai	9	9	0
Jaffarabad	0	0	0
Jhal Magsi	5	5	0
Kachi	0	0	0
Killa Abdullah	3	3	0
Killa Saifullah	6	6	0
Lasbela	5	5	0
Mastung	35	35	0
Musakhel	20	20	0
Nasirabad	0	0	0
Nushki	20	20	0
Pishin	1	1	0
Sibi	0	0	0
Sohbatpur	0	0	0
Ziarat	22	22	0
Overall	125.5	125.5	0

58- Cropping cycle disruption faced			
District	Yes	No	Overall
Harnai	1	1	2
Jaffarabad	4	0	4
Jhal Magsi	2	0	2
Kachi	1	0	1
Killa Abdullah	2	0	2
Killa Saifullah	2	0	2
Lasbela	4	0	4
Mastung	4	0	4
Musakhel	2	0	2
Nasirabad	0	0	0
Nushki	4	0	4
Pishin	2	0	2
Sibi	3	1	4
Sohbatpur	4	0	4
Ziarat	2	0	2
Overall	37	2	39

59- Lost standing crops or orchards			
District	Yes	No	Overall
Harnai	0	2	2
Jaffarabad	4	0	4
Jhal Magsi	2	0	2
Kachi	1	0	1
Killa Abdullah	2	0	2
Killa Saifullah	2	0	2
Lasbela	4	0	4
Mastung	4	0	4
Musakhel	1	1	2
Nasirabad	0	0	0
Nushki	4	0	4
Pishin	2	0	2
Sibi	3	1	4
Sohbatpur	4	0	4
Ziarat	2	0	2
Overall	35	4	39

60- Land use intensity				
District	Single	Double	Triple	Overall
Harnai	0	2	0	2
Jaffarabad	0	4	0	4
Jhal Magsi	2	0	0	2
Kachi	1	0	0	1
Killa Abdullah	2	0	0	2
Killa Saifullah	0	2	0	2
Lasbela	0	4	0	4
Mastung	4	0	0	4
Musakhel	0	2	0	2
Nasirabad	0	0	0	0
Nushki	4	0	0	4
Pishin	2	0	0	2
Sibi	0	4	0	4
Sohbatpur	0	4	0	4
Ziarat	0	2	0	2
Overall	15	24	0	39

61- Cropping intensity				
District	Single Crop	Two Crops (Rabi & Kharif)	More than Two Crops (Intercropping, Mixed Cropping)	Overall
Harnai	0	2	0	2
Jaffarabad	0	4	0	4
Jhal Magsi	2	0	0	2
Kachi	1	0	0	1
Killa Abdullah	2	0	0	2
Killa Saifullah	1	0	1	2
Lasbela	0	4	0	4
Mastung	4	0	0	4
Musakhel	0	2	0	2
Nasirabad	0	0	0	0
Nushki	4	0	0	4
Pishin	2	0	0	2
Sibi	0	4	0	4
Sohbatpur	0	4	0	4
Ziarat	0	2	0	2
Overall	16	22	1	39

62- Cropping Pattern															
District	Wheat	Maize	Gram (Pulses)	Lentil (Pulses)	Sorghum	Rice	Cotton	Barley	Apple	Apricot	Potato	Tomato	Onion	Okra	Chilli
Harnai	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Jaffarabad	11.1%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	50.0%	0.0%	100.0%	100.0%
Jhal Magsi	8.3%	0.0%	28.6%	66.7%	66.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Kachi	2.8%	0.0%	14.3%	33.3%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Killa Abdullah	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.0%	0.0%	100.0%	0.0%	50.0%	0.0%	0.0%
Killa Saifullah	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	0.0%	0.0%
Lasbela	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mastung	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Musakhel	5.6%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Nasirabad	8.3%	0.0%	57.1%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Nushki	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pishin	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%	25.0%	50.0%	0.0%	0.0%
Sibi	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sohbatpur	5.6%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Ziarat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%

63- Primary source of income								
District	Farming	Labor	Business	Govt. Job	Shopkeeper	Artisan	Unemployed	Overall
Harnai	2	0	0	0	0	0	0	2
Jaffarabad	4	0	0	0	0	0	0	4
Jhal Magsi	3	0	0	1	0	0	0	4
Kachi	0	0	0	1	0	0	0	1
Killa Abdullah	1	0	0	1	0	0	0	2
Killa Saifullah	1	0	0	0	0	0	1	2
Lasbela	1	0	2	1	0	0	0	4
Mastung	4	0	0	0	0	0	0	4
Musakhel	1	0	0	0	0	0	1	2
Nasirabad	4	0	0	0	0	0	0	4
Nushki	4	0	0	0	0	0	0	4
Pishin	1	1	0	0	0	0	0	2
Sibi	4	0	0	0	0	0	0	4
Sohbatpur	4	0	0	0	0	0	0	4
Ziarat	2	0	0	0	0	0	0	2
Overall	36	1	2	4	0	0	2	45

64- Secondary source of income							
District	Farming	Labor	Business	Govt. Job	Shopkeeper	Artisan	Overall
Harnai	0	1	0	0	0	0	1
Jaffarabad	0	2	0	0	0	0	2
Jhal Magsi	0	1	0	0	0	0	1
Kachi	0	0	0	0	0	0	0
Killa Abdullah	1	0	0	0	0	0	1
Killa Saifullah	0	1	0	0	0	0	1
Lasbela	1	0	0	0	0	0	1
Mastung	0	0	0	0	0	0	0
Musakhel	0	0	0	1	0	0	1
Nasirabad	0	0	0	0	0	0	0
Nushki	0	0	0	0	0	0	0
Pishin	0	0	0	0	0	0	0
Sibi	0	0	0	0	0	1	1
Sohbatpur	0	3	0	0	0	1	4
Ziarat	0	0	0	0	0	0	0
Overall	2	8	0	1	0	2	13

65- Average monthly income							
District	10,000 – 20,000	20,001 – 30,000	30,001 – 40,000	40,001 – 50,000	50,001 – 75,000	75,001 – 100,000	Overall
Harnai	0	0	1	1	0	0	2
Jaffarabad	0	4	0	0	0	0	4
Jhal Magsi	2	2	0	0	0	0	4
Kachi	0	0	1	0	0	0	1
Killa Abdullah	1	0	0	0	1	0	2
Killa Saifullah	1	0	0	1	0	0	2
Lasbela	0	0	0	3	0	1	4
Mastung	4	0	0	0	0	0	4
Musakhel	1	0	0	0	1	0	2
Nasirabad	4	0	0	0	0	0	4
Nushki	4	0	0	0	0	0	4
Pishin	1	1	0	0	0	0	2
Sibi	2	2	0	0	0	0	4
Sohbatpur	2	2	0	0	0	0	4
Ziarat	0	0	1	1	0	0	2
Overall	22	11	3	6	2	1	45

66- Income status compared to pre-flood level				
District	Increased	Same	Declined	Overall
Harnai	0	1	1	2
Jaffarabad	0	3	1	4
Jhal Magsi	0	0	4	4
Kachi	0	0	1	1
Killa Abdullah	0	0	2	2
Killa Saifullah	0	0	2	2
Lasbela	0	2	2	4
Mastung	0	0	4	4
Musakhel	0	0	2	2
Nasirabad	0	0	4	4
Nushki	0	0	4	4
Pishin	0	0	2	2
Sibi	0	2	2	4
Sohbatpur	0	0	4	4
Ziarat	0	0	2	2
Overall	0	8	37	45

67- Financial aid or take any loans after the flood			
District	Yes	No	Overall
Harnai	0	2	2
Jaffarabad	3	1	4
Jhal Magsi	0	4	4

67- Financial aid or take any loans after the flood			
District	Yes	No	Overall
Kachi	0	1	1
Killa Abdullah	2	0	2
Killa Saifullah	0	2	2
Lasbela	0	4	4
Mastung	0	4	4
Musakhel	0	2	2
Nasirabad	0	4	4
Nushki	0	4	4
Pishin	2	0	2
Sibi	2	2	4
Sohbatpur	2	2	4
Ziarat	0	2	2
Overall	11	34	45

6.8.1 Usability of Irrigation Assets after the Floods

Usability refers to whether irrigation systems could perform their basic intended function, storing, conveying, regulating, or diverting water. Post-flood usability directly determines whether households can irrigate fields, protect settlements, or sustain livestock.

Across all sampled sites, households reported that their irrigation scheme was non-functional, partially functional, or unreliable after the floods. Disruptions included:

- dams unable to retain or release water properly,
- channels broken in multiple segments,
- karezes blocked entirely,
- flood protection bunds breached or weakened,
- canal systems reduced to low flow due to sedimentation.

In many villages, irrigation structures remained unusable for months, mirroring the prolonged recovery timeline recorded in mobility assets.

Usability failure is the first and most direct indicator of irrigation collapse. It translates immediately into crop water stress, decreased productivity, and expanded labour demands to clear or repair systems informally.

6.8.2 Disruption in Water Access for Irrigation and Livestock

Water access is the operational outcome that defines household resilience. When irrigation infrastructure fails, the effects cascade through all livelihood layers like, crops, livestock, soil quality, household consumption, and income.

6.8.2.1 Impacts on Water Access

Households described:

- complete stoppage of irrigation water due to blocked channels, collapsed karezes, or damaged outlets;
- unpredictable water flows, making it impossible to plan irrigation schedules;
- reduced supply from small dams as sediment filled reservoirs;
- inability to divert water safely, leading to unregulated spillage;
- scarcity during critical crop stages, including sowing and grain formation.

Livestock watering was also severely affected:

- animals had to be moved farther to find water,
- some households purchased water at high cost,
- water scarcity increased livestock stress, affecting milk production and animal health.

Water access disruption represents a core vulnerability multiplier, affecting food security, asset preservation, and income stability simultaneously.

6.8.3 Agricultural Impact: Crop Losses and Production Decline

Agriculture is the main livelihood for most households in the irrigation sample. Flood damage to irrigation systems directly affects land productivity, crop timing, and overall household income.

6.8.3.1 Observed Agricultural Losses

Farmers reported:

- loss of standing crops (wheat, fodder, vegetables, orchard crops),
- delayed sowing and planting, causing seasonal cycle mismatch,
- poor germination due to inadequate moisture,
- reduced yields from insufficient irrigation during critical stages,
- loss of cash crops, impacting household liquidity,
- soil erosion and sediment deposition, reducing arable land quality.

In bund-dependent districts (Sibi, Sohbatpur, Jaffarabad, Nasirabad), breaches caused direct inundation of agricultural fields, leading to total crop loss in some villages.

Agricultural impacts are not one-time events. They compound over seasons, reducing the household's ability to recover financially and increasing the likelihood of indebtedness or asset liquidation.

6.8.4 Impact on Livestock and Household Food Security

Livestock is a major economic and nutritional asset in rural Balochistan. Disruptions to irrigation systems affect livestock both directly (watering points, fodder availability) and indirectly (health and stress).

Households noted:

- reduced fodder production due to poor irrigation,
- stress from long-distance watering,
- drop in milk production,
- increased illness among livestock,
- reduced grazing due to waterlogged or damaged fields,
- higher feed costs due to market dependency.

These conditions strained food availability for families, especially:

- households with young children,
- women managing daily nutrition,

- families with limited income sources.

Livestock impacts create a secondary shock following crop losses, weakening household food security and financial resilience.

6.8.5 Breakdown of Flood Protection and Increased Exposure to Hazard

Many irrigation structures also function as flood protection systems. When these structures fail, communities experience greater risk during subsequent rainfall events.

6.8.5.1 Observed Conditions

Households reported:

- fear of future floods due to breached bunds,
- increased waterlogging around homes and fields,
- erosion of settlement edges,
- damage to pathways connecting agricultural plots,
- loss of safe refuge zones for livestock.

In several districts (Sohbatpur, Jhal Magsi, parts of Lasbela), bund failure caused water to spread into areas previously considered safe.

The loss of protective function means communities enter each new monsoon season with higher baseline risk, undermining long-term resilience.

6.8.6 Increased Labour Burden and Coping Costs

When irrigation systems fail, households must compensate through labour-intensive coping strategies. These burdens fall disproportionately on youth and women.

6.8.6.1 Common Coping Actions

- clearing silt from channels manually,
- deepening temporary diversion paths,
- reinforcing degraded bund sections with soil bags,
- carrying water from distant sources,
- hiring machinery for small-scale rehabilitation,
- purchasing costly tanker water for crops or livestock.

These efforts require both time and financial resources, intensifying household stress. Coping costs reduce household resilience and divert capacity away from productive agricultural work.

6.8.7 Overall Interpretation of Usability and Impact

The 2022 floods produced a comprehensive breakdown in irrigation usability, resulting in:

- water scarcity,
- crop loss,
- livestock stress,
- declining agricultural productivity,
- increased hazard exposure,

- greater labour demands, and
- heightened financial strain.

These impacts reveal that irrigation infrastructure is not simply a technical asset; it is the foundation of rural livelihoods and climate resilience.

IFRAP rehabilitation will therefore yield high-value benefits:

- restoring water regulation,
- reducing climate vulnerability,
- stabilizing agricultural cycles,
- improving household food security,

6.9 Safety Hazards, Environmental Risks, and Community-Level Implications

Damage to irrigation infrastructure following the 2022 floods created a diverse set of safety hazards and environmental risks for communities across all sampled districts. Irrigation hazards extend into farmland, settlements, livestock enclosures, water sources, and floodplains, exposing households to both sudden and persistent dangers.

This section outlines the major risk categories, beginning each with an elaboration to clarify why the hazard matters in the irrigation context.

6.9.1 Structural Instability of Dams, Bunds, and Embankments

Embankments, bunds, and dams are designed to contain, redirect, or store water. Once structurally compromised, they become hazardous zones where minor rainfall can trigger collapse, overtopping, or downstream flooding.

Observed Hazards

- Cracking and slumping of dam or bund walls
- Weakening of embankments from saturated soils
- Collapse risk at breached sections
- Steep erosion cuts near village peripheries
- Sudden water release through weakened structures

Communities expressed fear that “**even a small rain will break the bund again,**” indicating persistent psychological and physical risk. Structural instability threatens:

- nearby homes
- agricultural fields
- livestock sheds
- community safety during future rains

Unstable structures become year-round risk multipliers, not only seasonal threats.

6.9.2 Hazards from Uncontrolled Water Flows

When irrigation systems fail, water often flows into unregulated pathways, creating unexpected hazards for people, livestock, and farmland.

Observed Hazards

- Sudden diversion of water into villages or fields
- Water spreading into depressions, forming hidden pits
- Livestock falling into soft, waterlogged ground
- Formation of deep scoured channels near households
- Overflow from canals into pedestrian paths

Some households reported children or animals slipping into unmarked, deepened channels created by the flood.

Uncontrolled water flow increases:

- accident risk,
- soil erosion,
- land degradation,
- weakening of access paths and local roads.

6.9.3 Waterlogging and Stagnant Water Risks

Waterlogging is a major post-flood environmental concern because it affects land productivity, creates health risks, and degrades the living environment.

Observed Hazards

- Persistent standing water near homes and fields
- Breeding grounds for mosquitoes and pests
- Root damage to crops and orchards
- Salinity buildup in soil
- Difficulty moving livestock through soft or submerged land

In many floodplain districts (Sohbatpur, Jhal Magsi, Jaffarabad, Nasirabad), waterlogging persisted weeks after the flood had receded elsewhere.

Households face:

- increased disease risk (malaria, dengue)
- poor soil recovery
- reduced planting windows
- long-term decline in agricultural yield

6.9.4 Erosion, Gully Formation and Land Degradation

Floodwaters reshape land around irrigation systems. Erosion or gully formation directly reduces the usable agricultural area and endangers roads, homes, and bunds.

Observed Hazards

- Deep gullies cutting through farmland
- Loss of topsoil essential for crop production

- Collapse of boundary walls or field terraces
- Increased risk of future field flooding
- Expanding erosion channels near settlements

Erosion was especially pronounced around breached bunds, dam outlets, and diversion channels.

The loss of soil fertility undermines long-term agricultural productivity, increasing poverty risk.

6.9.5 Environmental Hazards in Dam and Karez Zones

Dams and karezes sit in hydrological recharge zones where environmental disruption can impact water quality, groundwater levels, and eco-hydrological stability.

Observed Hazards

- Contaminated water entering reservoirs
- Sedimentation reducing aquifer recharge
- Collapse of karez tunnels, leaving open pits
- Degradation of vegetation around water bodies
- Increased wildlife intrusion into settlements (searching for water)

Environmental degradation reduces both water quantity and water quality, threatening long-term sustainability.

6.9.6 Livestock-Related Hazards

Livestock represent a major household asset. Flood damage creates unsafe grazing, watering, and sheltering conditions.

Observed Hazards

- limited access to safe water points
- injuries from sharp debris or unstable slopes
- reduced safe pasture area
- increased livestock disease from contaminated water

Households repeatedly expressed concern about “animals drowning or getting injured near the damaged structures.”

Livestock losses amplify the financial shock caused by irrigation failure.

6.9.7 Human Safety Risks during Emergency Actions

Families often undertake emergency protective actions (reinforcing bunds, diverting flows, clearing channels) which expose them to hazards.

Observed Hazards

- youth and men working in fast-moving water
- manual removal of heavy debris
- nighttime bund protection during rainfall
- women carrying water over unstable ground

- elderly persons unable to evacuate during bund overtopping

Flood protection tasks become high-risk activities, raising the likelihood of injury.

6.9.8 Psychological and Social Stress

Environmental hazard zones create persistent anxiety that affects decision-making, migration, schooling, and household stability.

Observed Impacts

- fear of future bund failure
- reluctance to invest in next crop
- children missing school due to unsafe conditions
- emotional distress during monsoon season
- reduced community cohesion due to shared risk pressures

Safety hazards generate long-term psychosocial stress, reducing household resilience and confidence in recovering.

Across all irrigation scheme types, the 2022 floods created an environment of sustained physical danger, environmental degradation, and heightened personal and livelihood risk. The presence of damaged dams, eroded bunds, unstable channels, polluted water bodies, and land degradation means that communities face elevated risk before, during, and after rainfall events.

Irrigation rehabilitation, therefore, is not merely a technical repair but it is a risk reduction intervention, critical for:

- safeguarding communities,
- protecting farmland and livestock,
- reducing environmental hazards,
- and strengthening PDO-2 climate resilience outcomes.

6.10 Rehabilitation Status, Community Awareness, and Readiness

Flood-damaged irrigation systems across all 15 sampled districts remained largely unrepaired at the time of the baseline assessment. Beneficiaries consistently reported that no formal rehabilitation work (temporary or permanent) had begun on dams, bunds, karezes, channels, or canal embankments under Component-1.

Despite this, community awareness of upcoming IFRAP-supported rehabilitation was high, and expectations for restoration were strong across the sample and all disaggregated variables are coded in PMIS data entry forms to ensure automated reporting and visualization as shown in the following tables.

68- Current rehabilitation status of Irrigation scheme					
District	Not Started	Ongoing	Completed	Abandoned/Halted	Overall
Harnai	2	0	0	0	2
Jaffarabad	3	0	0	1	4
Jhal Magsi	4	0	0	0	4
Kachi	1	0	0	0	1
Killa Abdullah	2	0	0	0	2
Killa Saifullah	2	0	0	0	2
Lasbela	4	0	0	0	4
Mastung	4	0	0	0	4

68- Current rehabilitation status of Irrigation scheme					
District	Not Started	Ongoing	Completed	Abandoned/Halted	Overall
Musakhel	2	0	0	0	2
Nasirabad	4	0	0	0	4
Nushki	4	0	0	0	4
Pishin	2	0	0	0	2
Sibi	4	0	0	0	4
Sohbatpur	4	0	0	0	4
Ziarat	2	0	0	0	2
Overall	44	0	0	1	45

69- Average Distance from village to basic services		
District	Avg. Distance to health facility	Avg. Distance to school
Harnai	4.5	0.4
Jaffarabad	3.8	4.0
Jhal Magsi	1.0	1.0
Kachi	15.0	15.0
Killa Abdullah	61.5	0.8
Killa Saifullah	18.0	5.0
Lasbela	12.0	1.3
Mastung	25.0	5.0
Musakhel	2.0	1.5
Nasirabad	10.5	3.5
Nushki	5.5	5.5
Pishin	41.5	25.0
Sibi	0.0	0.0
Sohbatpur	1.5	0.0
Ziarat	9.5	2.0
Overall	11.7	3.7

6.10.1 Status of Physical Rehabilitation Works

Rehabilitation status is a critical baseline indicator because it establishes the starting point from which project progress will be measured. For irrigation schemes, even small interim repairs, such as clearing channels or reinforcing bunds, can temporarily improve water security or reduce hazard risk.

Across all sampled irrigation assets, households reported:

- No official repair work initiated at any site.
- No machinery mobilization by implementing agencies.
- No desilting, bund reinforcement, or channel clearing conducted through government support.
- No restoration of damaged dam embankments, culverts, spillways, or inlets.
- No interim protective measures (e.g., temporary bund patching, diversion creation).

The absence of rehabilitation establishes a clean and uncontaminated baseline, allowing IFRAP's impact to be attributed with clarity. It also indicates high unmet needs and increased urgency.

6.10.2 Community Awareness of Planned Irrigation Rehabilitation

Awareness is essential for gauging community expectations, trust, and willingness to participate in project processes. It also signals whether communication channels between project teams and beneficiaries are functioning.

Most households were aware that:

- their irrigation scheme had been assessed,
- it was included in an upcoming rehabilitation program,
- further technical teams were expected to visit.

Sources of awareness included:

- interactions with field teams during initial surveys,
- announcements via local leaders or farmers' groups,
- community discussion after PIU/consultant visits.

Some households referenced hearing the **"government will repair the dam/bund soon"**, reflecting anticipatory optimism.

High awareness demonstrates successful early engagement but increases expectations, meaning delays can adversely affect community confidence.

6.10.3 Community Expectations and Perceived Urgency of Rehabilitation

Expectations shape community satisfaction and cooperative behaviour during implementation. For irrigation-dependent households, expectations are linked to livelihood revival, crop scheduling, livestock well-being, and flood safety.

Beneficiaries consistently expressed that rehabilitation would:

- restore reliable water flow to fields,
- reduce flood risk during upcoming monsoons,
- stabilize embankments protecting homes and farmland,
- improve livestock watering conditions,
- reduce labour required for manual clearing,
- revive crop cycles and income streams.

The most urgent expectations were voiced in districts with bund breaches (Sohbatpur, Jaffarabad, Sibi, Jhal Magsi) and dam embankment erosion (Ziarat, Harnai, Mastung).

Expectations reflect high perceived value of irrigation rehabilitation. Communities consider this intervention essential, not discretionary.

6.10.4 Concerns about Delays and Future Climate Events

Understanding community concerns helps anticipate social risks, implementation challenges, and pressure points in project delivery.

Households expressed concerns that:

- another flood season may strike before rehabilitation, worsening damage.
- temporary coping may not withstand future rainfall.
- erosion around bunds and dams will deepen over time.
- karezes may collapse further if left unmaintained.
- sedimentation in reservoirs will reduce next season's irrigation water.

Some communities openly feared **"losing the next crop too"** if rehabilitation did not begin promptly.

Delays in rehabilitation deepen vulnerability and may erode trust. This highlights the need for timely mobilization and communication updates.

6.10.5 Community Readiness and Willingness to Cooperate

Successful irrigation rehabilitation often requires community engagement, clearing access paths, supporting contractors, managing temporary water diversions, and maintaining structures post-repair.

Communities demonstrated strong readiness indicators:

- willingness to support construction teams,
- interest in protecting rehabilitated structures,
- commitment to assist with minor works (debris clearing),
- proactive identification of risk-prone sections for engineers.

Farmers repeatedly emphasized:

"We will fully support the rehabilitation; we just want it to start."

Community readiness is high, creating favourable conditions for smooth implementation and long-term sustainability of interventions.

6.11 Integrated Interpretation and Implications for the PDO

The Irrigation Sub-Component baseline presents a clear and consistent picture of severe flood impact, widespread infrastructure degradation, acute livelihood disruption, and heightened climate vulnerability across the 13 sampled districts. Irrigation assets (dams, delay action dams, karezes, bunds, perennial channels, diversion structures, and canal embankments) form the foundation of rural livelihoods in Balochistan. Their damage therefore translates not only into infrastructure failure but into direct economic, social, and environmental losses.

The following synthesis outlines the major cross-cutting insights emerging from the baseline.

6.11.1 Synthesis of Flood Exposure and Damage Patterns

The baseline confirms that:

- All sampled irrigation schemes were exposed to the 2022 floods.
- Exposure varied by hydrological zone but was universally severe.
- Flood forces caused structural damage, functional disruption, and environmental degradation.
- Damage patterns differed by scheme type, but all compromised water regulation and flood protection.

Key cross-cutting observations:

1. Dams and delay action dams suffered overtopping, scouring, and reservoir sedimentation.
2. Channels and perennial irrigation systems were broken, widened, or blocked.
3. Karezes (already fragile systems) collapsed or became clogged.
4. Bunds and embankments experienced breaches and erosion, eliminating protective functions.
5. Canal systems faced structural cracking, reverse flooding, and persistent waterlogging.

Irrigation systems were impacted through both hydraulic forces (overtopping, inflows, backflows) and geomorphic processes (erosion, sedimentation, slippage). The result is a systemic breakdown across all districts.

6.11.2 Functional Impacts on Water Access and Agricultural Production

Flood damage produced severe functional impairments:

- unreliable or zero irrigation water,
- disrupted seasonal cropping patterns,
- reduced fodder and orchard productivity,
- livestock water scarcity,
- significant soil degradation and waterlogging,
- increased labour and financial burden on households.

Agriculture (the backbone of rural income) experienced:

- crop failure,
- delayed sowing,
- poor yields,
- greater reliance on markets, and
- depletion of household savings.

Irrigation failures immediately undermine food security, income generation, and household stability, making recovery extremely difficult without external support.

6.11.3 Heightened Household Vulnerability and Safety Risks

Irrigation damage created persistent hazards:

- unstable embankments and dam walls,
- uncontrolled water flows near homes,
- deep scoured channels and erosion cuts,
- waterlogging in settlements and fields,
- livestock accidents and contamination risks.

These hazards disproportionately affected:

- women responsible for water collection and livestock care,
- youth performing high-risk manual clearing tasks,
- elderly individuals with limited mobility,
- children exposed to unsafe channels and pits.

Irrigation failure creates **3C5-day vulnerability**, not limited to monsoon periods. Communities enter each new season with higher baseline risk.

6.11.4 Absence of Rehabilitation and High Community Readiness

At baseline:

- no formal rehabilitation had begun,
- no machinery had been mobilized,

- no dam, bund, channel, or karez had received official repair.

Yet, communities demonstrated:

- strong awareness of IFRAP,
- urgent demand for rehabilitation,
- willingness to support implementation teams,
- proactive identification of critical risk points.

Rehabilitation under IFRAP will not only address technical needs but will also respond to deep community expectations, reinforcing trust and institutional credibility.

6.11.5 Implications for PDO-1: People Regaining Access to At Least One Essential Service

Although irrigation is not an essential *mobility* service, it is an essential livelihood and food security service.

Rehabilitation will restore:

- access to productive agricultural land,
- access to water for crops and livestock,
- functionality of flood protection bunds that safeguard homes and fields.

For rural households, regaining irrigation functionality is equivalent to regaining access to income, food, and survival systems.

Irrigation rehabilitation will contribute indirectly but significantly to PDO-1 by restoring a critical, life-sustaining service disrupted by the floods.

6.11.6 Implications for PDO-2: People with Enhanced Resilience to Climate Risks

This is where irrigation rehabilitation has maximum impact. By restoring irrigation systems, IFRAP will:

- reduce vulnerability to future floods (through rehabilitated bunds and dams),
- improve water regulation during erratic rainfall,
- strengthen groundwater recharge,
- stabilize agricultural production during climate shocks,
- reduce water insecurity for households and livestock,
- prevent land degradation and soil loss,
- enhance coping capacity across seasons.

Irrigation rehabilitation directly strengthens climate resilience, making households less exposed, more adaptable, and better equipped to withstand future shocks.

The irrigation component will therefore be a major driver of **PDO-2** performance.

6.11.7 Implications for Intermediate Results Indicators (IRIS)

The baseline enables clear measurement of:

- number of irrigation schemes rehabilitated,
- people benefiting from restored water systems,

- land protected by flood protection bunds,
- improved agricultural productivity,
- reduced climate risk exposure.

Because no rehabilitation had begun at baseline, all improvements will be attributable to IFRAP.

6.11.8 Overall Interpretation

The irrigation baseline demonstrates that Component-1 investments will produce high-value, multi-dimensional resilience gains.

Flood damage caused:

- structural instability,
- functional breakdown,
- livelihood losses,
- environmental degradation,
- and persistent safety hazards.

Rehabilitation will restore:

- water security,
- agricultural productivity,
- flood protection,
- village safety,
- and long-term climate resilience.

The Irrigation Sub-Component offers some of the highest returns for climate resilience within IFRAP. Its rehabilitation will contribute meaningfully to both **PDO-1** and **PDO-2**, while stabilizing rural livelihoods across multiple risk-prone districts.

7. UC-LEVEL DEMOGRAPHIC SECONDARY DATA FOR IRRIGATION SCHEMES

For the Irrigation Schemes component, the inclusion of UC-level demographic profiles is particularly important because irrigation infrastructure generally benefits entire agricultural communities rather than only directly surveyed households. Improved irrigation channels, water distribution systems, and flood-resilient water management structures often influence farming productivity, water accessibility, agricultural livelihoods, and climate resilience across broader geographic catchment areas.

The addition of estimated male, female, and youth population data enables the baseline to establish the demographic context of each irrigation intervention area. This information will support endline evaluation in assessing whether project investments resulted in broader improvements in irrigation access, agricultural recovery, livelihood restoration, and resilience outcomes for surrounding communities.

For example, Union Councils such as Huramzai (Pishin), Sharag (Harnai), Sohbatpur Saddar, and Pathar-I (Lasbela) represent relatively large surrounding populations dependent upon irrigation systems for agricultural activities and household livelihoods. During the endline survey, these population benchmarks will help determine whether reconstruction and rehabilitation activities generated proportionate benefits for the wider beneficiary population, including women, youth, and vulnerable farming households.

70- UC-wise demographic secondary data					
UC	District	Estimated Total Population	Estimated Male	Estimated Female	Estimated Youth (15–24 Years)
Karkana	Musakhel	18,500	9,600	8,900	4,000
Batozai	Killa Saifullah	21,000	10,900	10,100	4,600
Zaranda	Ziarat	15,500	8,000	7,500	3,300
Sharag	Harnai	29,005	15,300	13,700	6,200
Jilga	Killa Abdullah	26,500	13,700	12,800	5,800
Huramzai	Pishin	147,844	73,896	73,947	31,000
Sanzala	Pishin	19,000	9,700	9,300	4,100
Mashkaaf	Kachi	17,500	9,100	8,400	3,800
Marghzani/Dhapal	Sibi	16,800	8,700	8,100	3,600
Kanak	Mastung	24,000	12,400	11,600	5,200
MC Ganda Wah	Jhal Magsi	22,000	11,400	10,600	4,700
Baghak batoo	Nushki	20,500	10,600	9,900	4,400
Shumali walapat	Lasbela	23,500	12,100	11,400	5,100
Pathar 1	Lasbela	27,000	14,000	13,000	5,900
Sohbatpur Saddar	Sohbatpur	31,000	16,000	15,000	6,700
Sohbatpur Saddar	Usta Muhammad	29,500	15,200	14,300	6,300
Warad No. 11	Jaffarabad	18,000	9,300	8,700	3,900
Warad No. 3	Jaffarabad	17,200	8,900	8,300	3,700
Quba Shair Khan Sharaki	Nasirabad	25,000	12,900	12,100	5,400
Pathar 1	Lasbela	27,000	14,000	13,000	5,900

Source: Pakistan Bureau of Statistics (PBS) – Population & Housing Census 2023; district and tehsil demographic profiles compiled from Census 2023 administrative population tables.

8. IMPLEMENTATION READINESS, RISK AWARENESS AND MONITORING IMPLICATIONS

8.1 Purpose and Analytical Boundaries of This Section

This section provides an analytical interpretation of baseline findings to support risk awareness and monitoring focus as Component-1 of IFRAP transitions toward physical implementation. It is derived entirely from the evidence documented in the baseline assessment and does not introduce new data, engineering analysis, or implementation judgments.

The purpose of this section is to:

- interpret baseline conditions through a risk and monitoring lens,
- highlight system-level sensitivities observed at baseline,
- identify areas where monitoring attention may be required to safeguard timely achievement of Project Development Objectives (PDOs).

This section does not assess engineering design adequacy, contractor performance, implementation scheduling, or Annual Work Plan feasibility. Such assessments fall outside the scope of a baseline study and are appropriately addressed through supervision missions and regular progress and monitoring reports.

8.2 Baseline-Informed Asset Sensitivity and Criticality Considerations

The baseline assessment confirms that Component-1 assets differ in their functional role, exposure profile, and consequence of failure. From an M&E perspective, these differences influence how delays, partial functionality, or phased rehabilitation may affect PDO measurement and beneficiary outcomes.

Baseline evidence suggests three broad sensitivity dimensions:

- **Service Dependency Sensitivity**

Assets directly linked to access to essential services or livelihood systems exhibit higher sensitivity in PDO-1 measurement. Roads and bridges influence mobility-based services, while irrigation and flood protection assets underpin livelihood continuity and food security.

- **Single-Point Failure Sensitivity**

Certain assets, particularly bridges and town-level flood protection bunds, function as single-point systems with limited or no redundancy. Baseline findings show that failure or prolonged non-functionality of such assets results in complete service disruption rather than partial degradation.

- **Climate Exposure Sensitivity**

Assets located in floodplains, canal command areas, and downstream catchments demonstrate higher exposure to recurring climatic stress. Baseline conditions indicate that prolonged non-rehabilitation may compound vulnerability prior to subsequent rainfall events.

These sensitivity dimensions do not constitute a prioritization or sequencing recommendation. Rather, they provide a contextual lens for interpreting baseline risks and for focusing monitoring attention during implementation.

8.3 Monitoring-Relevant Risk Considerations for Roads Sub-Component

Baseline findings for the Roads Sub-Component indicate complete usability loss across all sampled

locations, driven by multi-layer structural failure and drainage-related vulnerabilities.

From an M&E risk awareness perspective, the following considerations emerge:

- **Persistence of Isolation Risk**

Prolonged baseline inaccessibility directly affects measurement of PDO-1, as access to health, education, markets, and administrative services remains constrained until road functionality is restored.

- **Partial Functionality Sensitivity**

Baseline damage patterns suggest that partial surface restoration without addressing drainage and sub-base conditions may not immediately translate into sustained usability. From a monitoring standpoint, this underscores the importance of distinguishing between nominal reopening and functional accessibility in results reporting.

- **Safety and Vulnerability Considerations**

Baseline evidence highlights heightened safety risks for women, elderly individuals, and youth during periods of road instability. Monitoring frameworks may need to account for safety perception and usage patterns, not only physical completion.

These observations do not prescribe implementation actions but inform how road-related indicators should be interpreted during early stages of rehabilitation.

8.4 Monitoring-Relevant Risk Considerations for Bridges Sub-Component

The baseline confirms that sampled bridges exhibit binary functionality, where damage results in near-total mobility disruption.

From an M&E perspective, key baseline-informed sensitivities include:

- **Immediate PDO Sensitivity**

Restoration of bridge usability is directly linked to PDO-1 outcomes, as households regain access to services almost instantaneously once safe crossing is re-established.

- **Measurement Discontinuity Risk**

During periods where bridge rehabilitation is ongoing but not yet functional, beneficiaries may remain effectively excluded from service access. Monitoring systems should therefore distinguish between construction progress and functional outcomes.

- **Risk Concentration**

Given the absence of alternate crossings documented at baseline, any delay or interruption maintains a high level of beneficiary vulnerability, which may influence interim PDO reporting.

These considerations reinforce the importance of clearly defining “functional restoration” within monitoring instruments, rather than relying solely on physical completion metrics.

8.5 Monitoring-Relevant Risk Considerations for Irrigation and Flood Protection Sub-Component

The irrigation baseline reveals the most complex interaction between infrastructure functionality, livelihoods, and climate resilience.

From an M&E standpoint, several baseline-informed risk considerations are evident:

- **Seasonal Sensitivity of Outcomes**

Baseline findings show that irrigation and flood protection assets are closely tied to agricultural cycles. Delays in restoring functionality may have effects that manifest across seasons rather than immediately, affecting interpretation of livelihood-related outcomes.

- **Dual-Function Asset Sensitivity**

Many irrigation structures also serve protective functions. Baseline evidence indicates that incomplete or delayed restoration may sustain flood exposure risks even where partial water delivery resumes.

- **Livelihood Attribution Complexity**

Agricultural recovery depends on multiple factors beyond infrastructure. Baseline documentation of complete pre-intervention dysfunction establishes a clear attribution point, but monitoring frameworks must remain attentive to timing effects and external climatic variability.

- **Community Readiness as a Moderating Factor**

High community awareness and willingness to cooperate, consistently observed at baseline, represents a positive contextual factor that may influence implementation dynamics but does not substitute for structural rehabilitation.

These observations highlight the importance of interpreting irrigation-related indicators with attention to functional restoration and seasonal timing.

8.6 Implications for Monitoring Alignment with Ongoing Implementation

As Component-1 activities advance under the approved implementation arrangements, the baseline highlights several areas where monitoring attention may be particularly relevant:

- distinguishing physical progress from functional usability,
- tracking beneficiary-level access and protection outcomes alongside construction milestones,
- interpreting early results cautiously where seasonal or climatic factors interact with rehabilitation timelines.

These considerations do not assess implementation performance but support adaptive interpretation of monitoring data, ensuring that PDO progress is neither overstated nor underestimated during transitional phases.

8.7 Contribution of the Baseline to Adaptive M&E and PDO Safeguarding

The baseline establishes a robust pre-intervention reference point characterized by:

- zero rehabilitation activity,
- high service disruption,
- elevated vulnerability and climate exposure.

By documenting these conditions in detail and interpreting them through monitoring and risk-awareness lens, the baseline strengthens IFRAP's ability to:

- attribute observed changes to project interventions,
- identify early warning signals during implementation,
- contextualize progress reporting against pre-existing constraints,
- safeguard the credibility of PDO achievement measurement.

This analytical overlay enhances the usability of the baseline for ongoing M&E while preserving its core function as a pre-intervention diagnostic.

ANNEXURES

ANNEXURE-A: DISTRICT-WISE BASELINE SURVEY SAMPLE

District	Irrigation	Roads	Bridge	Overall
Harnai	1	0	0	1
Jaffarabad	1	0	0	1
Jhal Magsi	1	1	0	2
Kachi	1	0	0	1
Killa Abdullah	1	0	0	1
Killa Saifullah	1	0	0	1
Lasbela	2	0	0	2
Mastung	1	0	0	1
Musakhel	1	0	0	1
Nasirabad	1	0	0	1
Nushki	1	0	0	1
Pishin	1	0	0	1
Quetta	0	0	1	1
Sibi	1	0	0	1
Sohbatpur	1	1	0	2
Ziarat	1	0	0	1
Overall	16	2	1	19

ANNEXURE-B: SCHEME-WISE SAMPLE LIST

Sr.#	Date of Visit	District	Irrigation Scheme Name	Beneficiary Name
1	10/17/2025	Musakhel	Gargoji perennial irrigation scheme	Sikandar Hayat
2	10/15/2025	Killa Saifullah	Toiwer Batozai Dam FIS	Sharaf Uddin
3	10/17/2025	Musakhel	Gargoji perennial irrigation scheme	Noor Jahan bibi
4	10/15/2025	Killa Saifullah	Toiwer Batozai Dam FIS	Meerjawa
5	10/13/2025	Ziarat	Peechi Dam	Bibi Suofora
6	10/13/2025	Ziarat	Peechi Dam	Malik Muhammad Ghous
7	10/12/2025	Harnai	Zarkhail Delay Action Dam, Shahrag	Bibi Malala
8	10/12/2025	Harnai	Zarkhail Delay Action Dam, Shahrag	Abdul Wahad
9	10/8/2025	Killa Abdullah	Mako Katch Dam	sultan Muhammad
10	10/8/2025	Killa Abdullah	Mako Katch Dam	Bibi shereen
11	10/9/2025	Pishin	Sanzala karez	Abdullah
12	10/9/2025	Pishin	Sanzala karez	Ameer hamza
13	10/7/2025	Kachi	Khumbari Dam	Umeed Ali
14	10/7/2025	Sibi	Flood Protection along Nari River at Ghulam Bolak Area Sibi	Sasi
15	10/7/2025	Sibi	Flood Protection along Nari River at Ghulam Bolak Area Sibi	Muhammad raiq
16	10/7/2025	Sibi	Flood Protection along Nari River at Ghulam Bolak Area Sibi	Ghulam Rasool
17	10/7/2025	Sibi	Flood Protection along Nari River at Ghulam Bolak Area Sibi	Pari Gul
18	10/5/2025	Mastung	That Dam	Abdul Fatha
19	10/5/2025	Mastung	That Dam	Naz hatoon
20	10/5/2025	Mastung	That Dam	Bi bi Saiqa
21	10/5/2025	Mastung	That Dam	Abdul Ghafoor
22	10/5/2025	Jhal Magsi	Restoration of Flood Protection Bund Gandawah Town Left and Right side	Mukhtiar Begum
23	10/5/2025	Jhal Magsi	Restoration of Flood Protection Bund Gandawah Town Left and Right side	Abdul Malik
24	10/5/2025	Jhal Magsi	Restoration of Flood protection bund Gandawah Town Left and Right Side	Zulakha
25	10/5/2025	Jhal Magsi	Restoration of Flood protection bund Gandawah Town left and right Side	Naimatullah
26	10/4/2025	Nushki	Azdaghol Dam	Jamaiti
27	10/4/2025	Nushki	Azdaghol Dam	Jaleel Ahmed
28	10/4/2025	Nushki	Azdaghol Dam	Bi bi Shaida
29	10/4/2025	Nushki	Azdaghol Dam	Muhammad Alim
30	10/4/2025	Lasbela	Thrara Flood Protection Bund	Abdul Rahim
31	10/4/2025	Lasbela	Thrara Flood Protection Bund	Abdul Hameed
32	10/3/2025	Sohbatpur	Flood Protection bund for Sohbatpur town	Banazir bibi
33	10/3/2025	Sohbatpur	Flood Protection bund for Sohbatpur town	Sobadar khan
34	10/3/2025	Sohbatpur	Flood Protection bund for Sohbatpur town	Zareena bibi
35	10/3/2025	Sohbatpur	Flood Protection bund for Sohbatpur town	Horan Khan
36	10/3/2025	Jaffarabad	Protection Band	Ahmad Ali
37	10/3/2025	Jaffarabad	Protection Band	Imam khatoon
38	10/3/2025	Jaffarabad	Protection Band	Rafiq Ahmed
39	10/3/2025	Jaffarabad	Protection Band	Zahida
40	10/3/2025	Nasirabad	Restoration/ strengthening Flood embankment of Patfeedar Canal RD 455 to RD 505	Dad Ali
41	10/3/2025	Nasirabad	Restoration/ strengthening Flood embankment of Patfeedar Canal RD	Wali Muhammad

Sr.#	Date of Visit	District	Irrigation Scheme Name	Beneficiary Name
			455 to RD 505	
42	10/3/2025	Lasbela	Restoration of Lasbela canal	Ghos bux Gujjar
43	10/3/2025	Nasirabad	Restoration/ strengthening Flood embankment of Patfeedar Canal RD 455 to RD 505	Naza
44	10/3/2025	Nasirabad	Restoration/ strengthening Flood embankment of Patfeedar Canal RD 455 to RD 505	Mai Mema
45	10/3/2025	Lasbela	Restoration of Lasbela canal	Zubair Gujjar
Bridge				
1	10/4/2025	Jhal Magsi	Black Top Road Nautal to Ghandawah Jhal Magsi	Muhammad Akbar
2	10/4/2025	Jhal Magsi	Black Top Road Nautal to Ghandawah Jhal Magsi	Malka
3	10/4/2025	Jhal Magsi	Black Top Road Nautal to Ghandawah Jhal Magsi	Ali Nawaz
4	10/4/2025	Jhal Magsi	Black Top Road Nautal to Ghandawah Jhal Magsi	Giran Naaz
5	10/4/2025	Sohbatpur	Sohbatpur Road, Dera Allah yar to Hairdeen via Sohbatpur	Umair ali
6	10/4/2025	Sohbatpur	Sohbatpur Road, Dera Allah yar to Hairdeen via Sohbatpur	Abdul fatah
7	10/4/2025	Sohbatpur	Sohbatpur Road, Dera Allah yar to Hairdeen via Sohbatpur	Ali Haider
8	10/4/2025	Sohbatpur	Sohbatpur Road, Dera Allah yar to Hairdeen via Sohbatpur	Shanwaz Khan
Road				
1	10/6/2025	Quetta	Killi shah Alam nawa killi	Bibi Sahib Jana
2	10/6/2025	Quetta	Killi shah Alam nawa killi	Shah Alam
3	10/4/2025	Quetta	Ahmadabad kuchlak Quetta	Shamsullah
4	10/4/2025	Quetta	Ahmadabad kuchlak Quetta	Asif khan