FLOOD FIGHTING PLAN 2026:

PANJNAD HEADWORKS

Subject:

Strategic Framework of Readiness, Response, and Rehabilitation at Panjnad Headworks for Flood Event of 2026

Location:
Panjnad Headworks, Tehsil Alipur, Muzaffargarh

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INRODUCTION OF THE FLOOD FIGHTING PLAN 2026: PANJNAD HEADWORKS

1.1 Objectives of Flood Fighting Plan 2026: Panjnad Headworks

EXECUTIVE SUMMARY:

"The bend in the road is not the end of the road unless you fail to make the turn."

— Helen Keller

The *Flood Fighting Plan (FFP) 2026* emerges as the logical continuation of the 2025 post-flood experience — a transformation of lessons into action, and of reflection into readiness. The Super Flood of 2025 was not merely a natural event; it was a full-scale test of design integrity, operational preparedness, and institutional coordination at the Panjnad Headworks. It reaffirmed a timeless truth — that while reactive heroism may win the moment, only engineered reactiveness secures the future.

The 2025 event served as both a crucible and a revelation. It proved that the main barrage stood resilient, but the protective ecosystem surrounding it—its embankments, bunds, and allied structures—remained critically vulnerable. The trial exposed how sediment accretion, Bella formation, and constricted waterways transformed tailwater behavior and challenged outdated design assumptions. It reminded us that *"a chain is only as strong as its weakest link."* The performance gap between design and reality underscored the need for comprehensive hydraulic and morphological reassessment, compelling us to reimagine flood resilience as a systemic, not singular, attribute.

The lessons of 2025 are unambiguous: preparation is not an act of convenience but of necessity. The meticulous pre-monsoon inspections, material stockpiling, and coordinated responses validated that *"an ounce of prevention is worth a pound of cure,"* and that *"he who is well prepared has half won the battle."* Vigilance, not valor, proved to be the true currency of survival. Yet, amid the storm, field teams exemplified extraordinary courage and technical improvisation—often applying "technical tourniquets" to stabilize critical structures—illustrating that *"for want of a nail the shoe was lost."*

FFP 2026 transforms these hard-won lessons into doctrine. It adopts a forward-looking strategy centered on anticipation rather than reaction, emphasizing real-time monitoring, sediment management, embankment strengthening, and institutional readiness. It embodies the guiding wisdom that *"heroism should be a last resort, not a standard operating procedure,"* and advances a framework where science replaces chance, and planning replaces panic. Through digital monitoring, predictive modeling, and capacity building, the Plan operationalizes the principle that *"you cannot manage what you cannot measure."*

Just as the post-flood 2025 report emphasized, *"a stitch in time saves nine."* The FFP 2026 prioritizes proactive structural rehabilitation, the recalibration of freeboard levels, and reinforcement of historically weak reaches along the marginal and flood bunds. It aligns with the builder's wisdom that *"fixing the*

foundation is cheaper than rebuilding the house," ensuring that the protective ring around Panjnad is strengthened before the next test.

Institutionally, the plan also carries forward the spirit of unity and shared responsibility that defined the 2025 response. The teamwork across departments and agencies reaffirmed that *"if you want to go fast, go alone. If you want to go far, go together."* This collective ethos forms the cornerstone of the 2026 preparedness framework, where coordination, communication, and command coherence are paramount.

In essence, the *Flood Fighting Plan 2026* is not merely a document—it is a commitment. It embodies the principle that *"a wise man learns from his mistakes, but a wiser man learns from the mistakes of others."* It is a pledge that the courage of 2025 will mature into the competence of 2026.

As the Dutch proverb reminds us, *"You can't stop the waves, but you can learn to surf."* The FFP 2026 ensures that Panjnad does just that—transforming every lesson of adversity into an architecture of resilience. For, in the end, *"we did not inherit this land from our ancestors; we are borrowing it from our children."*

PART-A

CHAPTER 1

SALIENT FEATURES OF THE PANJNAD HEADWORKS



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SALIENT FEATURES OF THE PANJNAD HEADWORKS

1.1. Location of Panjnad Headworks
Strategic, Geographical, and Hydrological Significance of Panjnad Headworks
1.2 General Description
Historical Context and Commissioning Timeline of Panjnad Headworks
Structural Evolution and Key Components
Salient Features of Panjnad Headworks and its Allied Flood Protection Embankments
1.3 Administrative Setup / Organizational Chart

1.1 LOCATION OF PANJNAD HEADWORKS

The Panjnad Headworks, located in Alipur Tehsil of District Muzaffargarh (29.3469° N, 71.0196° E), is a critical infrastructure asset of the Punjab Irrigation Department, functions as a cornerstone of the Indus Basin Irrigation System. Its strategic importance and operational history are deeply rooted in its unique location and the continuous evolution of its design to meet hydrological challenges.

The Panjnad, meaning "five rivers" in Persian, is the name given to the river formed by the sequential confluence of the five major tributaries of the Indus Plain—the Jhelum, Chenab, Ravi, Beas, and Sutlej. It is called so because it marks the final point where these five great rivers, having drained the vast Punjab region (itself meaning "Land of Five Rivers"), merge their waters into a single channel near the town of Panjnad in Pakistan. This united river then flows a short distance further to finally join the mighty Indus River near Sarki Rakh, Kot Mithan Sharif, Rajanpur.

STRATEGIC, GEOGRAPHICAL, AND HYDROLOGICAL SIGNIFICANCE OF PANJNAD HEADWORKS:

Strategic Significance:

Panjnad Headworks serves as the final hydraulic control structure governing the distribution of water resources for agriculture, drinking water, and industrial use across Southern Punjab, making it vital for regional food security and economic stability.

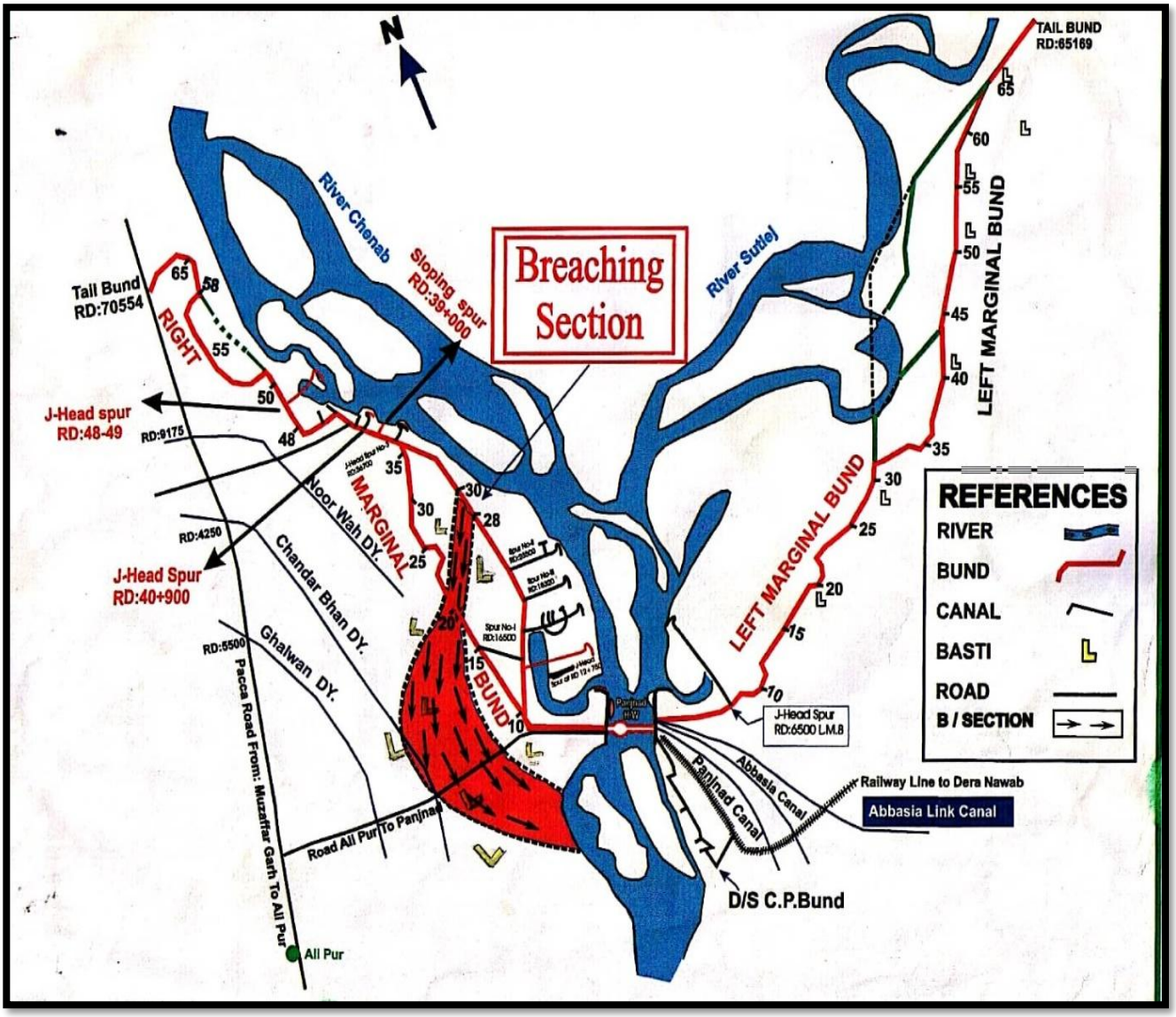
Geographical Significance:

The headworks occupies a crucial geographical position immediately downstream of the confluence of the Chenab and Sutlej rivers, serving as the terminal hydraulic control on the Chenab River before its flows merge with the Indus River downstream of Taunsa & Panjnad Headworks near Sarki Rakh, Kot Mithan Sharif.

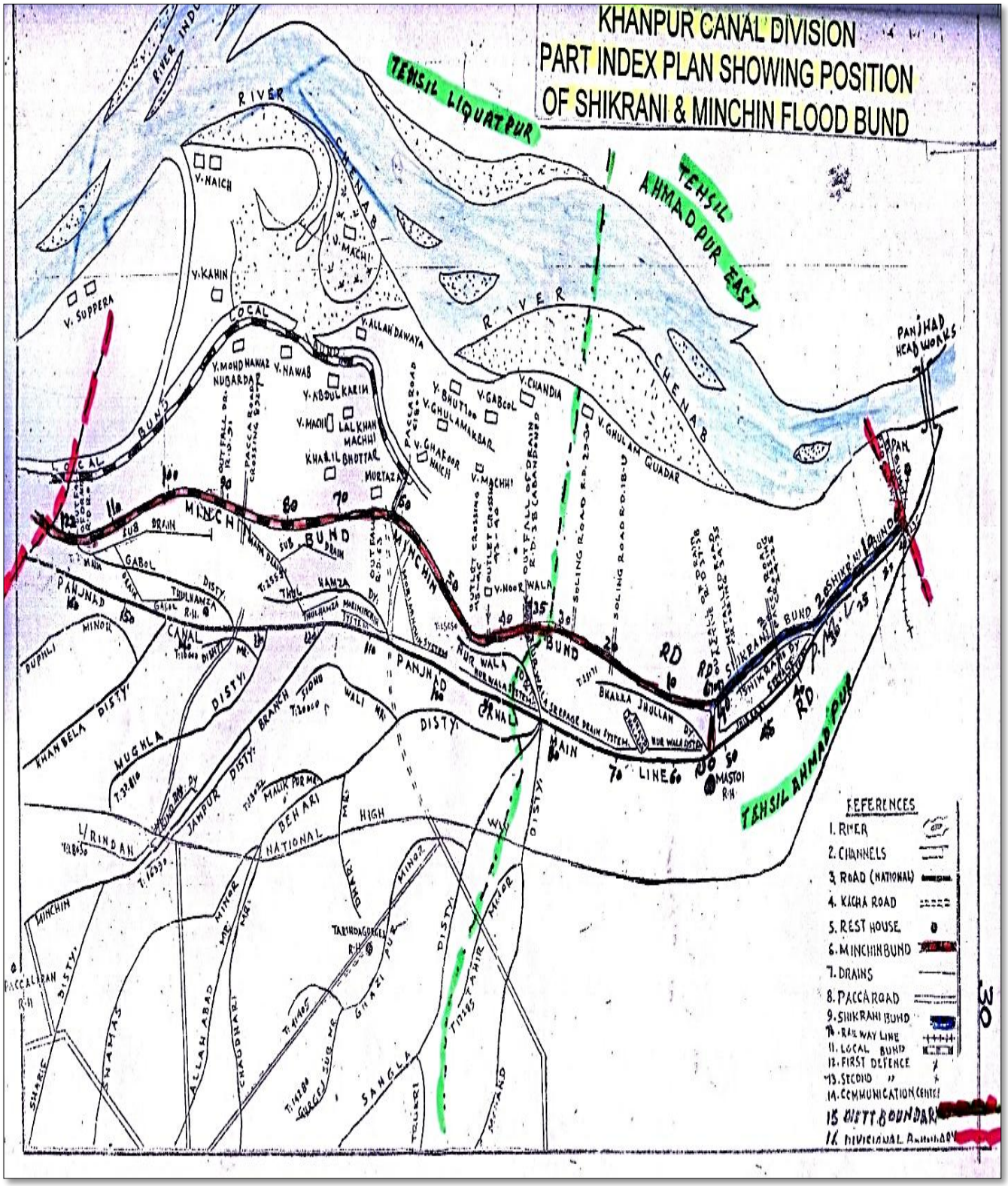
Hydrological Significance:

The structure regulates the combined flows of five major rivers of the Punjab - Jhelum, Chenab, Ravi, Sutlej, and Beas - making it one of the most hydrologically significant structures in Pakistan's irrigation network. The Chenab River, originating in Himachal Pradesh, India, accumulates flows from the Jhelum

and Ravi before joining the Sutlej, which itself originates in Tibetan plateau. This unique convergence of multiple river systems at a single control point makes Panjnad Headworks the ultimate arbiter of water distribution for this complex river basin system.



LOCATION MAP OF PANJNAD HEADWORKS (UPSTREAM SIDE)



LOCATION MAP OF PANJNAD HEADWORKS (DOWNSTREAM SIDE)

1.2 GENERAL DESCRIPTION OF PANJNAD HEADWORKS

The Panjnad Headworks is a critical and complex irrigation and flood management system that has undergone significant evolution to meet growing hydraulic demands. Originally constructed between 1925-1929 with a capacity of 450,000 cusecs, its design was proven inadequate within its first year by a major flood, leading to an immediate first upgrade by 1932 that expanded its capacity to 700,000 cusecs by adding an annexe weir. The most comprehensive modernization occurred nearly a century later with the Trimmu-Panjnad Barrage Improvement Project (TPBIP) from 2019-2022. This major rehabilitation was a direct response to the structure's age and vulnerabilities exposed by historic super-floods. The project dramatically increased the design flood capacity to 865,000 cusecs by constructing three new depressed bays, implemented crucial structural strengthening with RCC overlays and new sheet piles, and introduced operational modernizations including a complete gate replacement and a state-of-the-art SCADA system for remote monitoring. Concurrently, extensive remodeling of marginal and flood protection bunds was undertaken to align with the new, higher flood levels. However, despite these extensive improvements, a critical vulnerability persists, as not all associated river training structures have been raised to match the headworks' enhanced discharge capacity, creating a residual risk that requires urgent attention to ensure complete system resilience.

HISTORICAL CONTEXT AND COMMISSIONING TIMELINE OF PANJNAD HEADWORKS:

A. COMMISSIONING & FIRST UPGRADE

Original Commissioning (1925-1929):
The Headworks was originally constructed during this period under Sutlej Valley Project with an initial design discharge capacity of 450,000 Cusecs and an upstream High Flood Level (HFL) of RL 341.50 feet.

The First Major Upgrade (1932):
Shortly after its inauguration, the Headworks faced a severe test in September 1929, when a flood of 550,000 Cusecs occurred. This event immediately exposed the inadequacy of its original design. Consequently, a major capacity enhancement was undertaken, completed around 1932, which involved adding 14 new bays (currently Bays No. 37 to 50) on the right side of the headworks. This expansion increased its discharge capacity to 700,000 Cusecs, while maintaining the original HFL. These new bays were separated from the original structure by a 250-foot wide earthern Junction Groyne.

B. THE LATEST CHAPTER: TPBIP REHABILITATION (2019-2022):

Acknowledging the structure's age and vulnerabilities exposed by historic super-floods (1973, 1992), the Trimmu-Panjnad Headworks Improvement Project (TPBIP) was executed. The following major/key structural components of the civil and hydraulic works of the Barrage have been re-designed and also executed by the Contractor:

- a Reinforced Cement Concrete (RCC) overlay of 6” thickness placed on the upstream floor and the glacis, the crest, downstream glacis and the downstream impervious floor of the existing sections of the Barrage;
- addition of sheet piles in the upstream Left Pocket;
- extension of downstream impervious floor in Left Pocket, Main Weir and Annexe Weir;
- addition of downstream concrete block and Stone Apron in Left Pocket, Main weir and Annexe Weir;
- rehabilitation/remodelling of the Head Regulators of the Panjnad, Abbasia and Abbasia Link Canals;
- construction of a set of three (3) No. of additional Depressed Bays in place of existing Junction Groyne; as consequence, this Junction Groyne has been fully dismantled;
- construction of the downstream right and left abutment and flared-out walls and abutment walls of the 3 additional Depressed Bays;
- dismantling of existing Junction Groyne;
- construction / replacement of the upstream Divide Wall of Left Pocket at Pier No. 6 instead of the existing location at Pier No. 4;
- construction/rehabilitation/renovation of office and buildings for the staff of Irrigation Department (Colony premises).

Enhanced Flood Security: To increase the design flood capacity from 700,000 Cusecs to 865,000 Cusecs (a 1-in-100-year event). This was achieved by construction of depressed bays at RL. 322 instead of 325-ft of mein weir and annexe weir. The HFL was raised to 343.03-ft.

Structural Strengthening: This included a 6-inch RCC overlay on existing floors, the addition of new upstream and downstream sheet piles, and extensive repairs to aprons and floors.

Operational Modernization: The project involved a complete replacement of gates and hoists, and the installation of a state-of-the-art SCADA (Supervisory Control and Data Acquisition) system for remote operation and monitoring from a dedicated Control Room building.

Remodeling of Marginal and Flood Bunds: The comprehensive flood protection system at Panjnad Headworks underwent significant upgrades through two major initiatives. The Left and Right Guide Banks were rehabilitated under the TPBIP project, while the remodeling of the Left and Right Marginal Bunds and associated flood embankments was executed from 2020 to 2022 under the Disaster and Climate Resilience Improvement Project (DCRIP) by the Project Implementation Unit. These works were essential to address the revised hydraulic conditions established by TPBIP, which elevated the design Highest Flood Level to 343.03 ft. The primary objective was to enhance structural integrity and ensure long-term safety in accordance with Federal Flood Commission standards, incorporating detailed geotechnical analysis of soil strata and slope stability considerations. The comprehensive effort included restoration of wetting channels to design specifications and upgrading of the Colony Protection Bund to maintain a 7-foot freeboard above tail-water level.

However, critical gaps remain in the flood protection system. The PIU's scope was limited to the shank portion of river training works, leaving the stone-pitched portion of J-head spurs unaddressed and vulnerable during high flood events. Furthermore, not all river training structures have been raised to align with the enhanced discharge capacity of Panjnad Headworks, creating residual risks that require urgent attention to ensure complete system resilience.

TABLE: HISTORY AND EVOLUTION OF PANJNAD HEADWORKS

PHASE	PERIOD / YEAR	PROJECT / EVENT	KEY FEATURES	DESIGN PARAMETERS
Original Commissioning	1925–29	Sutlej Valley Project	• Construction of Panjnad Headworks for irrigation and flood regulation • Main weir with 33 bays	• Capacity: 450,000 Cusecs • HFL: RL 341.50 ft
First Major Upgrade	1929-32	Post-1929 Flood Expansion	• Added 14 bays (currently No. 37–50) called Annexe weir on right side of Main weir; • built 250 ft Junction Groyne in between Main & Annexe wiers for improved flood passage.	• Capacity: 700,000 Cusecs • HFL: RL 341.50 ft
Rehabilitation	2019-22	Trimmu–Panjnad Barrage Improvement Project (TPBIP)	• Modernization and structural strengthening; • Three depressed bays at RL 322 ft; • HFL raised to 343.03 ft for higher discharge capacity	• Capacity: 865,000 Cusecs • HFL: RL 343.03 ft

STRUCTURAL EVOLUTION AND KEY COMPONENTS:

The headworks is not a single structure but a complex comprising several key elements that have been modified over time:

The Headworks Sections: The structure is divided into distinct sections:

- **Left Pocket:** Originally 4 bays, later expanded to 6 (from no. 01 to 06) bays during rehabilitation to improve silt management.

- **Main Weir:** The original 26-bay (from no. 07 to 33) core of the structure.

- **Additional / Depressed Bays:** Three new bays (from no. 34-36) constructed during the recent TPBIP rehabilitation (2019-2022), replacing the old Earthern Junction Groyne. These have a lower crest level (RL 322.00 ft) to enhance discharge capacity from 7,00,000 Cs to 8,65,000 Cs.

- **Annexe Weir:** The 14 bays (currently from no. 37-50) added in the 1932 upgrade.

The Divide Wall: The existing Divide Wall at Panjnad Headworks, originally an 800 ft long stone masonry structure with a rounded upstream nose, was later extended by 160 ft at the time of Abbasia Link Canal commissioning, including a 115 ft Fish Ladder. The wall, now totaling 960 ft in length, stands 26 ft high with a variable width—5 ft at the top, 7.5 ft midsection, and 13 ft at the base—resting on well foundations and protected by a stone apron at RL 320.0 ft.

Over time, structural deterioration occurred, notably a 201 ft collapse in 1988 due to deep scour, repaired with temporary stone-filled gabion boxes. Subsequent gabion extensions, including the 160 ft portion added in 1992, have also weakened due to corrosion, loss of stones, and settlement-induced cracking. Currently, about 360 ft of the Divide Wall exists as degraded gabion structure.

Under the Trimmu–Panjnad Headworks Improvement Project (TPBIP), consultants proposed relocating the Divide Wall from Pier No. 4 to Pier No. 6, thereby enlarging the left under-sluice pocket from four to six bays in line with the *Manual of Irrigation Practices (2017)*. As per report of PMO Barrages for TPBIP, the existing wall was supposed to be dismantled in a controlled manner after constructing the new one, while the Fish Ladder—extending 115 ft upstream—would be retained in serviceable condition and integrated with the new design.

SALIENT FEATURES OF PANJNAD HEADWORKS AND ITS ALLIED FLOOD PROTECTION EMBANKMENTS

I. SALIENT FEATURES OF UPGRADED PANJNAD HEADWORKS

Features	Units	Left Pocket Bays 1-6	Main Weir Bays 7-27	Additional Bays 1-3	Annexe Weir Bays 1-14
Maximum Designed Discharge Capacity	Cusecs	102,394	460,773	62,913	238,920
Maximum Designed Discharge Capacity through the Barrage	Cusecs	865,000			
Total No. of Bays	No.	6	27	3	14
Width of each bay	ft.	60	60	60	60
Pier Thickness	ft.	7	7	7	7
Pier Top at Nose	ft.	349.50	349.50	349.50	349.50
Total width	ft.	417	1,802	250	931
Clear Water Way	ft.	360	1,620	180	840
Max. U/S Flood Level	ft.	343.03	343.03	343.03	343.03
Max. D/S Flood Level	ft.	342.02	342.02	342.02	342.02
Summer Pond Level	ft.	338.50	338.50	338.50	338.50
Winter Pond Level	ft.	337.50	337.50	337.50	337.50
Weir Crest level	ft.	325.00	325.00	322.00	325.00
Weir Crest Width	ft.	4*/8.58**	4*/8.58**	6.50	4*/8.58**
U/S Floor level	ft.	320.00*/320.50**	320.00*/320.50**	320.50	320.00/320.50**
D/S Floor Level	ft.	316.00*/316.50**	316.00/316.50**	311.00	315.00/315.50**
U/S Glacis Slope	-	1 in 4	1 in 4	1 in 4	1 in 4
D/S Glacis Slope	-	1 in 5	1 in 5	1 in 5	1 in 5
U/S Glacis Length	ft.	20*/18**	20*/18**	6	20*/18**
D/S Glacis Length	ft.	45*/42.50**	45*/42.50**	55	50*/47.50**
U/S Stone Apron (Length/Thickness)	ft.	50/4	50/4	122/4.50	50/4
D/S Stone Apron (Length/Thickness)	ft.	75/4.50	75/4.50	184/4.50	75/4.50
U/S Floor Length	ft.	95	93	60.75	50
D/S Floor Length	ft.	44*/106**	44*/106**	120	39*/106**
U/S Block Apron Length	ft.	18	18	38.50	22
D/S Block Apron Length including Toe Wall	ft.	50.17	50.17	56.00	50.17
Bottom Elevation of Sheet Piles					
U/S 1st Sheet Pile	ft.	296.00	298.00	286.25	298.00
U/S 2nd Sheet Pile	ft.	292.00	292.00	286.25	298.00
D/S 1st Sheet Pile	ft.	288.50	288.50	274.50	292.00
DS 2nd Sheet Pile	ft.	283.00	283.00	274.50	283.00

Features	Units	Left Pocket Bays 1-6	Main Weir Bays 7-27	Additional Bays 1-3	Annexe Weir Bays 1-14
Gate Data					
Gate Type	-	Vertical Lift Stoney Type	Vertical Lift Stoney Type	Fixed Wheel Type	Vertical Lift Stoney Type
Maximum Design Head	ft.	19.34	19.34	22.34	19.34
Height of Gate	ft.	13.50	13.50	16.50	13.50
Width of Gate	ft.	60.00	60.00	60.00	60.00
Gate Crest Elevation	ft.	325.00	325.00	322.00	325.00
Bottom Level Fully Up	ft.	346.60	346.60	342.00	346.60
Top Level Fully Down	ft.	338.50	338.50	338.50	338.50

* Levels and dimensions prior to 6" thick concrete overlay.

** Levels and dimensions after 6" thick concrete overlay.

II. SALIENT FEATURES OF THE DIVIDE WALL

Sr. No.	Description	Unit	Left Pocket
1	Top Level	ft.	346.00
3	Length (including 115-ft Fish Ladder)	ft.	960
5	Width	ft.	5' at top 1/3rd height, 7.5 ft middle 1/3rd , 13 ft bottom
6	Fish Ladder	no.	1
7	Top Width including Fish Ladder	ft.	22

III. SALIENT FEATURES OF THE ARTERIAL ROAD BRIDGE

Sr. No.	Description	Unit	Sections			
			Left Pocket	Main Weir	Additional Bays	Annexe Weir
1	Top Level	ft.	352.25			
2	Span of Each Bay C/C	ft.	67.00			
3	Width including Footpath	ft.	29.50			

IV. SALIENT FEATURES OF THE THREE OFF-TAKING CANALS HEAD REGULATOR

Off-taking Canals	Units	Panjnad Canal	Abbasia Canal	Abbasia Link Canal
Full Supply Discharge	Cusecs	10,484	1,394	5,600/7,100^
Crest Level	ft.	332.50	330.00	330.00
U/S Floor Level	ft.	320.50	320.00	320.00
D/S Floor Level	ft.	325.00 (Bay No. 1-8) 324.50 (Bay No. 9-11)	328.70	323.00
Design Full Supply Level	ft.	335.70	336.30	335.40
Design Bed Level	ft.	324.20	328.50	325.90
Design Full Supply Depth	ft.	11.50	7.80	9.50
No. of Bays	No.	12	2	6
Width of Each Bay	ft.	26 (Bay No. 1-5 & 8-12) 18 (Bay No. 6-7)	20	25
Thickness of Pier	ft.	4	4	5
Clear Water Way	ft.	296	40	150

Off-taking Canals	Units	Panjnad Canal	Abbasia Canal	Abbasia Link Canal
Width Abutment	ft.	340	44	175
D/S Glacis Slope		1:6	Vertical Fall	1:5
D/S Floor Length	ft.	63.25 (Bay No. 1-8) 57.25 (Bay No. 9-12)	100	39*/70**
D/S Block Apron	ft.	15.83	25	20.33
D/S Stone Apron (Length/Thickness)	ft.	Varies	25/4.00	53.50/4.00
Design Bed Width	ft.	245.00	74.00	168.00
Gates Data				
Type	—	Fixed Wheel	Fixed Wheel	Fixed Wheel
Height of Gate	ft.	6.00	8.50	8.50

^ Future enhanced Design Discharge of Abbasia Link Canal

V. SALIENT FEATURES OF THE GUIDE BANKS

Sr. No.	Description	Unit	Value
U/S Left Guide Bank			
1	Length	(ft.)	3600.00
2	Top level	(ft.)	353.00 (start) 353.00 (Nose)
3	Top width	(ft.)	30.00 (Stem) 33.50 (Nose)
D/S Left Guide Bank			
1	Length	(ft.)	605.00
2	Top level	(ft.)	348.00
3	Top width	(ft.)	25.00
U/S Right Guide Bank			
1	Length	(ft.)	3600.00
2	Top level	(ft.)	353.00 (Start) 353.00 (Nose)
3	Top width	(ft.)	30 (Stem) 33.50 (Nose)
D/S Right Guide Bank			
1	Length	(ft.)	605.00
2	Top level	(ft.)	348.00
3	Top width	(ft.)	25

VI. SALIENT FEATURES OF THE MARGINAL BUNDS

Parameter	Units	Left Marginal Bund	Right Marginal Bund
Length	**ft.**	**68,000**	**70,554**
Top Level U/S End	**ft.**	**361.30**	**360.24**
Top Level D/S End	**ft.**	**353.20**	**353.20**
Top Width	**ft.**	**25**	**25**
Free Board	**ft.**	**7**	**7**
Side Slope (River Side)	**—**	**3H:1V**	**3H:1V**
Side Slope (Country Side)	**—**	**2H:1V**	**2H:1V**
Wetting Channel			
Length	**ft.**	**63,000**	**46,000**

Top Width	**ft.**	**6**	**6**
Bed Width	**ft.**	**3**	**3**
Water Depth	**ft.**	**4.5**	**4.5**
Free Board	**ft.**	**3 ft above HFL**	**3 ft above HFL**
Side Slope (River Side)	**—**	**3H:1V**	**3H:1V**
Side Slope (Country Side)	**—**	**2H:1V**	**2H:1V**
Top level U/S end	**ft.**	**357.30**	**356.40**
Top level D/S End	**ft.**	**347.74**	**347.84**

VII. SALIENT FEATURES OF THE DOWNSTREAM EMBANKMENTS / FLOOD BUNDS

Parameter	Units	Colony Protection Flood Bund	Shikrani Flood Bund	Minchin Flood Bund
Length	ft.	17,600	40,000	1,15,300
Top Width	ft.	25	25	25
Free Board	ft.	7	7	7
Side Slope (River Side)	—	3H:1V	3H:1V	3H:1V
Side Slope (Country Side)	—	2H:1V	2H:1V	2H:1V
Total Length (CPB+SFB+MFB)			**1,72,900 ft**	**34.58 Canal Miles**

TOTAL LENGTH OF ALL THE BUNDS & THEIR ALLIED STRUCTURES:

EMBANKMENT / STRUCTURE	LENGTH (Ft)	LENGTH (CANAL MILES)
Guide Bunds (RGB +LGB)	8,410	1.682
Marginal Bunds (RMB+LMB)	1,38,554	27.711
Retired Right Embankment (RRE)	25,230	5.046
D/S Flood Bunds (CPB+SFB+MFB)	1,72,900	34.58
All 21 River Training Structures (14-RMB **+** 01-LMB **+** 06-CPB)	46520	9.304
GRAND TOTAL	**3,91,614**	**78.323**

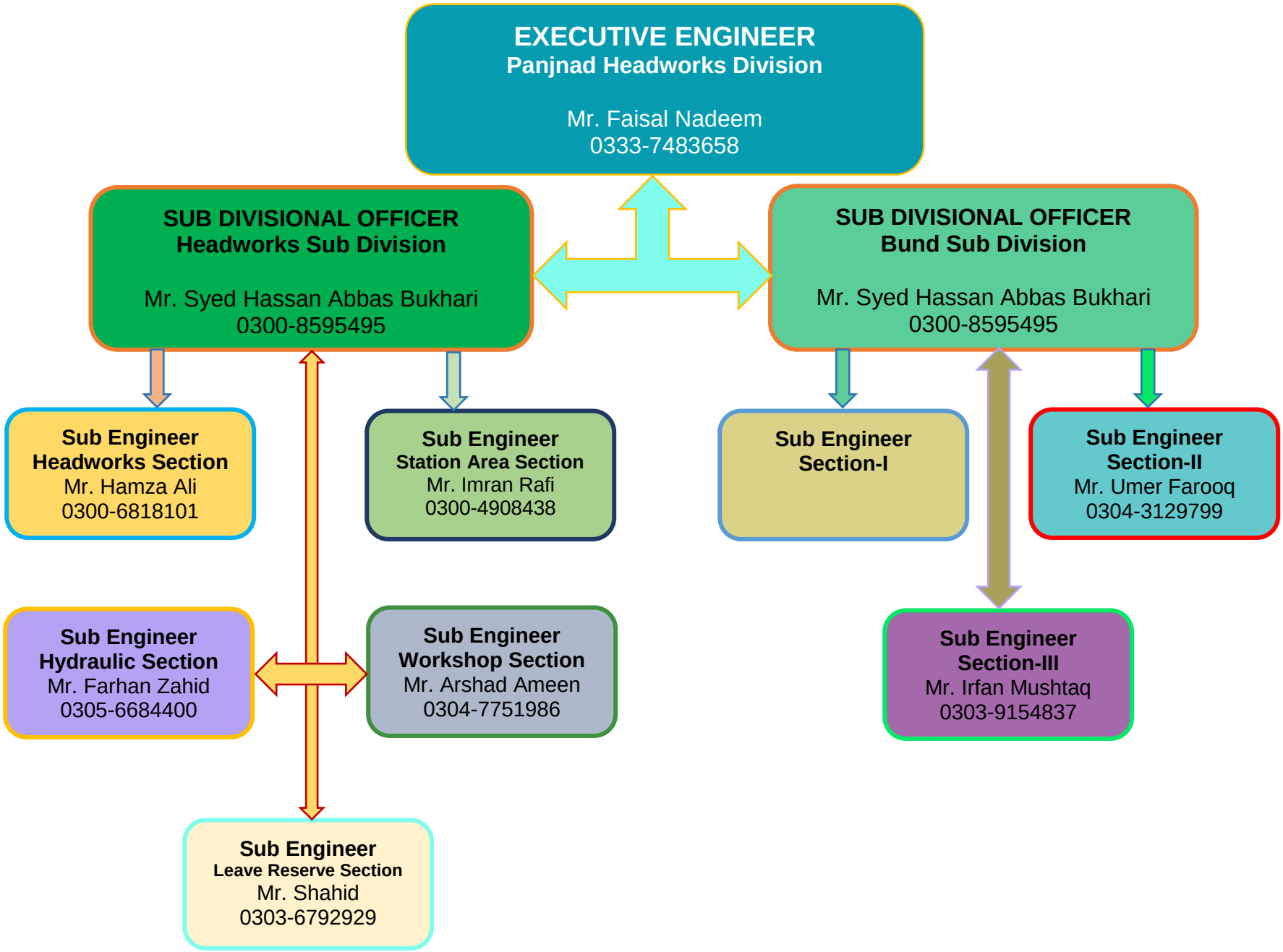
VIII. SALIENT FEATURES OF ALL THE RIVER TRAINING WORKS

Sr. No.	RD	Type	Length		Top RL (ft.)	NSL (ft.)	Height (ft.)	Width (ft.)	Side Slope
			(ft.)	Canal Miles					
a)	**Along RMB**								
1.	12+750	J. Head	7550	1.51				25	**For Earth work:** 1V:3H (River side) 1V:2H (Country side) **For stone work:** 1V:2H
2.	16+500	J. Head	5550	1.11	351.85	338.05	13.8	25	
3.	18+320	J-Head	4423	0.8846	352.05	336.29	15.76	25	
4.	23+500	J-Head	5282	1.0564	353.09	337.04	16.05	25	
5.	36+700	J-Head	1582	0.3164	353.13	340.02	13.11	25	
6.	39+000	Sloping	325	0.065	353.5	339.05	14.45	25	
7.	40+900	J-Head	1440	0.288	355.55	339	16.55	25	
8.	41+500	Sloping	380	0.076	355.93	340.02	15.91	25	
9.	42+200	Mole Head	577	0.1154	352	342.23	9.77	25	
10.	43+000	Sloping	626	0.1252	352	341.51	10.49	20	
11.	48-49 48+600	J-Head	5600	1.12	358	341.25	16.75	25	
12.	53+600	Sloping	780	0.156	356.95	342.05	14.9	25	
13.	55+000	Sloping	908	0.1816	356.95	342.57	14.38	25	
14	56+000	Sloping	1302	0.2604	356.95	342.38	14.57	25	
		Total	**36325**	**7.265**					
b)	**Along LMB**								
1.	6+500	J-Head	7100	1.42	350.82	340.20	10.62	25	
c)	**Along CPB**								
1.	2+750	Sloping	1800	0.36	346.51	334.88	11.63	25	**For Earth work:** 1V:3H (River side) 1V:2H (Country side) **For stone work:** 1V:2H
2.	5+500	Mole	310	0.062	345.93	334.50	11.43	25	
3.	6+700	Sloping	80	0.016	345.77	334.88	10.89	25	
4.	8+550	Sloping	165	0.033	344.65	33.05	12.60	25	
5.	9+000	Sloping	170	0.034	345.29	334.10	11.19	25	
6.	10+000	Sloping	570	0.114	345/13	332.20	12.93	25	
		Total	**3095**	**0.619**					
GRAND TOTAL (a+b+c)			**46520**	**9.304**					

IX. SALIENT FEATURES OF THE STONE APRON

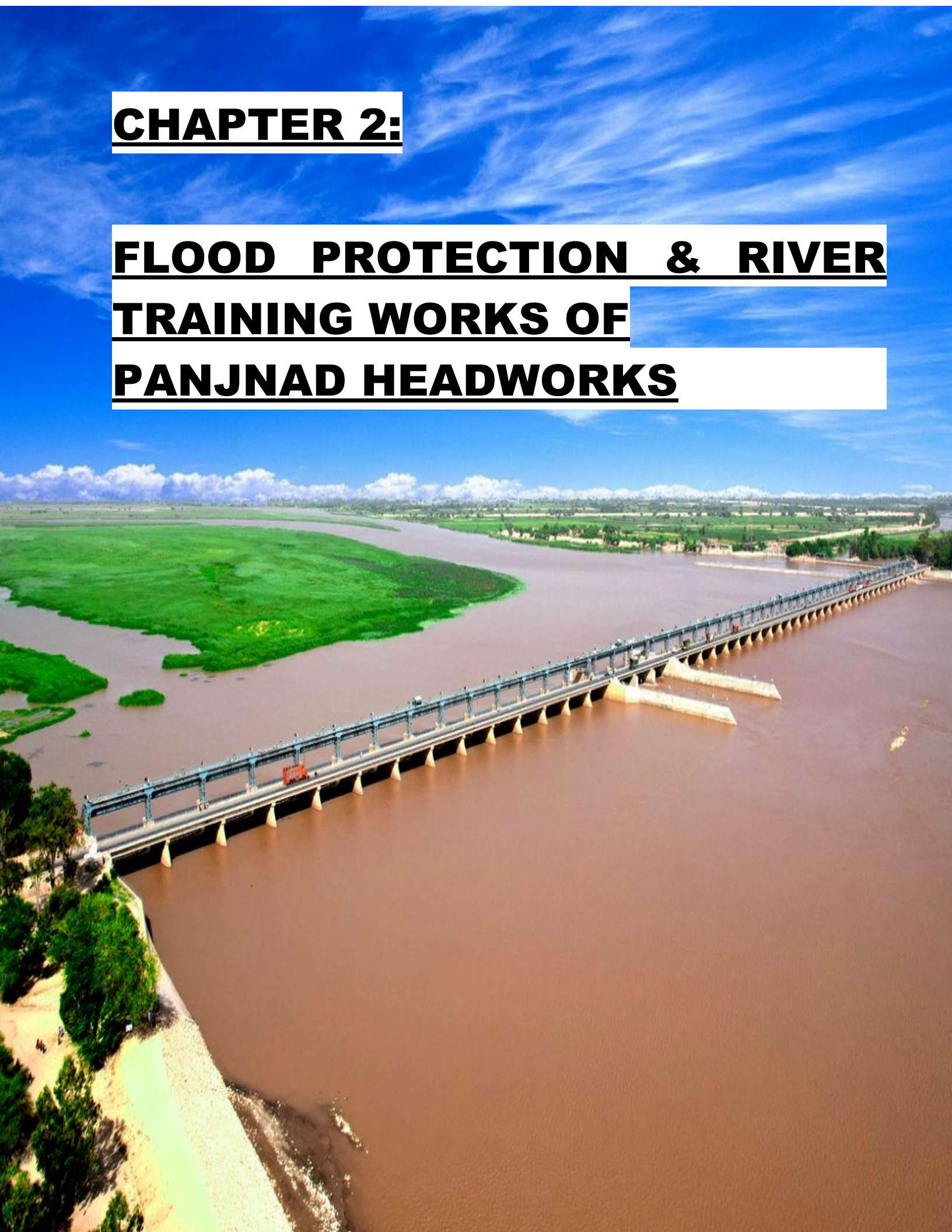
Sr. No.	Description	Left Pocket (ft.)	Main Weir (ft.)	Annexe Weir (ft.)	Additional Bays (ft.)
Upstream					
1.	Stone apron length calculated	41.41	41.41	41.41	76.65
2.	Existing stone apron length as per PIAIP Drawings	38.50	38.50	38.50	-
3.	Recommended stone apron length	50.00	50.00	50.00	75.00
4.	Thickness of Apron Calculated	3.70	3.70	3.70	4.40
5.	Thickness of Apron Proposed	4.00	4.00	4.00	4.50
Downstream					
1.	Stone apron length calculated	65	65	72.90	85.70
2.	Recommended stone apron length	75.00	75.00	75.00	85.00
3.	Thickness of Apron Calculated	4.39	4.39	4.35	4.51
4.	Thickness of Apron Proposed	4.50	4.50	4.50	4.50

1.3 Administration Setup



CHAPTER 2:

FLOOD PROTECTION & RIVER TRAINING WORKS OF PANJNAD HEADWORKS



CHAPTER 2:
FLOOD PROTECTION & RIVER TRAINING WORKS AT PANJNAD HEADWORKS

2.1 Design Parameters of River Training Works
2.2 Location Map
Technical & Structural Condition of Existing Infrastructure Post 2025 Flood

2.1. Design Parameter Of River Training Works

Executive Summary:

1. Overall System Overview and Condition

The Panjnad Headworks is protected by an extensive network of river training works and flood embankments spanning both banks of the Chenab River & Sutlej River. This system includes the Right and Left Marginal Bunds (RMB and LMB), Guide Bunds directly flanking the headworks, a downstream Colony Protection Bund (CPB), and the more distant Shikrani and Minchin Flood Bunds. Following the 2025 monsoon season, the core structures—the Headworks itself, the Right and Left Guide Bunds, and the main embankments of the RMB and LMB—were assessed to be in a satisfactory structural condition. This is largely a result of recent major rehabilitation projects, including the Trimmu-Panjnad Barrage Improvement Project (TPBIP) and the Disaster and Climate Resilience Improvement Project (DCRIP), which raised and strengthened these primary defenses to handle a 100-year design flood of 865,000 cusecs. However, this positive overall assessment masks critical, severe vulnerabilities at specific locations affecting the middle portion of right bank (RMB RD 32-45) and entire Left Marginal Bund (LMB).

2. Critical Vulnerabilities and Emergency Situations

Despite the general satisfactory condition, several key river training structures are in a state of imminent danger, necessitating emergency interventions. The most critical issues are concentrated on the Right Marginal Bund (RMB), which bears the brunt of the Chenab river's natural tendency to drift right. The J-Head Spurs at RD 36+700, RD 40+900, and RD 23+500 are in "very dangerous" or "sensitive" condition, with the latter two requiring emergency repairs in September 2025 after severe scouring launched their protective aprons. Similarly, the singular J-Head Spur on the Left Marginal Bund (LMB) at RD 6+500 also suffered apron launching in August 2025 due to a recent shift in river morphology. These incidents reveal a systemic weakness: while the main embankments were raised under DCRIP, the vital river training spurs that protect them were not upgraded to match the barrage's new, higher flood capacity. This has left these essential defenses chronically under-protected and reliant on reactive, costly emergency measures rather than proactive permanent solutions.

3. Residual Risks and Strategic Implications

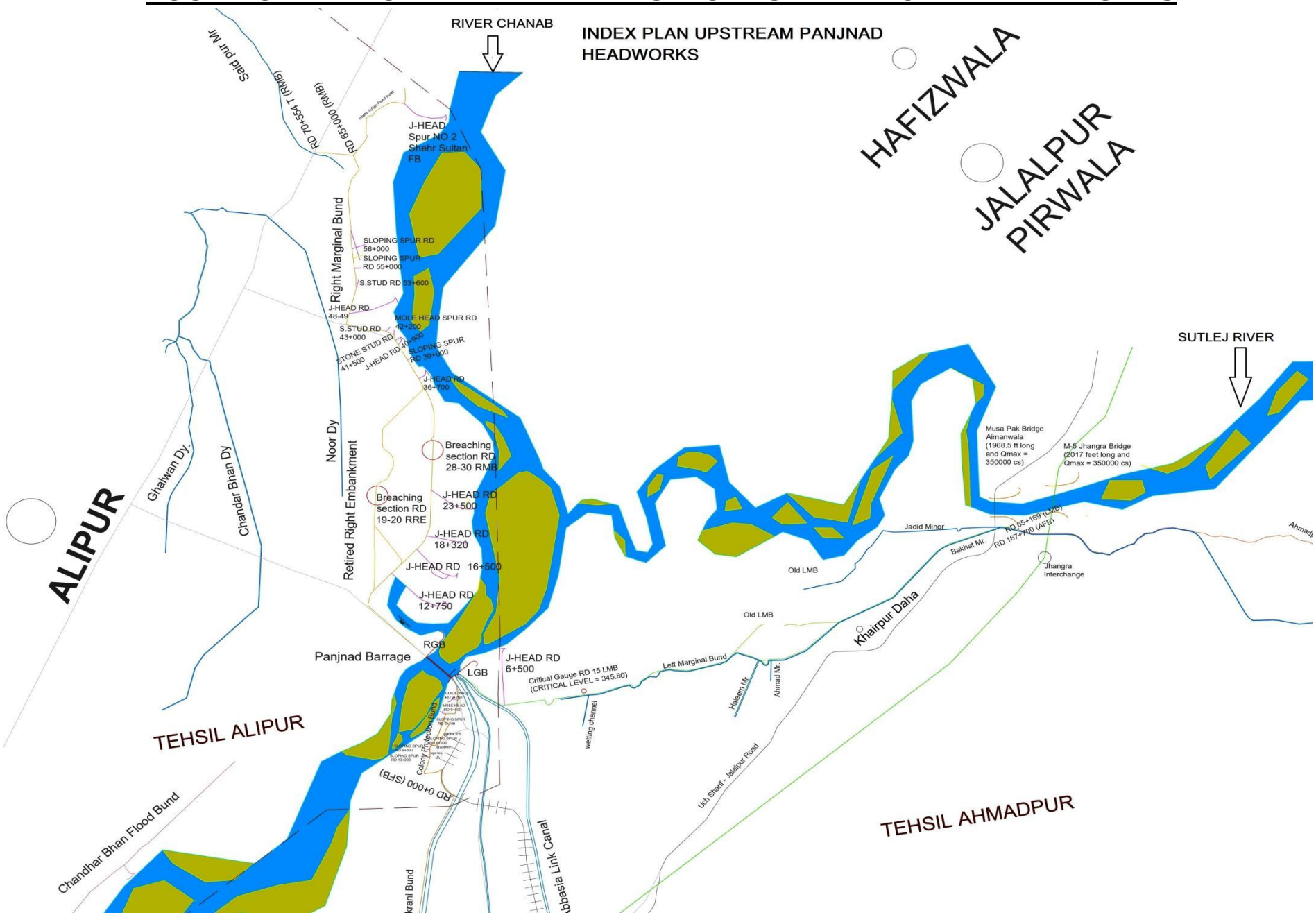
The infrastructure system contains inherent residual risks that require ongoing management and strategic investment. The Shikrani and Minchin Flood Bunds, while scheduled for future strengthening, currently lack robust river training works. The persistent failures of structures on the RMB underscore a fundamental strategic gap: the river training works are the system's first line of defense, and their current inadequacy threatens the integrity of the newly upgraded primary embankments (Marginal Bunds). Long-term

resilience is contingent upon executing the planned conversions of vulnerable spurs (e.g., at RD 39+000 and RD 43+000 as per IRI's report of 2006-07 and decision of DEC's experts dated 2020) and systematically raising all training works to the 100-year flood standard, ensuring the entire system operates at a consistent and reliable level of protection.

Following river training works exist in jurisdiction of Panjnad Headworks Division.

Sr. No.	RD	Type	Length		Top RL (ft.)	NSL (ft.)	Height (ft.)	Width (ft.)	Side Slope
			(ft.)	Canal Miles					
a)	**Along RMB**								
1.	12+750	J. Head	7550	1.51				25	**For Earth work:** 1V:3H (River side) 1V:2H (Country side) **For stone work:** 1V:2H
2.	16+500	J. Head	5550	1.11	351.85	338.05	13.8	25	
3.	18+320	J-Head	4423	0.8846	352.05	336.29	15.76	25	
4.	23+500	J-Head	5282	1.0564	353.09	337.04	16.05	25	
5.	36+700	J-Head	1582	0.3164	353.13	340.02	13.11	25	
6.	39+000	Sloping	325	0.065	353.5	339.05	14.45	25	
7.	40+900	J-Head	1440	0.288	355.55	339	16.55	25	
8.	41+500	Sloping	380	0.076	355.93	340.02	15.91	25	
9.	42+200	Mole Head	577	0.1154	352	342.23	9.77	25	
10.	43+000	Sloping	626	0.1252	352	341.51	10.49	20	
11.	48-49 48+600	J-Head	5600	1.12	358	341.25	16.75	25	
12.	53+600	Sloping	780	0.156	356.95	342.05	14.9	25	
13.	55+000	Sloping	908	0.1816	356.95	342.57	14.38	25	
14	56+000	Sloping	1302	0.2604	356.95	342.38	14.57	25	
		Total	**36325**	**7.265**					
b)	**Along LMB**								
1.	6+500	J-Head	7100	1.42	350.82	340.20	10.62	25	
c)	**Along CPB**								
1.	2+750	Sloping	1800	0.36	346.51	334.88	11.63	25	**For Earth work:** 1V:3H (River side) 1V:2H (Country side) **For stone work:** 1V:2H
2.	5+500	Mole	310	0.062	345.93	334.50	11.43	25	
3.	6+700	Sloping	80	0.016	345.77	334.88	10.89	25	
4.	8+550	Sloping	165	0.033	344.65	33.05	12.60	25	
5.	9+000	Sloping	170	0.034	345.29	334.10	11.19	25	
6.	10+000	Sloping	570	0.114	345/13	332.20	12.93	25	
		Total	**3095**	**0.619**					
GRAND TOTAL (a+b+c)			**46520**	**9.304**					

2.2 LOCATION MAP OF RIVER TRAINING WORKS AT PANJNAD HEADWORKS



TECHNICAL & STRUCTURAL CONDITION OF EXISTING INFRASTRUCTURE POST 2025 FLOOD

HEADWORKS AND CANAL HEAD REGULATORS

THE HEADWORKS

The Panjnad Barrage Headworks is the central control structure on the Chenab River, designed to manage a 100-year design flood of 865,000 cusecs and to reliably divert irrigation supplies to its three off-taking canals. The rehabilitated structure comprises four distinct sections, creating a composite weir system. From left to right (facing downstream), these are: the Left Pocket (6 bays, 360 ft clear waterway), the Main Weir (27 bays, 1,620 ft clear waterway), the Additional Depressed Bays (3 bays, 180 ft clear waterway), and the Annexe Weir (14 bays, 840 ft clear waterway). A key feature of the upgraded design is the new Divide Wall, which was realigned and anchored at Pier No. 6 to increase the Left Pocket's scouring capacity from 4 to 6 bays, thereby improving silt management for the canal head regulators. The entire barrage's operation is governed by the paramount rule that the hydraulic jump must be contained on the sloping glacis downstream of the weir crest to prevent damage to the structure. A state-of-the-art SCADA system in the Control Room building allows for remote monitoring and operation of all gates, with data transmitted to authorities in Lahore and Bahawalpur.

CANAL HEAD REGULATORS

Three major canals off-take from the left bank of the barrage, each controlled by a dedicated head regulator structure designed for specific functions and capacities.

- **Paninad Canal Head Regulator:**

This is the largest of the three, with 12 bays of varying widths (ten @ 26 ft and two @ 18 ft), providing a clear waterway of 296 ft. It is a non-perennial canal designed to carry a maximum discharge of 10,484 cusecs (Kharif Discharge). Its crest is set at RL 332.50 ft, and it uses fixed wheel gates to regulate flow. The regulator's design ensures a Full Supply Level of RL 335.70 ft to feed a vast cultural command area.

- **Abbasia Canal Head Regulator:**

A smaller, perennial regulator with 2 bays, each 20 ft wide (40 ft total clear waterway). It is designed for a discharge of 1,394 cusecs from a crest level of RL 330.00 ft. It features a vertical drop on its downstream side instead of a glacis.

- **Abbasia Link Canal Head Regulator:**

This regulator has 6 bays, each 25 ft wide (150 ft total clear waterway). Its current design capacity is 5,600 cusecs, with a planned future enhancement to 7,100 cusecs to feed the proposed Khair Garh Flood Canal. Its crest is at RL 330.00 ft, and it uses fixed wheel gates to manage flows.

The operation of these regulators is critical. The Sub-Divisional Officer (SDO) Headworks receives indents from the canal divisions and adjusts the gates accordingly, ensuring the prescribed pond level (Summer: RL 338.50 ft, Winter: RL 337.50 ft) is maintained for accurate water diversion while minimizing sediment entry into the canals.

RIGHT GUIDE BUND (RGB)

The Right Guide Bund (RGB) at the Panjnad Barrage is a critical 4,205-ft (3,600-ft u/s and 605 ft d/s) long earthen structure on the right bank, designed to smoothly guide the river's flow towards the barrage's bays and protect its right abutment from direct attack and scour. As a key component of the recent rehabilitation, its upstream section was raised to a crest level of RL 353.00 ft., providing a 7-foot freeboard above the new 100-year design flood level to safely pass a discharge of 865,000 cusecs. The structure features a converging upstream alignment and a diverging downstream section, with its most vulnerable point—the upstream nose—being heavily armoured with stone to withstand severe currents. Its condition is rigorously monitored through weekly cross-section soundings and annual probing of its protective aprons. Following the monsoon season of 2025, a comprehensive post-flood inspection confirmed that the Right Guide Bund successfully withstood the hydrological forces, with ***no significant erosion, settlement, or structural damage observed***, and it continues to be rated in a satisfactory technical and structural condition.

LEFT GUIDE BUND (LGB)

The Left Guide Bund (LGB) at the Panjnad Barrage is a critical 4,205-ft (3,600-ft u/s and 605 ft d/s) long earthen structure on the left bank, designed not only to guide flow and protect the barrage's left abutment but also to counter the river's natural tendency for morphological change towards the left side post 2023, which could threaten the offtakes of the Panjnad, Abbasia, and Abbasia Link Canals. Its raised top (RL 353.00 ft.) and heavily armoured nose are engineered to deflect the main river thrust away from the left bank, ensuring a stable approach channel and preventing the river from carving a new course that could bypass or damage the canal headworks. Following the flood season of 2025, a comprehensive post-flood inspection confirmed that the Left Guide Bund had successfully stabilized the river's approach, with ***no significant erosion or structural damage observed***, and it continues to be rated in a satisfactory technical and structural condition, having effectively managed the river's diverted morphological pressures on left side.

RIGHT MARGINAL BUND (RMB)

The Right Marginal Bund (RMB) at the Panjnad Barrage is a critical 14-mile long earthen embankment that faces persistent and severe stress due to the Chenab River's high tendency to drift towards the right flank, a threat that has existed since the headworks' construction. This pressure is acutely felt in reaches like RD 32-45, where the main creek flows dangerously close—at some points only 160-200 feet from the bund's toe—and directly hits the river training structures. To combat this, a system of river training works, including 07 J-head spurs, 01 mole-head spur, and 06 stone & sloping studs, was constructed to deflect the current. However, a critical vulnerability exists between the spur at RD 36+700 and RD 40+900, where the main current, after crossing the downstream spur, loops back to form a gullet that simultaneously attacks the nose of the upstream spur and erodes the RMB itself, leaving a minimal foreshore of just 90 feet at RD 39+000. While the raising and strengthening of the RMB's embankment itself was completed under the Disaster and Climate Resilience Improvement Project (DCRIP), placing it in a satisfactory structural condition for high floods, its protective river training structures were not raised to match the barrage's enhanced design capacity. *Consequently, despite the embankment's satisfactory post-2025 monsoon condition, the RMB remains under significant and ongoing geomorphic threat*, with the second defense line—the Right Retired Embankment (RRE)—serving as a vital safeguard in case of an unintended breach.

The Irrigation Research Institute (Physics Wing), Lahore vide its report no. IRI/PHY/SM/3034 dated: December, 2025 titled “Geotechnical Investigations for evaluating the vulnerability of Flood Bunds in Punjab” concluded the following for Right Marginal Bund (RMB).

Geotechnical Investigations for Evaluating the Vulnerability of Flood Bunds in Punjab
Bahawalpur Zone (Interim Results)

Name of Zone: **Bahawalpur** Name of Division: **Punjnad Head works Division** Name of Flood Bund: **Right Marginal Bund**

Sr.No.	Parameter	RD →	J Head Spur RD 12+750	J Head Spur RD 23+500	J Head Spur RD 36+700	J Head Spur RD 43+000	70
1	Vulnerability	Class	Very High Vulnerability	Medium Vulnerable	Very High Vulnerability	Highly Vulnerable	Low Vulnerability
		REBVI Value	73	60	71	69	42
2	Prevailing Soil Strata	Class	(SM) Silty sand, fine *UnSuitable Soil Composition*	(SM) Silty Sand,fine *UnSuitable Soil Composition*	(SM) Silty Sand *UnSuitable Soil Composition*	(SM) Silty sand, fine *UnSuitable Soil Composition*	Silty sand (SM) *UnSuitable Soil Composition*
		Value (%)	Sand= 77.8 % Silt= 12 % Clay= 10.2 %	Sand= 74.6 % Silt= 13.8 % Clay= 11.6%	Sand= 74.4 % Silt= 20.1 % Clay= 5.5 %	Sand= 73.6 % Silt= 16.4 % Clay= 10 %	Sand= 68.8 % Silt= 23.15 % Clay= 8.05 %
3	Compaction	Class	High	Low	Low	Medium	Low
		Value (%)	90	72	51	85	78
4	Permeability	Class	Medium	Medium	Medium	Medium	Medium
		Value (cm/s)	0.0015	0.0019	0.0017	0.0020	0.0097
5	Visual Observation & Description	Class	V Poor	V Poor	V Poor	Poor	Normal
		Value	Spur damaged at slopes, stones, cracks	under design, spur damaged slopes	under design, spur damaged slopes	under design, spur damaged slopes	even slopes, according to design
6	Dispersion of Soil (Pin hole test)	Class	Dispersive Soil	Moderate Dispersive	Non Dispersive	Highly Dispersive	Non Dispersive
		Value	D1	ND3	ND1	D2	ND1
7	Plasticity	Class	Slight Plastic	Slight Plastic	Slight Plastic	Slight Plastic	Slight Plastic
		Value	3.6	4.8	4.6	3.8	4.9
8	Angle of Internal Friction	Class	Medium	Dense	Very Loose	Dense	Dense
		Value (degree)	34.5	36.4	25.3	39.4	37.5

J-HEAD STRUCTURES ON RIGHT MARGINAL BUND (RMB)

1. J-HEAD SPUR AT RD: 12+750 R.M.B

The J-Head Spur at RD 12+750 is a critical river training structure constructed along the Right Marginal Bund (RMB) of the Panjnad Headworks, forming part of an extensive defense system of 07 J-head spurs designed to combat the Chenab River's persistent tendency to attack the right flank. Its implementation was based on the recommendations of a Hydraulic Model Study conducted at the Nandipur Research Institute, which specifically proposed this structure to divert the river flow away from the eroding bank. Constructed during 2008-09, this substantial spur extends 7,550 feet (approximately 1.51 miles) and is engineered with a top width of 25 feet and robust side slopes to withstand direct hydraulic forces. ***Physically, the structure is currently assessed to be in a satisfactory condition***. However, a systemic vulnerability remains, as highlighted in the manual: under the recent DCRIP project, this and other essential river training spurs on the RMB were ***not raised to match the enhanced design capacity of the barrage itself***. Consequently, while currently sound, the long-term efficacy of the J-Head spur at RD 12+750 is contingent upon future upgrades to align with the barrage's 100-year flood safety standard.

2. J-HEAD SPUR AT RD: 16+500 R.M.B

The J-Head Spur at RD 16+500 is a strategically placed river training structure on the Right Marginal Bund (RMB), constructed as part of the comprehensive defense system to deflect the Chenab River's persistent attack on the right flank. This spur, with a length of 5,550 feet (approximately 1.1 miles), was built to a top level of RL 351.85 ft. with a height of 12.30 feet from the natural surface level (NSL) of RL 338.05 ft. Its structural integrity was tested during the freshet of March 2007 when its earthen shank sustained significant damage, necessitating a restoration effort that was successfully completed in 2008. ***Presently, the spur is assessed to be in a satisfactory physical condition***. However, it shares a critical systemic vulnerability with other spurs on the RMB: under the recent DCRIP project,

these essential defenses were not raised to match the enhanced 100-year design flood capacity of the barrage. Therefore, while the spur at RD 16+500 is currently sound and stable, its ability to perform reliably under future extreme, upgraded flood conditions remains a concern, highlighting a need for further reinforcement to ensure the long-term security of the Right Marginal Bund.

3. J-HEAD SPUR AT RD: 18+320 R.M.B

The J-Head Spur at RD: 18+320 is another critical component of the river training defense system along the Right Marginal Bund (RMB), strategically positioned to counter the Chenab River's persistent rightward drift. This structure is a substantial earth and stonework formation, with a length of 4423 feet (approximately 0.88 mile) and a significant height of 15.76 feet from its base at RL 336.29 ft. to its top at RL 352.05 ft. Like other spurs in this vulnerable reach, its structural integrity was tested during the freshet of March 2007 when its earthen shank was damaged, requiring a comprehensive restoration that was completed in 2008. ***Presently, the spur is reported to be in a satisfactory physical condition*** and is fulfilling its function of deflecting the main current. Despite its current robustness and successful repair, it is important to note that this spur, like all others on the RMB, was not raised to the new design standard during the recent DCRIP project. Consequently, while operationally effective under current conditions, its design has not been upgraded to match the barrage's enhanced 100-year flood capacity, indicating a potential area for future improvement to ensure long-term resilience against more extreme hydrological events.

4. J-HEAD SPUR AT RD. 23+500 R.M.B

The J-Head Spur at RD 23+500 on the Right Marginal Bund (RMB) of Panjnad Headworks is one of the most critical river training structures due to its location at the confluence of the Chenab and Sutlej rivers. It bears the combined hydraulic thrust of both rivers and protects the RMB by deflecting flow towards the barrage. The spur has a repeated history of damage: its prong was severed during the 2007 freshet and restored, followed by further damage to the J-Head portion, requiring major rehabilitation completed in 2016. ***Owing to its vulnerability, it has remained classified as "sensitive."***

On 14 September 2025, severe attack by the combined river flow created deep scouring along the upstream curved face, launching 50–60 feet of stone apron and posing an imminent threat to structural stability. Emergency restoration through loose stone dumping and wire crates was executed under Third-Party supervision. However, the spur was not raised to the revised 100-year flood standard under DCRIP, leaving it structurally under-capacity and prone to recurring emergency interventions instead of a permanent engineered solution.

5. J-HEAD SPUR RD 36+700 RMB

The J-Head Spur at RD 36+700 on the Right Marginal Bund (RMB) is a structure in a critically vulnerable and actively deteriorating condition. Its primary function is to help deflect the river current, but it is currently a victim of a destructive hydraulic phenomenon. The main river flow, after being deflected by the upstream J-Head Spur at RD 40+900, loops back to form a powerful gullet that runs parallel to the RMB. This returning current delivers a direct and sustained attack on the nose of the spur at RD 36+700, while simultaneously scouring the embankment's foreshore. This action has reduced the protective buffer of land to a dangerously narrow margin of just 90 feet at RD 39+000, leaving the spur and the bund it protects exposed to imminent undermining. The structure is officially classified as being in a "very dangerous condition," a status that demands extreme vigilance. While comprehensive, long-term solutions—including apron restoration informed by a pending model study from IRI—have been proposed, the immediate reality is that ***this spur remains in a state of requiring constant monitoring and emergency preparedness to prevent a catastrophic failure*** that would jeopardize the entire right-bank flood defense system at Panjnad Headworks.

6. J-HEAD SPUR RD 40+900 RMB

The J-Head Spur at RD 40+900 on the Right Marginal Bund (RMB) is a critical structure protecting the downstream bund. Constructed after the 1992 Super Flood, it diverts the main river current away from the RMB, but in doing so remains under constant hydraulic attack. The deflected flow generates strong back-currents at its upstream nose, causing severe scouring, apron launching, and pitching damage.

An emergency was declared on 7 September 2025, and immediate restoration through stone dumping and wire crates was carried out. Although past studies (2006–07 model study and 2020 Expert Committee) recommended permanent strengthening, including widening of the apron, these measures were not implemented due to funding constraints. ***The spur thus remains dependent on repeated emergency interventions to prevent failure of the RMB system at Panjnad Headworks.***

7. J-HEAD SPUR RD 48+600 RMB

The J-Head Spur at RD 48+600 is a significant river training structure on the Right Marginal Bund (RMB), serving as a major defensive point due to its substantial scale and design. This earth and stonework formation extends 5,600 feet (approximately 1.12 miles) in length and is constructed to a high-top level of RL 358.00 ft., standing 16.75 feet above the natural surface level (NSL) (RL 341.25 ft.) with a standard top width of 25 feet. Unlike other spurs on the RMB documented to be in acutely dangerous condition, this structure shows no recorded history of major failures or specific acute vulnerabilities, suggesting it has remained physically sound and stable under prevailing conditions. However, it shares a critical systemic vulnerability with all RMB spurs: these essential structures were not raised to match the barrage's enhanced 100-year design flood capacity during recent rehabilitation works. Consequently, while currently operational, its design lacks the necessary upgrades to safely withstand the extreme hydrological events the upgraded barrage is intended to convey, representing a latent risk that necessitates ongoing monitoring and future reinforcement to ensure long-term resilience.

SLOPING SPURS ON RIGHT MARGINAL BUND (RMB)

1. SLOPING SPUR RD 39+000 (R.M.B)

The Sloping Spur at RD 39+000 is situated within the most vulnerable reach of the Right Marginal Bund, where the foreshore has been severely reduced to just 90 feet. This structure has been specifically ***identified for conversion into a Hockey Spur as part of a comprehensive river training plan developed from hydraulic model studies.*** The conversion is designed to more effectively check the rightward drifting of the River Chenab and mitigate the destructive hydraulic loop affecting adjacent J-Head spurs. While the spur currently functions as a sloping structure, its strategic enhancement to a Hockey Spur represents a critical, planned intervention to address the systemic vulnerabilities in this high-risk section. The project has been prioritized for implementation, pending the outcomes of further model studies and funding allocation.

2. SLOPING SPUR RD 55+000 (R.M.B)

The Sloping Spur at RD 55+000 is a 908-foot long river training structure with a top level of RL 356.95 ft., standing 14.38 feet high from the natural surface level. This spur is one of several sloping structures positioned along the latter section of the Right Marginal Bund to provide continuous bank protection. While not currently flagged for major structural conversion like those in the more vulnerable upstream reaches, it shares the systemic limitation common to all RMB training works: its design elevation has not been upgraded to match the barrage's enhanced 100-year flood capacity. ***The spur remains in serviceable condition but requires monitoring to ensure its continued performance*** under increasing hydrological demands.

3. SLOPING SPUR RD 56+000 (R.M.B)

The Sloping Spur at RD 56+000 is a 1,300-foot long protective structure with a top level of RL 356.95 ft., constructed 14.57 feet above the natural surface level (NSL). As one of the longer sloping spurs on the bund, it contributes significantly to maintaining the alignment and stability of the right river bank. Similar to other structures in this sector, ***it currently maintains satisfactory physical condition*** but operates with design parameters that predate the current flood safety standards. Its ongoing performance underscores the need for a systematic review and potential upgrading of all river training works along the RMB to achieve consistent protection levels commensurate with the barrage's updated design flood capacity.

STONE STUDS ON RIGHT MARGINAL BUND (RMB)

1. STONE STUD RD 41+500 RMB

The Stone Stud at RD 41+500 is a river training structure with a top level of RL 355.93 ft., standing 15.91 feet high from the natural surface level (NSL). This stone stud features a reduced top width of 20 feet compared to other structures on the bund and functions as an intermediate protective measure between major spurs. Located in a reach where the river exhibits aggressive behavior, the stud's stone construction provides essential erosion resistance against direct river attack. ***While maintaining structural integrity, it operates within a vulnerable zone where the river's main current frequently approaches the Right Marginal Bund, and its stone pitching requires regular monitoring for any signs of launching or displacement.***

2. STONE STUD RD 43+000 RMB

The Stone Stud at RD 43+000 is a critical 577-foot long structure positioned at RL 352.00 ft., standing 10.49 feet above the natural surface level (NSL) with a 20-foot top width. This stone stud has been specifically identified for conversion into a Hockey Spur based on hydraulic model study recommendations. The stone construction currently provides essential bank protection, but its ***enhancement to a Hockey Spur is considered vital for more effective flow deflection in this vulnerable reach***. The stud's stone pitching has demonstrated resilience against direct river attack, though the planned conversion represents a necessary upgrade to address the persistent rightward drifting of the River Chenab that threatens this section of the RMB.

3. STONE STUD RD 53+600 RMB

The Stone Stud at RD 53+600 is a 780-foot long river training structure with a top level of RL 356.95 ft., constructed 14.90 feet above the natural surface level (NSL) and featuring a 25-foot top width. Positioned in a relatively stable section of the Right Marginal Bund, this stone stud provides consistent bank protection through its durable stone construction. The stud's stone pitching effectively withstands normal river forces and contributes to maintaining channel alignment. While not currently identified for structural modifications, ***the stone stud continues to perform its protective function reliably, though its design parameters remain based on pre-upgrade flood capacity standards.***

MOLE HEAD SPUR ON RIGHT MARGINAL BUND (RMB)

1. **MOLE HEAD SPUR RD 42+200 RMB**

The Mole Head Spur at RD 42+200 on the Right Marginal Bund is a 577-ft long stone river training structure with a crest level of RL 352.00 ft. Unlike J-head spurs, it projects compactly into the river to create localized turbulence and deflect the current. Strategically located between major spurs, it serves as an important intermediate defense against the Chenab's rightward drift.

Although structurally intact, it lies in an active hydraulic zone requiring constant monitoring. Its crest level has not been raised to the revised 100-year flood standard, posing vulnerability during extreme floods at Panjnad Headworks.

LEFT MARGINAL BUND (LMB)

The Left Marginal Bund (LMB) at the Panjnad Barrage is a 13-mile long earthen embankment on the left bank that benefits from the river's dominant tendency to drift right, affording it a more stable position than its right-side counterpart. It was remodeled and strengthened under the Disaster and Climate Resilience Improvement Project (DCRIP) during 2020-22. However, a significant technical challenge is posed by the bund's inherently unstable, swelling soil, which has led to small cracks, the development of infiltration galleries, and subsequent damage to its wetting channels. In response, a comprehensive Geo-Technical analysis was conducted by the Irrigation Research Institute (IRI) in August 2023, leading to an estimate for remediation work that has been completed now. Despite these material vulnerabilities, the LMB, which notably lacks a breaching section, was verified after the 2025 monsoon season to be in a partially satisfactory technical and structural condition, although having successfully contained very high flood levels of 2025's super flood.

The Irrigation Research Institute (Physics Wing), Lahore vide its report no. IRI/PHY/SM/3034 dated: December, 2025 titled "Geotechnical Investigations for evaluating the vulnerability of Flood Bunds in Punjab" concluded the following for Left Marginal Bund (LMB).

Geotechnical Investigations for Evaluating the Vulnerability of Flood Bunds in Punjab
Bahawalpur Zone (Interim Results)

Name of Zone: **Bahawalpur** Name of Division: **Punjnad Head works Division** Name of Flood Bund: **Left Marginal Bund**

Sr.No.	Parameter	RD →	Spur at 6+500	10	20	30	40	50
1	Vulnerability	Class	Very High Vulnerability	Medium Vulnerable	V low vulnerability	Medium Vulnerable	V low vulnerability	Medium Vulnerable
		REBVI Value	74	60	35	55	35	51
2	Prevailing Soil Strata	Class	(ML) Sandy Silt, fine *UnSuitable Soil Composition*	Silty Clayey Sand(SC-SM) fine to medium *UnSuitable Soil Composition*	Clayey Sand (SC) *Suitable Soil Composition*	Sandy Clay with silt *UnSuitable Soil Composition*	Silty Clay (CL-ML) *UnSuitable Soil Composition*	Silty Clayey Sand(SC-SM) fine to medium *UnSuitable Soil Composition*
		Value (%)	Sand= 34.7 % Silt= 42.4 % Clay= 22.9 %	Sand= 66.2 % Silt= 20.8 % Clay= 13.0 %	Sand= 52.6 % Silt= 23.2 % Clay= 24.2 %	Sand= 30.8 % Silt= 47.9 % Clay= 21.3%	Sand= 39.2 % Silt= 60.8 % Clay= 14.9 %	Sand= 52 % Silt= 28 % Clay= 20 %
3	Compaction	Class	Low	Low	Medium	Medium	Medium	Low
		Value (%)	80	77	83	88	80	65
4	Permeability	Class	Medium	Low	Medium	Low	Medium	Low
		Value (cm/s)	0.0034	0.0009	0.0026	0.0005	0.0012	0.0001
5	Visual Observation & Description	Class	Poor	Normal	Poor	Normal	Normal	Poor
		Value	Damaged Uneven slopes, stone pitching found, cracks, apparently consistent, over design	cracks, According to design	cracks, loose soil ,According to design	cracks, uneven slopes,According to design	Cracks , According to design	cracks, uneven slopes, According to design
6	Dispersion of Soil (Pin hole test)	Class	Highly Dispersive	Dispersive	Non Dispersive	Highly Dispersive	Non Dispersive	Non Dispersive
		Value	D2	D1	ND1	D2	ND1	ND1
7	Plasticity	Class	Low Plastic	Low Plastic	Low Plastic	Low Plastic	Medium Plastic	Low Plastic
		Value	8.5	5.7	7.3	8.2	13.7	8.6
8	Angle of Internal	Class	Loose	Loose	Medium	Loose	Medium	Loose
		Value (degree)	28.1	29.7	30.5	28.5	30.8	28.3

STRUCTURES ON LEFT MARGINAL BUND (LMB)

1. J-HEAD SPUR RD 6+500 LMB

The J-Head Spur at RD 6+500 is a critically important and singular protective structure on the Left Marginal Bund (LMB), strategically positioned immediately downstream of the Chenab and Sutlej river confluence. Its primary function is to deflect the combined river currents away from the LMB and channelize flow towards the barrage, thereby safeguarding vast left-bank agricultural areas from flooding.

The structural integrity of this spur was compromised in August 2025, prompting an official emergency declaration. A subsequent Zonal Technical Committee investigation pinpointed the cause: a significant and recent shift in river morphology towards left side. This shift was driven by two key factors—the development of a deep channel along the left side upstream of the headworks after 2023 flood in Sutlej River, and the presence of a persistent bela (sandbar) on the right side. Together, these features deflected the river's primary current, forcing it into a pronounced loop that slammed directly into the upstream nose and curved section of the J-Head Spur. The impact of this redirected flow, combined with resulting swirling backflows, caused severe scouring that launched the protective apron and threatened to undermine the entire structure.

In response to this extreme situation, the immediate recouping of the launched apron using loose stone and stone-filled wire crates under the supervision by third-party consultant was carried out. This emergency intervention underscored the spur's pivotal role; its failure would risk redirecting the main river current towards the Left Marginal Bund and Left Guide Bund, threatening the entire left-flank defense system of the Panjnad Headworks.

DOWNSTREAM COLONY PROTECTION FLOOD BUND (CPB)

The Colony Protection Bund (CPB) is a critical 3-mile earthen embankment located along the right bank immediately downstream of Panjnad Headworks, constructed to protect the staff colony and adjoining infrastructure from river action. Originally built with 5.0-ft freeboard and 20-ft top width, it was badly damaged during the 1973 flood and subsequently reconstructed in a retired alignment with 6.0-ft freeboard and 25-ft top width.

Over time, adverse river morphology—particularly a pronounced downstream loop—caused severe erosion between RD 4–5, with scouring reaching the toe near Spur RD 5+500 in March 2015. Following an IRI model study and expert recommendations, a permanent guide wall was constructed by the PIU and completed in 2018 to deflect attacking currents.

In May 2023, the competent authority approved further upgradation to 7.0-ft freeboard above design tailwater level with 25-ft top width in line with Federal Flood Commission criteria. After the 2025 monsoon, the bund remains physically satisfactory; however, raising and strengthening works are ongoing through Machinery Division, DG Khan to ensure sustained resilience against Chenab River dynamics.

The Irrigation Research Institute (Physics Wing), Lahore vide its report no. IRI/PHY/SM/3034 dated: December, 2025 titled “Geotechnical Investigations for evaluating the vulnerability of Flood Bunds in Punjab” concluded the following for Colony Protection Bund (CPB).

Geotechnical Investigations for Evaluating the Vulnerability of Flood Bunds in Punjab
Bahawalpur Zone (Interim Results)

Name of Zone: **Bahawalpur** Name of Division: **Punjnad Head works Division** Name of Flood Bund: **Colony Protection Bund**

Sr.No.	Parameter ↓	RD →	0 10	17+600
1	Vulnerability	Class	Medium Vulnerable	Very High Vulnerability
		REBVI Value	57	84
2	Prevailing Soil Strata	Class	(SP-SM) Poorly-graded sand with silt, fine *UnSuitable Soil Composition*	(SM) Silty sand, fine *UnSuitable Soil Composition*
		Value (%)	Sand= 93.4 % Silt= 6.6 % Clay= - %	Sand= 70.6 % Silt= 19.2 % Clay= 10.2 %
3	Compaction	Class	Medium	Low
		Value (%)	81.35	78.55
4	Permeability	Class	Medium	Medium
		Value (cm/s)	0.0038	0.0058
5	Visual Observation & Description	Class	Poor	Poor
		Value	Damaged/enven slopes, cracks,under design,	uneven damaged slopes, loose soil
6	Dispersion of Soil (Pin hole test)	Class	Moderate Dispersive	Moderate Dispersive
		Value	ND3	ND3
7	Plasticity	Class	Non Plastic	Slight Plastic
		Value	0.0	4.5
8	Angle of Internal Friction	Class	Medium	Loose
		Value (degree)	32.14	28.98

STRUCTURES ON COLONY PROTECTION BUND (CPB)

1. GUIDE WALL SPUR AT RD 2+750 (C.P.B)

This is a **Concavo-Convex Guide Wall Spur**, a 1800-foot long structure constructed to a top level of RL 346.51 ft. It was a direct recommendation from a 2008 hydraulic model study conducted by IRI Nandipur, specifically to address the River Chenab's adoption of an oblique route that directly attacks the left flank of the Colony Protection Bund after crossing the headworks. The spur was built to deflect this main river thrust and replace a simpler sloping spur that was previously at this location. It now functions as the primary upstream defense for the entire CP Bund and is ***reported to be in satisfactory condition***.

2. MOLE HEAD SPUR AT RD 5+500 (C.P.B)

This 310-foot long **Mole Head Spur** (Top Level: RL 345.93 ft.) is strategically positioned to bear the brunt of the main river current after it is deflected by the upstream guide wall. It functions as a crucial energy dissipation structure. Its history confirms its critical role; during the High Flood of 2013, its apron and stone-pitched slopes were damaged, requiring repairs that were completed in June 2014. Since then, it has been ***functioning properly and is maintained in satisfactory condition***, with special watching arrangements activated during high flood stages. However, it is pertinent to point out that the top RL of this structure has not been rehabilitated as per new HFL/TWL post rehabilitation project.

3. SLOPING SPUR AT RD 6+700 (C.P.B)

This 80-foot long **Sloping Spur** (Top Level: RL 345.77 ft.) was originally constructed in 1982 to correct the adverse river approach downstream of the headworks. It serves as a transitional structure between the larger spurs, ensuring a continuous line of defense. It is reported to be ***functioning properly and remains in a satisfactory condition***. it is pertinent to point out that the top RL of this structure has not been rehabilitated as per new HFL/TWL post rehabilitation project.

4. SLOPING SPUR AT RD 8+500 (C.P.B)

This 165-foot long **Sloping Spur** (Top Level: RL 344.65 ft.) is a key defensive structure. Its significant height of 12.60 feet allows it to handle substantial flow. The spur at RD 8+500 provides a protective shadow for the spur downstream at RD 9+000, shielding it from the river's direct action. ***It is in satisfactory condition.*** it is pertinent to point out that the top RL of this structure has not been rehabilitated as per new HFL/TWL post rehabilitation project.

5. SLOPING SPUR AT RD 9+000 (C.P.B)

This 170-foot long **Sloping Spur** (Top Level: RL 345.29 ft.) benefits from its position in the protective shadow of the upstream spur at RD 8+500. As a result, it does not come under the direct attack of the main river current. This sheltered location contributes to its ***stable and satisfactory condition***. it is pertinent to point out that the top RL of this structure has not been rehabilitated as per new HFL/TWL post rehabilitation project.

6. SLOPING SPUR AT RD 10+000 (C.P.B)

This 570-foot long **Sloping Spur** (Top Level: RL 345.13 ft.) is the last in the series of spurs along the Colony Protection Bund. It is very effective at pushing the main current away from the foreshore. As the river has subsequently created a deep channel in the middle of the course, this spur had sustained no damage up to 2018 and its ***overall condition remains good***. it is pertinent to point out that the top RL of this structure has not been rehabilitated as per new HFL/TWL post rehabilitation project.

SHIKRANI FLOOD BUND

The Shikrani Flood Bund is a distinct flood defense structure that extends beyond the immediate vicinity of the Panjnad Barrage complex. Its primary function is to protect the Panjnad Main Line (PML) Canal and vast agricultural areas from river spillage. Constructed in 1982-83, it originates from the tail of the Colony Protection Bund at RD 17+600 and runs along the right bank of the PML Canal up to RD 32+000, after which it continues along the Shikrani Distributary before connecting with the Minchin Flood Bund at its RD 6+700.

Unlike the barrage's main guide and marginal bunds, the Shikrani Bund was constructed without any river training works, making it a simple earthen embankment. Its original design parameters include a 25-foot top width and a 7-foot freeboard above the 1973’s High Flood Levels (HFLs), with side slopes of 3:1 on the river side and 2:1 on the country side. These specifications have been formally reaffirmed as per the latest Federal Flood Commission criteria by the competent authority in October 2023.

For its future strengthening, a project titled “Preventing Erosion Of River Indus Along Minchin Flood Bund (Taunsa-Guddu reach)” has been identified under the FPSP-III financial window, and the PC-I for this scheme has been submitted by the Panjnad Headworks Division, paving the way for its upcoming reinforcement in accordance with the approved design.

It is submitted that the proposed reconstruction/rehabilitation of Chander Bhan Flood Bund along its existing alignment, instead of the new alignment recommended through the numerical study of the Administrative Department, is likely to have adverse hydraulic implications. Maintaining the current alignment will not counter the inherent downstream leftward drift of the river below Panjnad Headworks, thereby increasing hydraulic pressure on Shikrani Flood Bund and exposing it to potential erosion and structural distress.

Furthermore, during Super Flood 2025, the observed High Flood Levels (HFLs) already encroached upon the design freeboard by approximately 18.5 inches in reach RD 0–1 and 10.45 inches in reach RD 35–40. Retaining the existing alignment is expected to further aggravate afflux and backwater effects, resulting in additional rise in HFLs beyond the already exceeded freeboard limits.

The new development d/s Panjnad Headworks right side renders this Flood Bund highly sensitive, prone to structural instability and erosion during next flood.

The Irrigation Research Institute (Physics Wing), Lahore vide its report no. IRI/PHY/SM/3034 dated: December, 2025 titled “Geotechnical Investigations for evaluating the vulnerability of Flood Bunds in Punjab” concluded the following for Shikrani Flood Bund (SFB).

Geotechnical Investigation for Evaluating the Vulnerability of Flood Bunds in Punjab

Name of Zone: **Bahawalpur** Name of Division: **Punjnad Head works Division** Name of Flood Bund: **Shikrani F/B**

Sr.No.	Parameter	RD →	0 10	20	30	40
1	Vulnerability	Class	Highly Vulnerable	Highly Vulnerable	Low Vulnerability	Highly Vulnerable
		REBVI Value	67	67	44	68
2	Prevailing Soil Strata	Class	(SM) Silty sand, fine *UnSuitable Soil Composition*	(SM) Silty sand, fine *UnSuitable Soil Composition*	(SC) Clayey sand, fine *Suitable Soil Composition*	(SM) Silty sand, fine *UnSuitable Soil Composition*
		Value (%)	Sand= 84 % Silt= 10 % Clay= 6 %	Sand= 86.3 % Silt= 10.7 % Clay= 3 %	Sand= 58.8 % Silt= 21.2 % Clay= 20 %	Sand= 75.1 % Silt= 15.9 % Clay= 9 %
3	Compaction	Class	Low	Low	Low	Low
		Value (%)	70.92	72.57	71.66	79.22
4	Permeability	Class	Medium	Medium	Medium	Medium
		Value (cm/s)	0.0035	0.0031	0.0084	0.0034
5	Visual Observation & Description	Class	V poor	Poor	Poor	Poor
		Value	Damaged/enven slopes, over design,	Damaged/enven slopes, cracks,under design,	Damaged/enven slopes, cracks,over design,	Damaged/enven slopes, cracks,under design,
6	Dispersion of Soil (Pin hole test)	Class	Highly Dispersive	Highly Dispersive	Moderate Dispersive	Highly Dispersive
		Value	D2	D2	ND3	D2
7	Plasticity	Class	Slight Plastic	Slight Plastic	Medium Plastic	Low Plastic
		Value	2.7	3.9	11.4	6.8
8	Angle of Internal Friction	Class	Dense	Dense	Loose	Medium
		Value (degree)	35.4	36.4	29.45	30.24

MINCHIN FLOOD BUND

The Minchin Flood Bund is a major flood protection embankment situated downstream of Panjnad Headworks, running parallel to the left bank of River Chenab at an average offset of 1.5–2.0 miles. It originates near RD 52+000 of Panjnad Main Line Canal; the initial reach up to RD 6+700 remains abandoned, where it confluences with the tail of Shikrani Flood Bund at RD 40+000. Thereafter, the bund extends up to RD 122+000 under the jurisdiction of Panjnad Headworks Division, covering Bahawalpur District up to RD 32+000 and Rahim Yar Khan District beyond.

As per design approval accorded in October 2023 in line with Federal Flood Commission criteria, the bund section comprises 25-ft top width, 7-ft freeboard above 1992 HFL, and side slopes of 3:1 (river side) and 2:1 (country side). A comprehensive strengthening scheme titled “Preventing Erosion of River Indus along Minchin Flood Bund (Taunsa-Guddu reach)” has been prioritized under FPSP-III, and the PC-I has been submitted by this Division for systematic upgradation in accordance with approved parameters.

It is further submitted that the proposed reconstruction/rehabilitation of Chander Bhan Flood Bund along its existing alignment, instead of the realigned option recommended through numerical modeling by the Administrative Department, may induce adverse hydraulic consequences. Retention of the present alignment is unlikely to mitigate the inherent downstream leftward river drift below Panjnad Headworks and may consequently intensify hydraulic loading on Minchin Flood Bund, increasing susceptibility to erosion, afflux, and structural instability.

Furthermore, during Super Flood 2025, the observed High Flood Levels (HFLs) already encroached upon the design freeboard by approximately 19.8 inches in reach RD 0–122 and a maximum of 26.88 inches in reach RD 60. Retaining the existing alignment is expected to further aggravate afflux and backwater effects, resulting in additional rise in HFLs beyond the already exceeded freeboard limits.

The new development d/s Panjnad Headworks right side renders this Flood Bund highly sensitive, prone to structural instability and erosion during next flood events.

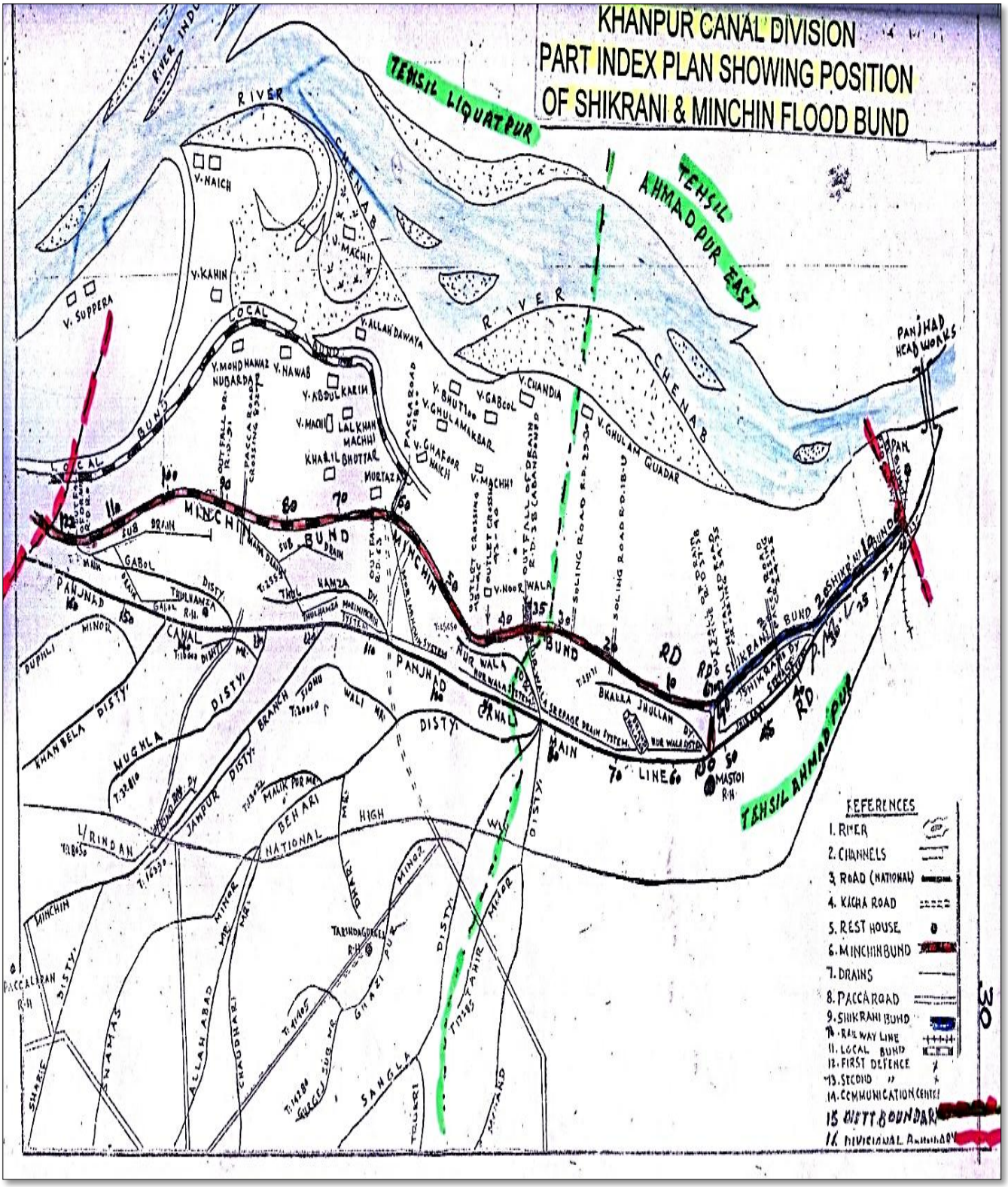
The Irrigation Research Institute (Physics Wing), Lahore vide its report no. IRI/PHY/SM/3034 dated: December, 2025 titled “Geotechnical Investigations for evaluating the vulnerability of Flood Bunds in Punjab” concluded the following for Minchin Flood Bund (MFB).

IRRIGATION DEPARTMENT

Geotechnical Investigations for Evaluating the Vulnerability of Flood Bunds in Punjab
Bahawalpur Zone (Interim Results)

Name of Zone: **Bahawalpur** Name of Division: **Punjnad Head works Division** Name of Flood Bunds: **Minchin Floo**

Sr.No.	Parameter	RD →	0 20	30	40	50	60	70	80	90	100	120
1	Vulnerability	Class	Highly Vulnerable	Very High Vulnerability	Highly Vulnerable	Highly Vulnerable	Highly Vulnerable	Highly Vulnerable	Very High Vulnerability	Highly Vulnerable	Very High Vulnerability	Highly Vulnerable
		REBVI Value	61	77	67	62	66	64	72	65	82	68
2	Prevailing Soil Strata	Class	(SM) Silty sand, fine *UnSuitable Soil Composition*	(SM) Silty sand *UnSuitable Soil Composition*	(SM) Silty sand, fine *UnSuitable Soil Composition*	(SM) Silty sand, fine *UnSuitable Soil Composition*	(SP) Poorly graded sand *UnSuitable Soil Composition*	(SM)Silty Sand,fine *UnSuitable Soil Composition*	(SM) Silty Sand,fine *UnSuitable Soil Composition*	(SP) Poorly graded sand, fines *UnSuitable Soil Composition*	(SM) Silty Sand, fine *UnSuitable Soil Composition*	(SP)Poorly graded sand, fines *UnSuitable Soil Composition*
		Value (%)	Sand= 74 % Silt= 26 % Clay= - %	Sand= 83.1 % Silt= 16.9 % Clay= - %	Sand= 74.8 % Silt= 15 % Clay= 10.2 %	Sand= 72.1 % Silt= 23.8 % Clay= 6.1 %	Sand= 95.5 % Silt= 5.5 % Clay= - %	Sand= 76.4 % Silt= 20 % Clay= 3.6 %	Sand= 69.6 % Silt= 30.4 % Clay= - %	Sand= 92.8 % Silt= 6.2 % Clay= - %	Sand= 70.6 % Silt= 15.6 % Clay= 13.8 %	Sand= 90.8 % Silt= 9.2 % Clay= - %
3	Compaction	Class	Low	Medium	Medium	Low	Low	Medium	Medium	Medium	Low	Medium
		Value (%)	78	84	84	76	73	84	89	82	74	89
4	Permeability	Class	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
		Value (cm/s)	0.0162	0.0035	0.0024	0.0075	0.0024	0.0038	0.0017	0.0064	0.0074	0.0038
5	Visual Observation & Description	Class	V poor	Poor	Poor	V poor	Poor	Poor	Poor	Poor	Poor	Poor
		Value	Damaged/ unven slopes, cracks,over design, Seepage at RD 18	Damaged/ unven slopes, cracks,under design,	Damaged/ unven slopes, cracks,under design,	Damaged/ unven slopes, cracks,under design,	Damaged slopes, over design	Damaged/ unven slopes, cracks,over design, Seepage	Damaged/ unven slopes, cracks,under design, Seepage	Damaged/ unven slopes, cracks,under design, seepage	Damaged/ unven slopes, cracks,over design,	Damaged/ unven slopes, cracks,under design,
6	Dispersion of Soil (Pin hole test)	Class	Moderate Dispersive	Moderate Dispersive	Dispersive	Dispersive	Moderate Dispersive	Moderate Dispersive	Moderate Dispersive	Non Dispersive	Slight Dispersive	Moderate Dispersive
		Value	ND3	ND3	D1	D1	ND3	ND3	ND3	ND1	ND4	ND3
7	Plasticity	Class	Low Plastic	Low Plastic	Slight Plastic	Slight Plastic	Slight Plastic	Slight Plastic	Slight Plastic	Non Plastic	Non Plastic	Non Plastic
		Value	7.4	5.6	3.5	4.2	4.8	3.9	4.1	0	0	0
8	Angle of Internal Friction	Class	Medium	Loose	Medium	Dense	Loose	Loose	Medium	Medium	Medium	Dense
		Value (degree)	32.4	29.5	33.5	36.4	28.1	29.7	30.1	33.3	34.1	36.5


KHANPUR CANAL DIVISION
PART INDEX PLAN SHOWING POSITION
OF SHIKRANI & MINCHIN FLOOD BUND
TEHSIL LIQUATPUR
TEHSIL AHMADPUR EAST
TEHSIL AHMADPUR
RIVER CHENAB
RIVER INDUS
PANJNAD HEAD WORKS
MINCHIN BUND
SHIKRANI BUND
LOCAL BUND
PANJNAD CANAL
MUGHLA BRANCH
JAMPUR DISTY
KHANBELA DISTY
DUPHLI MINOR
SOLING ROAD R.D. 18-U
V. GHULAM GUADAR
V. CHANDIA
V. NOOR WALA
V. ALLAH DAWAYA
V. KAHIN
V. NAICH
V. SUPPERA
V. MACHI
V. NAWAB
V. ABDUL KARIM
V. GABOL
V. BHUTTO
V. GHAFOOR MACH
V. MACHHI
KHAIL BHUTTAR
MURTAZA
LAL KHAN MACHHI
V. MOHD NAWAZ NUMBARDAR
OUTFALL DRAIN R.D. 38 CABANDED
OUTLET CROSSING
PACCA ROAD CROSSING
SUB DRAIN
MAIN DRAIN
GABOL DRAIN
THUL HAMZA DY
THULHAMZA MAINMINOR SYSTEM
NUR WALA SYSTEM
NUR WALA DISTRY
SEEPAGE DRAIN SYSTEM
BHALLA JHULLAN DY
SHIKRANI BUND DY
MASTOI R.H.
L/RINDAN
MALIK PUR MAJ
BEHARI NATIONAL HIGH WAY
DHARI MINOR
TARINDA GORGEJ R.H.
GHAZI PUR
TAHIR MINOR
SHARIF MINOR
ALLAH ABAD MINOR
CHAUDHARI MINOR
SANGLA
TULKRI
MITHAND
PASCCALIPAN R.H.
REFERENCES
1. RIVER
2. CHANNELS
3. ROAD (NATIONAL)
4. KACHA ROAD
5. REST HOUSE
6. MINCHIN BUND
7. DRAINS
8. PACCA ROAD
9. SHIKRANI BUND
10. RAILWAY LINE
11. LOCAL BUND
12. FIRST DEFENCE
13. SECOND "
14. COMMUNICATION CENTRE
15 DISTT BOUNDARY
16 INDIVIDUAL

RETIRED RIGHT EMBANKMENT (RRE)

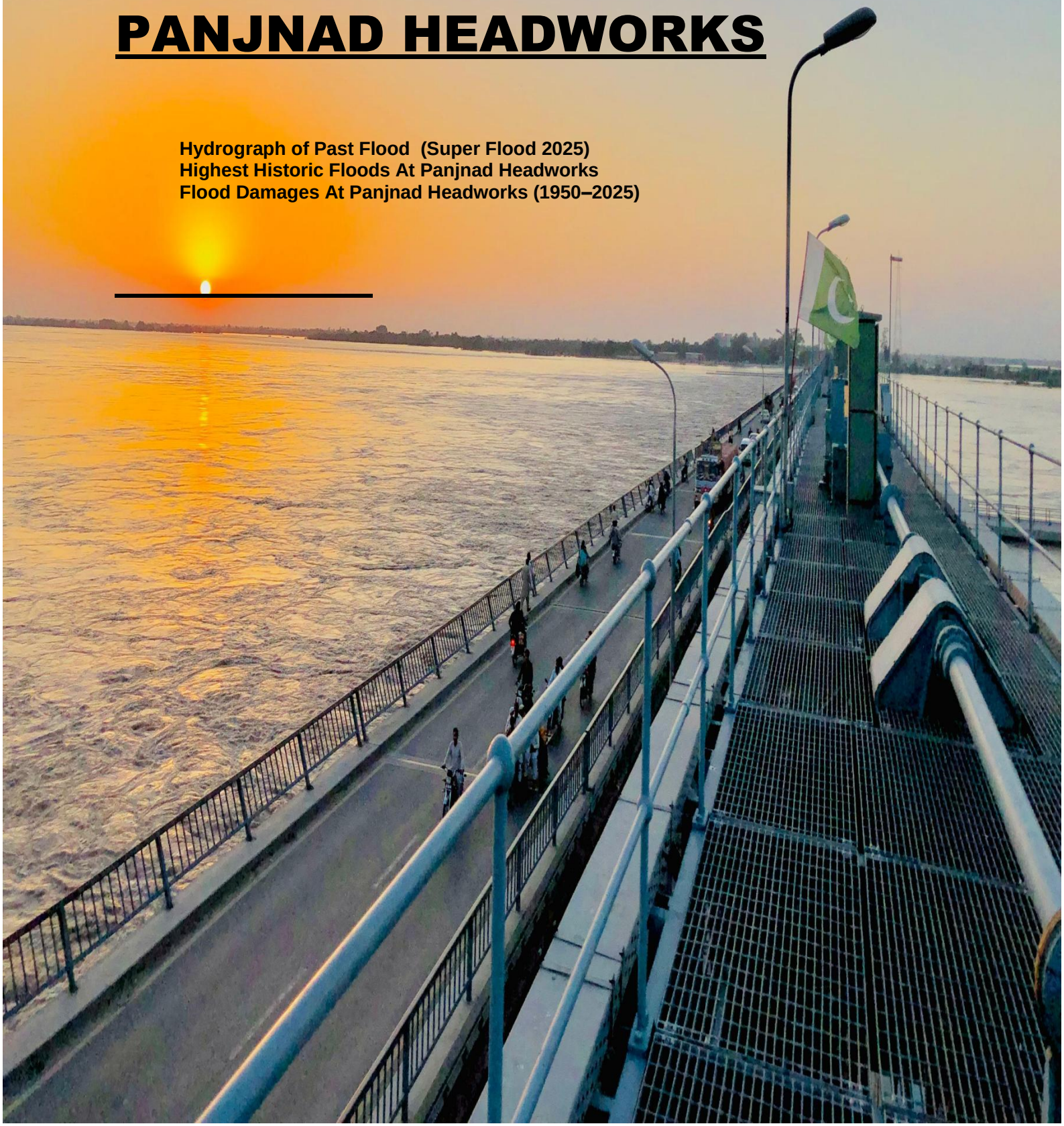
The Retired Right Embankment (RRE) is a 25,230-foot-long secondary flood defense located on the right bank, upstream of the Panjnad Headworks, serving as a vital safeguard behind the primary Right Marginal Bund (RMB). The Retired Right Embankment (RRE) runs from RD 10+000 to RD 35+230 of Right Marginal Bund (RMB). Its most critical function is as a pre-identified controlled breaching section at RD 19+000 to 21+000, designed to be deliberately operated during an exceptionally high flood to relieve catastrophic pressure on the main barrage. The execution follows a strict, pre-planned sequence: first, the K.L.P. Road is cut to create a spillway; second, the RRE breaching section is activated; and finally, the main RMB breaching section is opened, a methodology designed to provide a smooth passage for floodwater back into the river channel downstream. This drastic action, authorized by the Breach Operation Committee at a final warning stage of 500,000 cusecs, necessitates the complete evacuation of 35 villages in its predicted inundation path. The RRE's operation is not a failure but a calculated, last-resort measure to sacrifice a designated area to save the entire headworks system, a strategy successfully employed during the 1992 super flood.

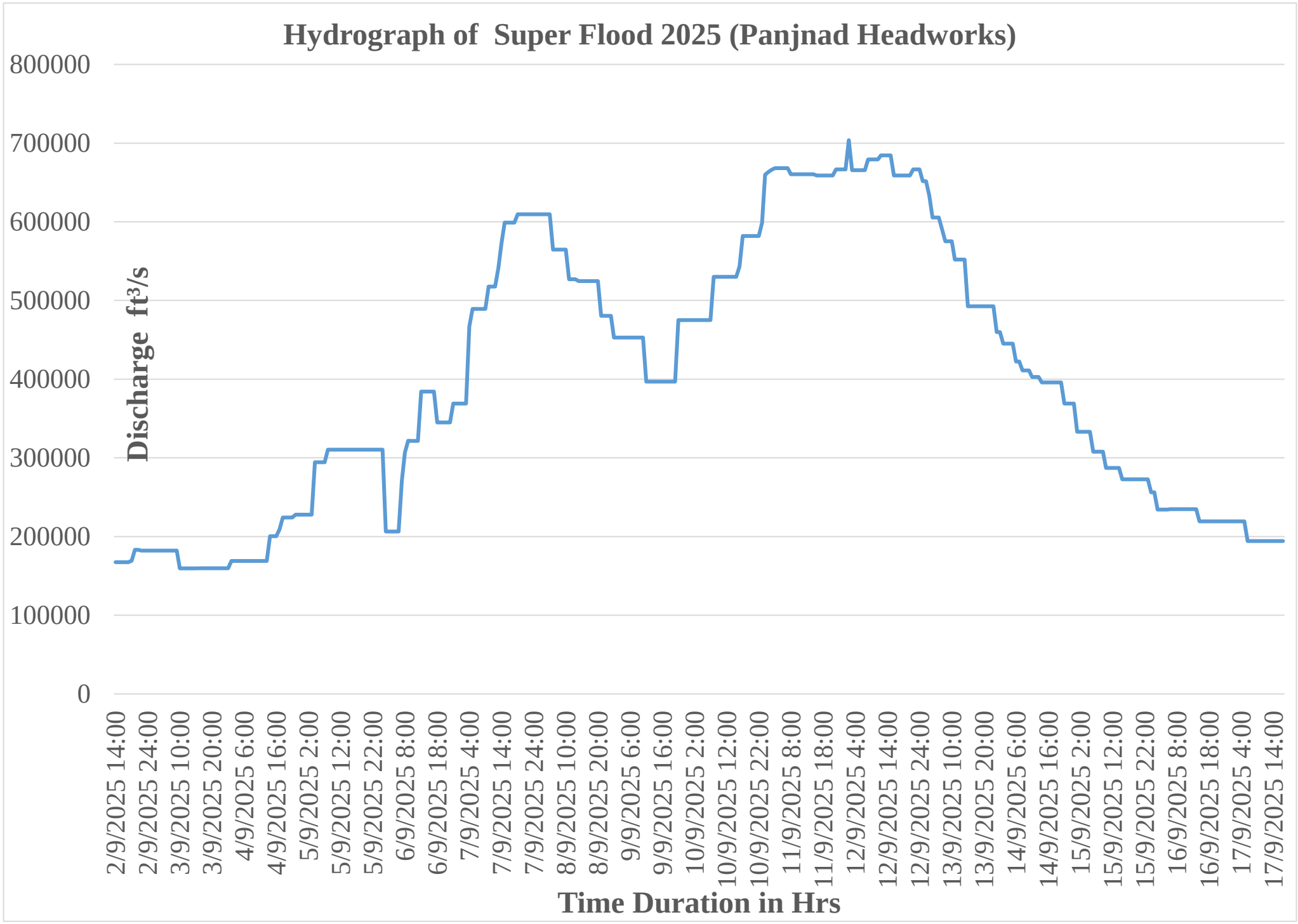
The RRE experienced backwater thrust on its country-side slope during super flood 2025 rendering it susceptible to instability in the future. In order to cater for this, a work of rehabilitating RRE as per design criterium of FFC Islamabad has been proposed and is likely to be sanctioned by competent authority in March, 2026. The completion of that work will ***significantly advance the structural stability of the said embankment.***

CHAPTER 3

BRIEF HISTORY OF PAST FLOOD EVENTS AT PANJNAD HEADWORKS

Hydrograph of Past Flood (Super Flood 2025)
Highest Historic Floods At Panjnad Headworks
Flood Damages At Panjnad Headworks (1950–2025)




Hydrograph of Super Flood 2025 (Panjnad Headworks)
Discharge ft³/s
800000
700000
600000
500000
400000
300000
200000
100000
0
2/9/2025 14:00
2/9/2025 24:00
3/9/2025 10:00
3/9/2025 20:00
4/9/2025 6:00
4/9/2025 16:00
5/9/2025 2:00
5/9/2025 12:00
5/9/2025 22:00
6/9/2025 8:00
6/9/2025 18:00
7/9/2025 4:00
7/9/2025 14:00
7/9/2025 24:00
8/9/2025 10:00
8/9/2025 20:00
9/9/2025 6:00
9/9/2025 16:00
10/9/2025 2:00
10/9/2025 12:00
10/9/2025 22:00
11/9/2025 8:00
11/9/2025 18:00
12/9/2025 4:00
12/9/2025 14:00
12/9/2025 24:00
13/9/2025 10:00
13/9/2025 20:00
14/9/2025 6:00
14/9/2025 16:00
15/9/2025 2:00
15/9/2025 12:00
15/9/2025 22:00
16/9/2025 8:00
16/9/2025 18:00
17/9/2025 4:00
17/9/2025 14:00
Time Duration in Hrs

HIGHEST HISTORIC FLOODS AT PANJNAD HEADWORKS

The highest recorded discharge at Panjnad Headworks was 812,152 cusecs during the 1992 flood, when breaching sections at RD 28–30 of the Right Marginal Bund (RMB) and RD 19–21 of the Right Retired Embankment (RRE) were operated; prior to this, the maximum discharge had been 802,516 cusecs in 1973, which caused breaches in both RMB and the Left Marginal Bund (LMB) at RD 9–10, 19–20, and 34–35, severely damaging the Panjnad Main Line Canal, the Abbasia Canal, and large areas extending toward Rahim Yar Khan District. Discharges exceeding 500,000 cusecs were also recorded in multiple years including 1950, 1955, 1957, 1988, 1995, 1996, and 1997, while more recent floods include the 2014 event with 453,570 cusecs, which damaged the spur at RD 48–49 of RMB, and the 2015 flood with 139,366 cusecs, which affected the apron and pitching of the J-Head of the spur at RD 23+500 of RMB. Although the histogram of floods from 1992–2024 shows that flows rarely exceeded 500,000 cusecs, the 2025 flood season saw unusually high freshets, with 609,664 cusecs recorded at 1900 hours on 07.09.2025 and the ultimate peak of 703,698 cusecs at 0200 hours on 12.09.2025.

SR NO	FLOOD CATEGORY	YEAR	DATE	U/S GAUGE	D/S GAUGE	DISCHARGE (LAC CS)
1	Super Flood	**1992**	18.07.1992	340.50	340.30	**8.12**
2	Super Flood	**1973**	17.08.1973	341.00	340.30	**8.02**
3	Super Flood	**1976**	11.08.1976	342.40	340.70	**7.10**
4	Exceptionally High Flood	**2025**	12.09.2025	342.90	342.40	**7.03**
5	Exceptionally High Flood	**1950**	27.09.1950	340.30	339.80	**6.76**
6	Exceptionally High Flood	**1995**	05.05.1995	339.20	338.90	**6.05**
7	Exceptionally High Flood	**1996**	31.08.1996	339.00	338.60	**5.71**
8	Exceptionally High Flood	**1955**	16.10.1955	339.35	338.40	**5.50**
9	Exceptionally High Flood	**1957**	02.09.1957	339.30	335.10	**5.29**
10	Exceptionally High Flood	**1997**	04.07.1997	339.55	339.45	**5.12**
11	Exceptionally High Flood	**1988**	28.07.1988	340.90	339.70	**5.07**
12	Very High Flood	**1959**	12.07.1959	339.20	338.15	**4.93**
13	Very High Flood	**1975**	29.07.1975	338.00	337.00	**4.82**
14	Very High Flood	**2014**	16.09.2014	340.18	339.90	**4.53**
15	Very High Flood	**1964**	23.08.1964	339.00	338.00	**4.41**

TABLE 3.2: Highest Recorded Floods At Panjnad Headworks

FLOOD DAMAGES AT PANJNAD HEADWORKS (1950–2025)

Including the history of past floods, affected areas, nature of damage, and restoration measures in a flood fighting plan is fundamental because it transforms the document from a generic procedural checklist into a strategic, intelligence-driven defense system. This historical context provides predictive intelligence, revealing recurring patterns and worst-case scenarios to anticipate future threats. By precisely mapping previously affected areas and understanding the specific nature of past damages—such as scouring at spurs or seepage in saturated embankments—the plan enables the pre-positioning of correct resources and dictates the most effective emergency counter-measures. Furthermore, documenting proven restoration measures creates a pre-approved playbook for rapid response, ensuring that hard-won lessons are institutionalized. Ultimately, this collective knowledge shifts the entire strategy from reactive guesswork to proactive, targeted action based on empirical evidence, thereby building a cycle of continuous resilience.

Year	Peak Discharge (Cusecs)	Affected Structures / Locations	Nature of Damages	Restoration Measures
1950	> 500,000	RMB / LMB	Over-topping threats	Bund strengthening carried out
1955	> 500,000	RMB / LMB	Erosion and stress on embankments	Emergency stone pitching
1957	> 500,000	RMB / LMB	Localized erosion	Restored with earthwork
1973	802,516	RMB & LMB (Breaches at RD 9–10, 19–20, 34–35)	Breaches caused heavy damages to Panjnad Main Line Canal, Abbasia Canal, and public property; area up to Rahim Yar Khan inundated	Emergency closure works executed
1988	> 500,000	RMB / LMB	Stress on bunds	Patrolling & stone pitching
1992	812,152 (Highest Recorded)	RMB (RD 28–30) & RRE (RD 19–21)	Breaching section operated; widespread inundation	Controlled by breaching operation
1995	> 500,000	Bund system	Local damages	Restored with earthwork
1996	> 5,00,000	Bund system	Local damages	Restored with earthwork
1997	> 5,00,000	Bund system	Local damages	Restored with earthwork
2010	3,12,000	Minchin Bund (RD 122+000 to RD 60+000)	Seepage at multiple points due to Indus backwater	Controlled with earthwork
2013	~3,00,000	Shikrani Bund (RD 19+000–40+000) & Minchin Bund (RD 6+700–45+000, 60+000–122+000)	Water contact, no major damage	Continuous watch & ward
2014	4,53,570	RMB (Spur RD 48–49)	J-Head of spur damaged	Restored after flood
2015	1,39,366	RMB (Spur RD 23+500)	Apron and pitching at J-Head damaged	Restoration completed before 2016 flood
2016–2024	< 1,40,000	-	No direct flood contact	Routine maintenance only
2025	7,03,698	**HEADWORKS:** ✓ A 703,698 cusec peak flow achieved u/s and d/s water levels	**HEADWORKS** ✓ Discharge passing efficiency reduced due to higher TWL	**HEADWORKS** i. 01 no. of Physical Model Study is underway at IRI, Nandipur for checking the following:

Year	Peak Discharge (Cusecs)	Affected Structures / Locations	Nature of Damages	Restoration Measures
		designed for an 865,000 cusec event, eliminating the safety margin on protective embankments and revealing severe downstream bottlenecks. **RIGHT MARGINAL BUND (RMB)** ✓ J-Head Spur RD 40+900 ✓ J-Head Spur at RD 23+500 ("Confluence Defender") ✓ Reach RD 32+000 to 45+000 (High Velocity Impact Zone)	resulting from accreted bed levels and constricted water way at confluence of Chenab-Indus d/s Panjnad Headworks. **RIGHT MARGINAL BUND (RMB)** ✓ **Severe Scouring:** J-Head Spurs at RD 23+500 and 40+900 experienced severe apron launching and foundation undermining from direct river attack. ✓ **Slope Instability:** Reach RD 32+000 to 45+000 suffered from slope sloughing and erosion due to sustained high-velocity impact.	● Correcting River Approach u/s Panjnad Headworks in order to recoup the discharge capacity by removing u/s right side bella formation **RIGHT MARGINAL BUND (RMB)** **i.** A PC-I namely "Remodeling and Protection of LMB & RMB of Panjnad Headworks in critical reaches" is in P&D Board Lahore. Its eventual execution will rehabilitate RMB by the construction of wetting channel from RD 25-28. **ii.** 01 no. of Physical Model Study is underway at IRI, Nandipur for checking the following: (the concept note for inclusion of the scheme in ADP 2026-27 has also been sent from this division) ● Checking advancement of River Chenab towards right side RMB. Scope includes: • Extension and conversion of existing sloping stud at RD 43+000 (RMB) into a hockey spur. • Extension and conversion of existing sloping stud at RD 39+000 (RMB) into a hockey spur. • Restoration of apron width (30 ft) for existing J-head spurs at RD 40+000 and RD 36+700. **iii.** A concept note for inclusion of the following scheme in ADP 2026-27 has also been sent from this division: ● Restoration / Raising of River Training Structures of Panjnad Headworks (including all 14 structures of RMB) **<u>LEFT MARGINAL BUND (LMB)</u>** **i.** A PC-I namely "Remodeling and Protection of LMB & RMB of Panjnad Headworks in critical

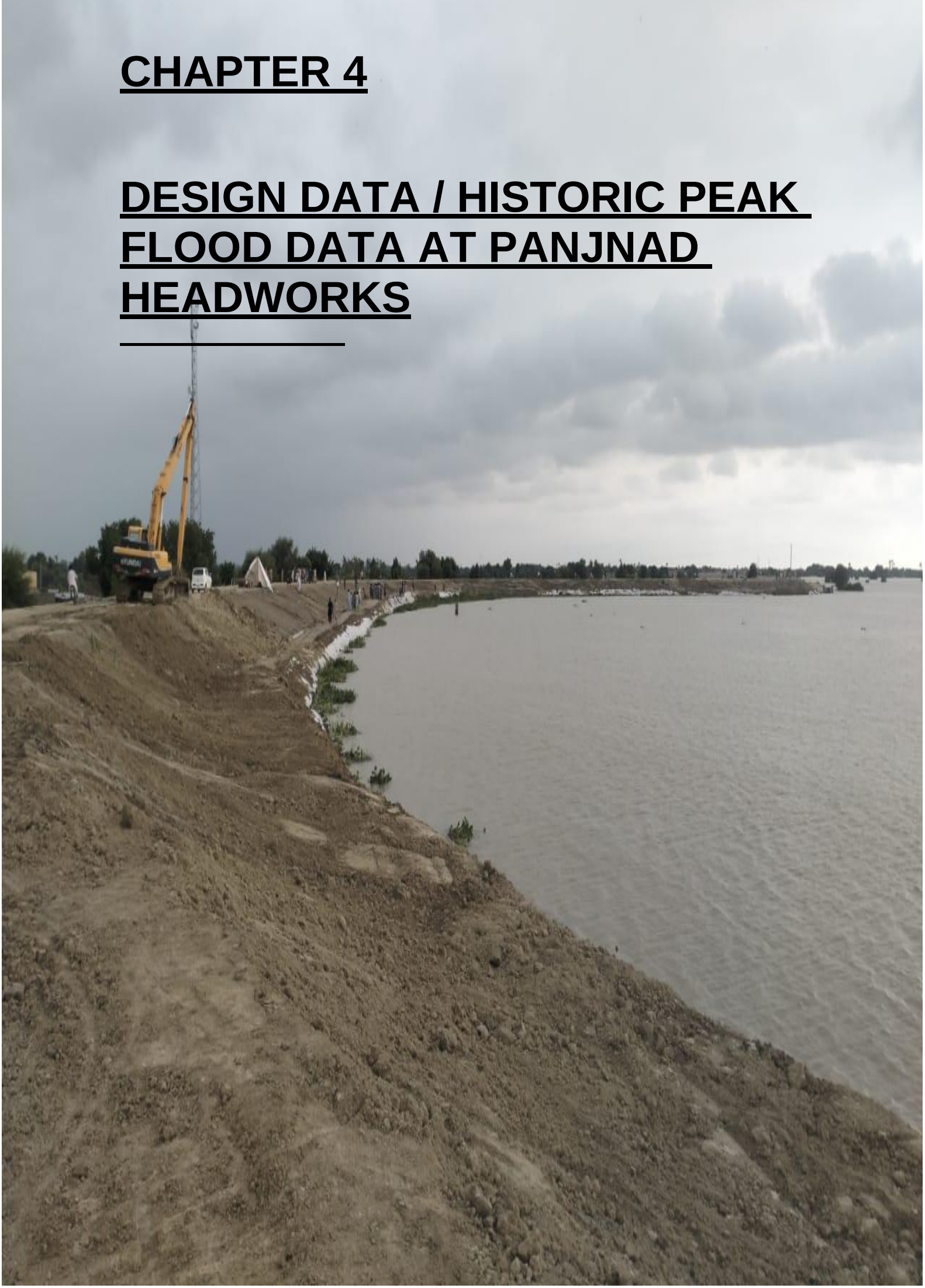
Year	Peak Discharge (Cusecs)	Affected Structures / Locations	Nature of Damages	Restoration Measures
		LEFT MARGINAL BUND (LMB) ✓ J-Head Spur at RD 6+500 ✓ Reach RD 0+000 to 6+000 (Critical Seepage Zone) ✓ Reach RD 10+000 to 35+000 (River Morphology Impact Zone) ✓ Historic 1973 breach sites (RD 09-11, 19-21, 34-35) **SHIKRANI FLOOD BUND** ✓ Reach RD 37+000 to 38+000 (Freeboard Deficiency Zone) ✓ Reach RD 0+000 to 18+000 (High Seepage Risk Section)	**LEFT MARGINAL BUND (LMB)** ✓ **Foundation Scouring:** apron of J-Head Spur at RD 6+500 was undermined by aggressive currents. ✓ **Seepage & Piping:** Reach RD 0+000 to 6+000 showed severe seepage and sand boils, risking internal erosion. ✓ **Reactivation of Weak Zones:** Reach RD 10+000 to 35+000 and historic breach sites experienced erosion due to a shift in river morphology. **SHIKRANI FLOOD BUND** ✓ **Inadequate Freeboard:** Reach RD 37+000 to 38+000 had its freeboard encroached, risking overtopping. ✓ **Seepage Emergence:** Reach RD 0+000 to 18+000 exhibited significant seepage lines due to a high hydraulic head.	reaches" is in P&D Board Lahore. Scope includes following for LMB: ✓ Straightening and strengthening of old breach sites (RD 10+100 –11+200 and RD 19+000 – 20+000) on the LMB, along with provision of wetting channels. ✓ Provision of stone pitching on the river-side slope of the LMB in critical reaches RD 34+500 – RD 44+000 (9,500-ft) at the existing 1:3 slope, as adopting a 1:2 slope would require excessive cutting, increasing overall project's cost, and adversely affecting embankment's stability. ✓ Stone pitching of length 2000 ft (from RD 4+000 to 6+000) on the upstream shank of J-Head Spur at RD 6+500 (LMB) to control erosive action. **SHIKRANI FLOOD BUND** **i.** Flood Restoration related work is ongoing through Machinery Division, Multan. Scope of work is to rehabilitate the said bund as per FFC criteria before 15.05.2026. **ii.** A comprehensive strengthening scheme titled "Preventing Erosion of River Indus along Minchin Flood Bund (Taunsa-Guddu reach)" has been prioritized under FPSP-III, and the PC-I has been submitted by this Division for systematic upgradation in accordance with approved parameters. **MINCHIN FLOOD BUND** **i.** Flood Restoration related work is ongoing through Machinery Division, Multan. Scope of work is to rehabilitate the said bund as per FFC criteria before 15.05.2026. **ii.** A comprehensive strengthening scheme titled "Preventing Erosion of River Indus along Minchin Flood Bund (Taunsa-Guddu reach)" has been prioritized under FPSP-III, and the PC-I has been submitted by this Division for systematic upgradation in accordance with

Year	Peak Discharge (Cusecs)	Affected Structures / Locations	Nature of Damages	Restoration Measures
		MINCHIN FLOOD BUND ✓ Reach RD 62+000–65+000 ✓ Reach RD 98+000–100+000 ✓ Reach RD 96+000–98+000	**MINCHIN FLOOD BUND** ✓ **Toe Erosion & Scour:** Reaches RD 62+000–65+000 and RD 98+000–100+000 suffered active scouring from the river's main current. ✓ **Apron Damage:** Reach RD 96+000–98+000 experienced minor damage to its protective stone pitching and launching aprons.	approved parameters.

TABLE 3.3: History of Past Floods at Panjnad Headworks

CHAPTER 4

DESIGN DATA / HISTORIC PEAK FLOOD DATA AT PANJNAD HEADWORKS



CHAPTER 4
DESIGN DATA / HISTORIC PEAK FLOOD DATA AT PANJNAD HEADWORKS

4.1 FLOOD LIMITS / CLASSIFICATION AT PANJNAD HEADWORKS
4.2 TIME LAG OF FLOODS
4.3 HIGHEST HISTORIC PEAK FLOODS
4.4 PEAK DISCHARGES
HIGHEST WATER LEVELS RECORDED DURING PEAK YEARS ON VARIOUS EMBANKMENTS OF PANJNAD HEADWORKS

4.1 FLOOD LIMITS / CLASSIFICATION AT PANJNAD HEADWORKS

Floods are classified as low, medium, high, very high, or exceptional high so authorities and communities can quickly understand the severity and potential impact of rising water. These categories are based on factors like water depth, speed, and how much land, property, or infrastructure is likely to be affected. A clear classification system helps emergency services decide when to issue warnings, prepare evacuations, or deploy rescue teams, and it also guides the public in knowing how urgently they need to act. By using consistent levels, governments and hydrologists can compare flood events, improve forecasting, plan safer infrastructure, and support insurance and disaster-management decisions.

Flood Limit / classification at Panjnad Headworks was fixed in the *"Meeting of the working group regarding revised lag times and flood classification / limits held on 9th July 2021 in the office of Chief Meteorologist, Flood Forecasting Division (FFD), Lahore"*. The minutes of the same meeting were issued vide Chief Meteorologist FFD Lahore office letter no. FWC-2/ 2019/ 2/ IV dated: 23.07.2021 ***(Copy attached)***.

The approved classification is as under:-

Sr. No.	Flood Stage / Classification	Discharge (Lac Cs)
1.	Low Flood.	1.50 to 2.00
2.	Medium Flood.	2.00 to 3.00
3.	High Flood.	3.00 to 4.50
4.	Very High Flood.	4.50 to 6.00
5.	Exceptionally High Flood.	Above 6.00

TABLE 4.1: FFD's approved Flood Limits / Classification for Panjnad Headworks

4.2 TIME LAG OF FLOODS AT PANJNAD HEADWORKS

Lag times provide a crucial window for life-saving action. The period between a flood wave forming upstream and its arrival at a vulnerable point like a city or headworks is not a delay but a strategic opportunity. This lead time is essential for issuing accurate public warnings, executing the orderly evacuation of populations, and mobilizing emergency personnel and resources to critical defense points. Furthermore, it allows operators at key infrastructure, such as barrages and reservoirs, to make strategic releases and adjust gate operations to mitigate the peak impact of the incoming flood. Essentially, understanding time lags transforms a passive disaster into a manageable emergency, enabling a proactive defense that saves lives and minimizes economic damage.

Lag times for Panjnad Headworks were fixed in the *"Meeting of the working group regarding revised lag times and flood classification / limits held on 9th July 2021 in the office of Chief Meteorologist, Flood Forecasting Division (FFD), Lahore".* The minutes of the same meeting were issued vide Chief Meteorologist FFD Lahore office letter no. FWC-2/ 2019/ 2/ IV dated: 23.07.2021 ***(Copy attached)***. The approved lag times are as under:-

REACH	TRIMU TO PANJNAD	SIDHNAI TO PANJNAD	ISLAM TO PANJNAD
Distance in Canal Miles.	165 Miles.	145 Miles.	130 Miles.
STAGE OF FLOOD	**TIME LAG**		
Low Supplies	81 Hrs.	63 Hrs.	74 Hrs.
Low Floods	75 Hrs.	60 Hrs.	70 Hrs.
Medium Flood	75 Hrs.	60 Hrs.	70 Hrs.
High Flood	81 Hrs.	63 Hrs.	72 Hrs.
Very High Flood	81 Hrs.	63 Hrs.	72 Hrs.
Exceptional High Flood	81 Hrs.	63 Hrs.	72 Hrs.
Supper Flood as in 1973	50 Hrs.	45 Hrs.	30 Hrs.
Supper Flood as in 1992	78 Hrs.	60 Hrs.	30 Hrs.
Very High Flood 2014	121 Hrs.	82 Hrs.	-
Exceptional High Flood 2025	***133 Hrs.***	***102 Hrs.***	***74 Hrs.***

TABLE 4.2: FFD's approved Lag Time for Panjnad Headworks

4.3 HIGHEST HISTORIC PEAK FLOODS AT PANJNAD HEADWORKS

The highest recorded discharge at Panjnad Headworks was 812,152 cusecs during the 1992 flood, when breaching sections at RD 28–30 of the Right Marginal Bund (RMB) and RD 19–21 of the Right Retired Embankment (RRE) were operated; prior to this, the maximum discharge had been 802,516 cusecs in 1973, which caused breaches in both RMB and the Left Marginal Bund (LMB) at RD 9–10, 19–20, and 34–35, severely damaging the Panjnad Main Line Canal, the Abbasia Canal, and large areas extending toward Rahim Yar Khan District. Discharges exceeding 500,000 cusecs were also recorded in multiple years including 1950, 1955, 1957, 1988, 1995, 1996, and 1997, while more recent floods include the 2014 event with 453,570 cusecs, which damaged the spur at RD 48–49 of RMB, and the 2015 flood with 139,366 cusecs, which affected the apron and pitching of the J-Head of the spur at RD 23+500 of RMB. Although the histogram of floods from 1992–2024 shows that flows rarely exceeded 500,000 cusecs, the 2025 flood season saw unusually high freshets, with 609,664 cusecs recorded at 1900 hours on 07.09.2025 and the ultimate peak of 703,698 cusecs at 0200 hours on 12.09.2025.

SR NO	FLOOD CATEGORY	YEAR	DATE	U/S GAUGE	D/S GAUGE	DISCHARGE (LAC CS)
1	Super Flood	**1992**	18.07.1992	340.50	340.30	**8.12**
2	Super Flood	**1973**	17.08.1973	341.00	340.30	**8.02**
3	Super Flood	**1976**	11.08.1976	342.40	340.70	**7.10**
4	Exceptionally High Flood	**2025**	12.09.2025	342.90	342.40	**7.03**
5	Exceptionally High Flood	**1950**	27.09.1950	340.30	339.80	**6.76**
6	Exceptionally High Flood	**1995**	05.05.1995	339.20	338.90	**6.05**
7	Exceptionally High Flood	**1996**	31.08.1996	339.00	338.60	**5.71**
8	Exceptionally High Flood	**1955**	16.10.1955	339.35	338.40	**5.50**
9	Exceptionally High Flood	**1957**	02.09.1957	339.30	335.10	**5.29**
10	Exceptionally High Flood	**1997**	04.07.1997	339.55	339.45	**5.12**
11	Exceptionally High Flood	**1988**	28.07.1988	340.90	339.70	**5.07**
12	Very High Flood	**1959**	12.07.1959	339.20	338.15	**4.93**
13	Very High Flood	**1975**	29.07.1975	338.00	337.00	**4.82**
14	Very High Flood	**2014**	16.09.2014	340.18	339.90	**4.53**
15	Very High Flood	**1964**	23.08.1964	339.00	338.00	**4.41**

TABLE 4.3: Highest Recorded Floods At Panjnad Headworks

4.4 YEAR-WISE PEAK DISCHARGES AT PANJNAD HEADWORKS

SR. NO.	YEAR	U/S GAUGE	D/S GAUGE	DISCHARGE (LAC CS)
1	**1950**	340.30	339.80	**6.76**
2	**1951**	337.50	335.30	**2.45**
3	**1952**	N/A	N/A	**N/A**
4	**1953**	337.50	335.20	**2.78**
5	**1955**	339.35	338.40	**5.50**
6	**1956**	337.10	332.20	**1.45**
7	**1957**	339.30	335.10	**5.29**
8	**1958**	338.50	334.20	**1.61**
9	**1959**	339.20	338.15	**4.93**
10	**1960**	337.50	336.40	**3.55**
11	**1961**	337.50	337.00	**3.81**
12	**1962**	337.60	335.00	**2.19**
13	**1963**	337.80	332.80	**1.09**
14	**1964**	339.00	338.00	**4.41**
15	**1965**	337.70	334.90	**1.92**
16	**1966**	338.60	336.90	**4.15**
17	**1967**	337.80	334.40	**1.55**
18	**1968**	337.90	335.10	**2.13**
19	**1969**	N/A	N/A	**N/A**
20	**1970**	337.70	333.60	**1.44**
21	**1971**	337.70	336.20	**2.61**
22	**1972**	337.90	335.25	**1.61**
23	**1973**	341.00	340.30	**8.02**
24	**1974**	N/A	N/A	**N/A**
25	**1975**	338.00	337.00	**4.82**
26	**1976**	342.40	340.70	**7.10**
27	**1977**	337.80	335.40	**2.57**
28	**1978**	337.90	336.60	**3.33**
29	**1979**	338.00	334.00	**1.39**
30	**1980**	338.40	334.95	**1.80**
31	**1981**	N/A	N/A	**N/A**
32	**1982**	337.90	335.00	**1.49**
33	**1983**	339.00	337.10	**3.20**
34	**1984**	338.20	334.80	**1.54**
35	**1985**	338.20	335.50	**2.55**
36	**1986**	341.50	337.40	**3.53**
37	**1987**	338.20	335.10	**1.60**
38	**1988**	340.90	339.70	**5.07**
39	**1989**	339.20	337.40	**4.29**
40	**1990**	338.20	335.45	**2.00**
41	**1991**	338.20	335.00	**1.70**
42	**1992**	340.50	340.30	**8.12**
43	**1993**	338.20	337.20	**3.55**
44	**1994**	338.50	336.20	**2.66**
45	**1995**	339.20	338.90	**6.05**
46	**1996**	339.00	338.60	**5.71**
47	**1997**	339.55	339.45	**5.12**
48	**1998**	338.50	334.20	**1.61**
49	**1999**	338.30	328.50	**0.48**
50	**2000**	338.20	330.60	**0.75**

51	**2001**	338.20	330.10	**0.57**
52	**2002**	338.20	331.00	**0.68**
53	**2003**	338.10	333.70	**0.93**
54	**2004**	338.20	326.80	**0.33**
55	**2005**	338.00	334.00	**1.01**
56	**2006**	338.20	336.40	**2.82**
57	**2007**	338.20	331.90	**0.51**
58	**2008**	338.20	332.00	**0.53**
59	**2009**	338.20	329.60	**0.32**
60	**2010**	338.80	338.70	**3.10**
61	**2011**	338.00	337.05	**1.66**
62	**2012**	336.50	334.50	**0.56**
63	**2013**	338.80	336.96	**3.17**
64	**2014**	340.18	339.90	**4.53**
65	**2015**	338.20	335.00	**1.39**
66	**2016**	338.10	335.70	**1.30**
67	**2017**	338.10	333.50	**0.78**
68	**2018**	338.10	331.20	**0.57**
69	**2019**	337.90	334.55	**0.87**
70	**2020**	338.00	336.10	**1.47**
71	**2021**	338.00	333.25	**0.75**
72	**2022**	338.00	335.00	**1.21**
73	**2023**	337.70	336.10	**1.59**
74	**2024**	338.00	335.10	**0.72**
75	**2025**	342.90	342.40	**7.03**

TABLE 4.4: Year-wise Peak Discharges At Panjnad Headworks

HIGHEST WATER LEVELS RECORDED DURING PEAK YEARS ON VARIOUS EMBANKMENTS OF PANJNAD HEADWORKS

The inclusion of "Highest Water Levels Recorded during peak years (considering Historic and recent-past floods) on Various Embankments" in a Flood Fighting Plan is absolutely critical because it provides the definitive, battle-tested benchmark for all operational decisions. This historical data establishes the proven defense line each embankment has held, allowing flood fighters to do the following:

- identify vulnerable reaches,
- anticipate the magnitude of an impending threat, and
- trigger pre-planned emergency responses at precise water level thresholds
- discern whether a current flood is behaving normally or is an unprecedented event
- enable the strategic deployment of resources to known weak spots
- timely activation of drastic measures like controlled breaching to prevent catastrophic, uncontrolled failure of the entire flood defense system.

A critical design parameter was revised during the Panjnad Headworks rehabilitation under the TBPIP project (2018-2023). The established Highest Flood Level (HFL) was raised from its pre-rehabilitation datum of **341.50 ft** to a new design HFL of **343.03 ft**. Consequently, all historical flood level records predating the rehabilitation must be interpreted with reference to this **+1.53 ft shift in the HFL benchmark**.

RIGHT MARGINAL BUND (RMB):

RD	1973	Design HFL @ 8.65 Lac Cs (Top RL of Bund - 7' free-board)	2025		
			Existing Top RL of Bund	Max Water Level achieved @ 7.03 lac Cs	Available Free Board against design 7 ft
5	345.38	346.20	353.79	345.39	8.40
10	345.48	346.40	353.97	346.05	7.92
15	345.85	347.00	354.51	346.65	7.86
20	346.74	349.30	356.35	348.60	7.75
25	347.63	350.40	357.31	350.00	7.31
30	348.10	350.50	357.36	350.63	6.73
35	348.57	350.60	357.32	351.22	6.10
40	349.43	351.00	358.57	351.72	6.85
45	350.69	351.40	358.40	352.23	6.17
50	351.32	351.80	358.86	352.82	6.04
55	351.95	352.20	359.00	352.50	6.50
60	351.95	352.60	359.60	353.53	6.07
65	351.95	353.00	360.00	353.85	6.15
70	352.90	353.40	Water Not Touched		

LEFT MARGINAL BUND (LMB):

RD	1973	Design HFL @ 8.65 Lac Cs (Top RL of Bund - 7' Free-board)	2025		
			Existing Top RL of Bund	Max Water Level achieved @ 7.03 lac Cs	Available Free Board against design 7 ft
0	345.56	344.84	-	-	-
5	347.20	346.20	353.20	344.50	8.70
10	350.30	349.30	356.30	348.15	8.15
15	350.70	349.70	356.70	347.85	8.85
20	351.10	350.10	357.10	348.62	8.48
25	351.30	350.30	357.30	348.70	8.60
30	351.50	350.50	357.50	348.10	9.40
35	351.70	350.70	357.70		
40	351.90	350.90	357.90		
45	352.10	351.10	358.10		

RD	1973	Design HFL @ 8.65 Lac Cs (Top RL of Bund - 7' Free-board)	2025		
			Existing Top RL of Bund	Max Water Level achieved @ 7.03 lac Cs	Available Free Board against design 7 ft
50	352.30	351.30	358.30		
55	352.50	351.50	358.50	348.20	10.30
60	353.90	352.90	359.90		
65	355.30	354.30	361.30		
68	-	354.86	361.86		

COLONY PROTECTION BUND:

RD	1973	Design HFL @ 8.65 Lac Cs (Top RL of Bund - 7' Free-board)	2025		
			Existing Top RL of Bund	Max Water Level achieved @ 7.03 lac Cs	Available Free Board against design 7 ft
1	340.70	342.00	348.65	342.14	6.51
5	339.93	341.25	346.81	341.94	4.87
10	339.13	340.50	347.08	341.55	5.53
15	-	339.75	346.62	340.04	6.58
17+600	-	339.36	345.50	339.36	6.14

SHIKRANI FLOOD BUND:

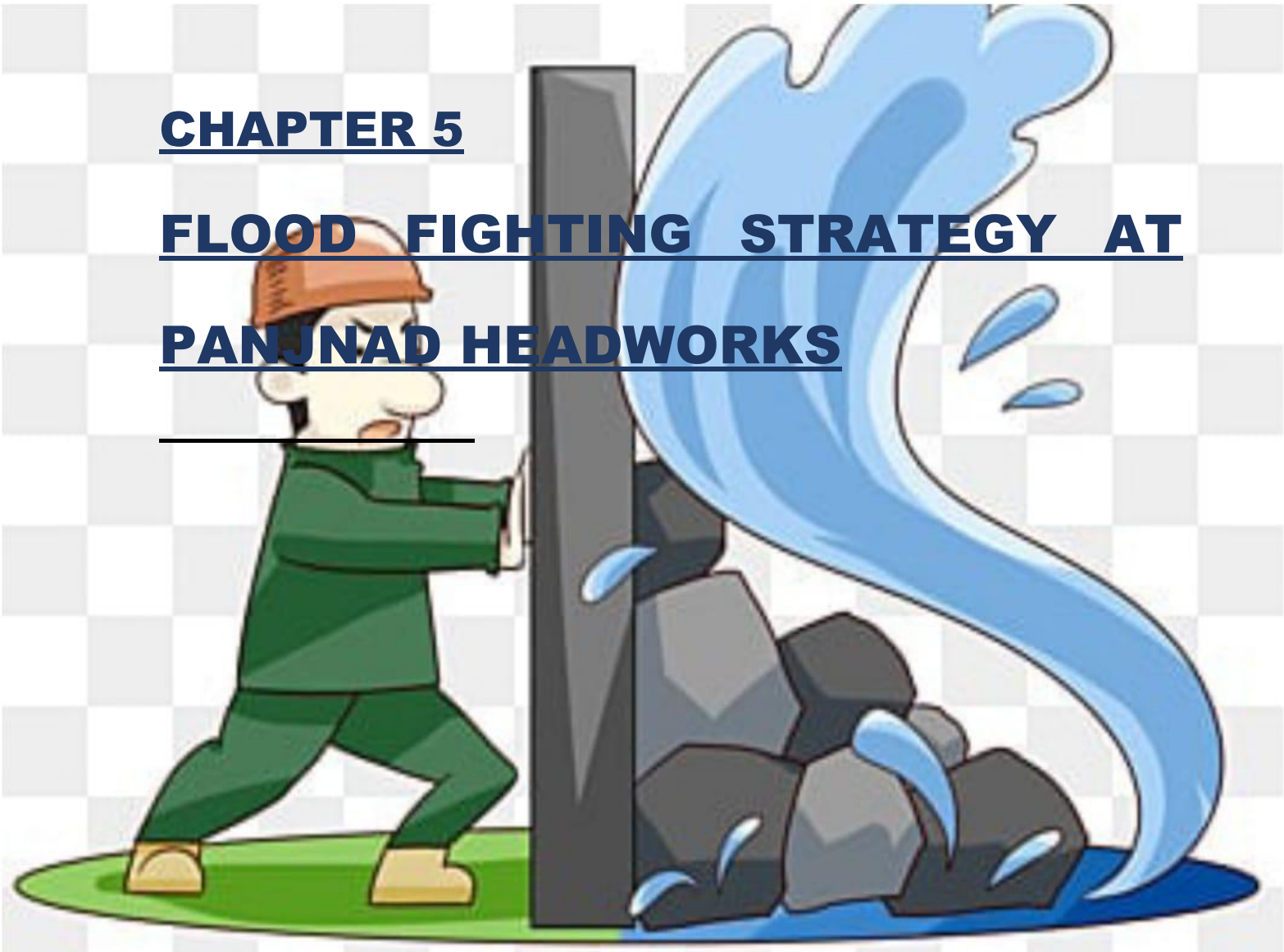
RD	1973	Design HFL @ 8.65 Lac Cs (Top RL of Bund - 7' Free-board)	2025		
			Existing Top RL of Bund	Max Water Level achieved @ 7.03 lac Cs	Available Free Board against design 7 ft
0	338.26	339.36	344.35	339.36	4.99
5	337.98	338.61	344.21	338.76	5.45
10	336.95	337.86	343.39	337.79	5.60
15	335.82	337.11	341.93	337.52	4.41
20	335.22	336.36	340.50	336.45	4.05
25	334.67	335.61	340.86	336.14	4.72
30	333.90	334.86	340.20	335.42	4.78
35	333.59	334.11	339.30	334.98	4.32
40	332.84	333.36	338.73	334.20	4.53

MINCHIN FLOOD BUND:

RD	1973	1988	1992	2010	2014	Design HFL @ 8.65 Lac Cs (Top RL of Bund - 7' Free-board)	2025		
							Existing Top RL of Bund	Max Water Level achieved @ 7.03 lac Cs	Available Free Board against design 7 ft
5	333.01	-	-	-	-	-	-	-	-
6+700	332.84	331.74	332.94	-	331.11	333.36	338.73	334.20	4.53
10	332.58	331.48	332.61	-	330.92	332.93	339.16	334.18	4.98
15	332.03	330.93	332.11	-	330.37	332.28	338.17	333.75	4.42
20	331.54	330.44	331.61	-	329.82	331.63	337.69	333.43	4.26
25	331.05	329.95	331.11	-	329.27	330.98	336.98	332.53	4.45
30	330.56	329.74	330.61	-	328.72	330.33	336.78	331.80	4.98
35	330.08	328.98	330.11	-	328.27	329.68	335.93	331.20	4.73
40	329.68	328.58	329.71	-	327.82	329.03	335.67	330.67	5.00
45	329.38	328.28	329.41	-	327.42	328.38	334.50	330.02	4.48
50	329.07	327.97	329.10	-	326.82	327.73	335.69	329.18	6.51
55	328.76	327.66	328.79	-	326.52	327.08	334.64	328.98	5.66
60	328.46	327.36	328.49	326.52	326.33	326.43	334.59	328.72	5.87
65	325.90	325.80	325.93	325.96	325.55	325.78	331.92	327.50	4.42
70	324.90	323.00	325.26	325.29	324.66	325.13	331.87	326.96	4.91
75	322.90	321.80	324.59	324.62	323.97	324.48	330.51	326.26	4.25
80	322.34	321.24	323.92	323.95	323.24	323.83	331.59	325.67	5.92
85	321.40	320.30	323.25	323.28	322.49	323.18	328.88	324.83	4.05
90	319.50	318.40	322.58	322.61	321.72	322.53	328.88	323.30	5.58
95	319.08	317.98	321.97	322.00	320.97	321.88	327.63	322.34	5.29
100	317.03	316.93	321.24	321.27	320.19	321.23	326.89	320.63	6.26
105	316.65	315.55	300.57	300.60	319.27	320.58	326.24	318.34	7.90
110	316.40	315.30	319.90	219.93	318.32	319.93	325.43	316.76	8.67
115	316.32	315.22	319.23	319.26	317.37	319.26	326.22	315.57	10.65
120	316.32	315.22	318.56	318.59	316.42	318.63	325.39	315.11	10.28
122	316.32	315.22	318.33	318.35	315.47	318.37	325.49	314.54	10.95

CHAPTER 5

FLOOD FIGHTING STRATEGY AT PANJNAD HEADWORKS









CHAPTER 5
FLOOD FIGHTING STRATEGY AT PANJNAD HEADWORKS

Objective of forming Flood Fighting Strategy
The Readiness Phase (Pre-Flood)
The Response Phase (During Flood)
The Rehabilitation Phase (Post-Flood)
Flood Stage-Wise Response Mechanism

OBJECTIVE

The primary objective of flood fighting is to ensure the safe passage of flood discharges without causing any damage to the hydraulic structures (Headworks), flood embankments, and river training works. Flood fighting operations are also undertaken to counter any adverse river action that may endanger flood protection bunds, spurs, studs, guide walls, or adjacent infrastructure. In particular, flood fighting seeks to control erosive actions and to prevent encroachment of floodwaters towards embankments, canals, and critical public property.

A comprehensive Flood Fighting Strategy for a critical infrastructure node like the Panjnad Barrage is systematically subdivided into three interlinked phases: readiness, response, and rehabilitation. This structured approach transforms flood management from a reactive emergency procedure into a disciplined, continuous cycle of preparedness, execution, and learning, which is absolutely essential for safeguarding the massive structure and the vast agricultural and population centers dependent on it.

THE READINESS PHASE (PRE-FLOOD)

The Readiness Phase constitutes the foundational, proactive approach that systematically converts potential structural and operational vulnerabilities into managed contingencies before the monsoon season every year. This critical period implements a deliberately sequenced, multi-tiered program that holistically integrates engineering, logistics, and administrative preparedness. The process begins with rigorous, tiered inspections—conducted by Executive Engineers, Superintending Engineers, and the Chief Engineer between March and April—of all critical barrage components. These inspections thoroughly assess gates, hoisting machinery, embankments, and particularly vulnerable river training works, which have historically sustained damage during freshets and high floods in past years.

Simultaneously, material preparedness achieves strategic significance, with the replenishment of reserve stock—including stone boulders, shingle, and sandbags—reaching at least 70% completion at identified vulnerable locations by mid-June every year. This is complemented by comprehensive system checks: thorough testing of the SCADA system, communication networks, and backup power ensures fail-safe operation; calibration and fresh painting of all mile and RD gauges by 31 May guarantees accurate hydrological monitoring; and operation of wetting channels along the Left and Right Marginal Bunds by 20th June enhances embankment stability against anticipated saturation.

Administrative and procedural readiness is equally vital. Staff undergo intensive drills on gate regulation protocols strictly based on historical flood data and the Permissible Gate Opening tables for each weir section, ensuring precise control during flood events. The proper maintenance of breaching sections, including coordination with the Pakistan Army for advance procurement of explosives, ensures this final contingency remains viable. Furthermore, the crucial removal of critical encroachments by mid-May restores unobstructed access to bunds, facilitating emergency machinery movement and eliminating hydraulic constrictions. A mock flood simulation exercise

conducted by 15th June validates communication, evacuation, and inter-agency coordination protocols, while the formal formulation, approval, and circulation of the Flood Fighting Plan by 22nd April under the Chief Engineer's authority provides the definitive operational framework.

The 2025 experience unequivocally reaffirmed that the success of flood response operations is entirely dependent upon this disciplined, punctual, and thorough pre-flood readiness. Any deviation or delay at this stage—such as neglecting spur maintenance or delaying encroachment removal—risks transforming manageable hydrological stress into structural failure and large-scale inundation, as evidenced by historical breaches in 1973. Consequently, the institutional strength and resilience of the entire flood management system are fundamentally rooted in the rigor, comprehensiveness, and timeliness of its pre-season planning, rather than merely in its emergency interventions.

Sr. No.	Schedule of Activities	Timeline	Action Taken
1	Flood Fighting Plan	30th April	To be vetted by CE D&F
2	Inspection of Flood Protection Works By Executive Engineer By Superintending Engineer By Chief Engineer By Departmental and Army Team	15th March 30th March 30th March 15th April	
3	Establishment of Flood Camps	From onset of Low Flood (1.5–2 lac Cs)	
4	Replacement of Reserve Stock	At least 70% by 15th June	99% Available
5	Operation of Breaching Section	Need based	100% payment of explosives for operating breaching section made to Pak Army
6	Operation of Wetting Channels • Left Marginal Bund • Right Marginal Bund	10th –25th July	
7	Deployment of Machinery	Need Based	Will be deployed as required
8	Wireless Based Warning Center	15th June	Awaited from Punjab Police
9	Painting of Gauges/RD Marks	31st May	
10	Simulation / Mock Exercise	15th June	
11	Removal of critical Encroachments • Indication of Encroachments • Removal of Encroachments	30th April 15th May	Encroachments in critical reaches removed. No obstacle for machinery and vehicle movement during flood emergency 2025.

TABLE 5.1:

SCHEDULE OF READINESS ACTIVITIES
FOR FLOOD 2026 AT PANJNAD HEADWORKS

THE RESPONSE PHASE (DURING FLOOD)

Upon the receipt of a flood warning, the strategy immediately transitions intothe **Response Phase**, a period of intense, round-the-clock operational activity where the pre-established Flood Fighting Plan is dynamically executed under real-world conditions. This phase represents the culmination of all preparatory efforts, transforming theoretical protocols into actionable defense. The entire system shifts to a high-alert status, characterized by a multi-pronged strategy of continuous surveillance, coordinated resource deployment, and rapid intervention.

The operational core of this phase is the relentless, **real-time monitoring of the barrage's hydraulic behavior**. This is achieved on every 01-hourly basis through a dual-system approach: automated data acquisition from the SCADA system, which continuously tracks upstream and downstream water levels, head differentials across the structure, and individual gate positions, is complemented by physical patrols conducted by engineering staff. This constant stream of hourly

based data enables the Control Room / Officers making decisions regarding regulation of the headworks to make precise, calculated adjustments to the gate openings. The paramount objective of this regulation is twofold: to manage the upstream pond level within safe limits and, most critically, to ensure that the powerful hydraulic jump—the turbulent transition from supercritical to subcritical flow—remains stabilized on the robust sloping glacis of the stilling basin, thereby preventing its destructive migration onto the vulnerable horizontal floor or flexible / loose apron downstream.

Concurrently, the entire flood defense apparatus is fully mobilized on the ground. Designated **Flood Camps** are activated at strategic locations along all the embankments and allied structures, serving as forward command posts, equipment depots, and rest stations for patrols. Pre-positioned stockpiles of **flood fighting material** are dispatched to these camps and other critical sites identified as vulnerable. To maintain operational capability through the night, the Executive Engineer orders the installation of powerful **lighting systems** at key locations, including weak embankment reaches, active spur noses, and access points, ensuring that the fight against the flood does not halt at sunset.

Recognizing that a flood of this magnitude is a multi-agency challenge, robust and continuous **liaison** is maintained with the District Administration, the Police, the Pakistan Army, and disaster management authorities (PDMA) to coordinate evacuations, security, and logistical support. A significant and constant operational task involves the **clearing of debris**—comprising timber, vegetation, and other river-borne materials—accumulating against the upstream face of the gates. This is vital to prevent gate seizure, ensure smooth operation, and eliminate dangerous additional hydraulic loads on the gate structures.

A comprehensive **Watching Establishment**, comprising both departmental staff and labor hired through contractors as per the FFP's sanctioned strength, is deployed along the entire length of all embankments and critical structures. These patrols work in shifts, vigilantly searching for the first signs of distress: the appearance of seepage, the formation of boils or piping (indicative of subsurface erosion), or any slumping or erosion of the embankment slopes, allowing for immediate counter-measures.

As the ultimate, pre-authorized contingency embedded within the FFP, the strategy holds in reserve the drastic measure of **controlled breaching**. Should an "Exceptionally High Flood" threaten to overtop the main barrage structure with catastrophic consequences, the pre-identified breaching sections on the Right Marginal Bund (RD 28+000 to 30+000) and Retired Right Embankment (RD 19+000 to 21+000) are prepared. This fuse plug is designed to be deliberately operated with pre-positioned explosives, creating a controlled release that sacrifices a designated area to divert the immense hydraulic force away from the core barrage structure, thereby preventing an uncontrolled, catastrophic failure and saving the entire system.

ASPECT	KEY ACTIONS
Activation	Shift to high-alert; Flood Fighting Plan executed with continuous operations.
Monitoring	Hourly SCADA data + physical patrols; adjust gates to control pond level and keep hydraulic jump stable.
Ground Mobilization	Flood Camps activated; materials dispatched; machinery deployed; lighting installed at vulnerable points for night work.
Inter-Agency Coordination	Continuous liaison with District Administration, Police, Army, and PDMA for evacuation, security, logistics.
Debris Management	Removal of timber / vegetation from upstream gates to prevent blockage and hydraulic overload.
Watching Establishment	Staff and labor deployed along embankments to detect seepage, boils, piping, or slope erosion.
Emergency Breaching	Controlled breaching at RMB (RD 28–30) and RRE (RD 19–21) if flood becomes exceptionally precarious to the structure etc.

TABLE 5.2:
RESPONSE PHASE (DURING FLOOD)

THE REHABILITATION PHASE (POST-FLOOD)

The commencement of the Rehabilitation Phase is triggered by the full recession of flood waters, initiating a critical period dedicated to comprehensive damage assessment, strategic restoration, and the systematic enhancement of future flood resilience. This phase represents far more than simple repair work; it is a methodical process of learning from the flood event to fundamentally strengthen the entire flood defense system. The phase begins with an exhaustive post-flood evaluation conducted through multiple methodologies, including detailed **sounding and probing operations** to precisely measure scour depths downstream of impervious floors, stilling basins, and river training structures. At Panjnad Barrage, this specifically includes assessing any undermining around the newly constructed Additional Depressed Bays and the extended impervious floors, alongside thorough inspections of the concrete overlay on upstream floors and glacis for cavitation or erosion damage. Engineering teams verify the integrity of sheet piles, particularly the new upstream row at the Left Pocket with its bottom at EL. 296.00 ft., and conduct comprehensive assessments of all piezometers for functionality and structural displacement.

A critical focus is placed on **detailed damage mapping** of historically vulnerable structures, including launched aprons at J-Head spurs, if any, which required emergency interventions during that year's flood. Based on this comprehensive damage assessment, restoration is prioritized and executed through often urgent repairs, when necessary. This includes recouping launched aprons to their design profile using stone and wire crates, repairing damaged concrete surfaces on weir floors and glacises, and addressing localized undermining through grouting or additional bed protection. Particular attention is given to rehabilitating river training works, where repeated damage at critical locations necessitates not just apron restoration but a fundamental re-evaluation of its design.

The intelligence gathered during the flood and rehabilitation forms the cornerstone of systemic improvement through rigorous performance review and institutional learning. The flood's actual behavior—including recorded water levels at various discharges, gate performance metrics, and precise documentation of the hydraulic jump location—is meticulously compared against forecasts and design assumptions in the Detailed Post-Flood Report. This analysis proves crucial for updating tailwater rating curves and validating the IRI physical model study findings. The findings are formally documented and integrated into revised operational protocols, updating Permissible Gate Opening tables, refining alarm thresholds for piezometer readings and head differentials, and modifying patrolling protocols for identified weak spots. Furthermore, the phase provides compelling evidence to advocate for major infrastructure investments, where repeated structural failures strengthen the case for redesigning vulnerable elements or implementing pending schemes, if any. By systematically closing the loop between flood experience, forensic damage assessment, strategic repair, and plan updates, the Rehabilitation Phase ensures that the Panjnad Barrage system evolves into a more resilient, data-informed defense infrastructure, capable of withstanding the increasingly variable hydrological challenges of the future through continuous improvement and adaptation.

ASPECT	SUMMARY
Start Trigger	Flood recedes; rehabilitation begins.
Evaluation	Scour measurement, structural inspection, sheet pile & piezometer checks.
Damage Mapping	Identify failures in aprons, spurs, floors, glacis, and undermined zones.
Repairs	Restore aprons, repair concrete, grout undermining, fix river training works.
Performance Review	Compare actual flood behavior with design; update tailwater curves & model assumptions.
Protocol Updates	Revise gate openings, alarm thresholds, patrolling guidelines.
Long-Term Upgrades	Support redesigns and major schemes (e.g., Bela removal, mainstream waterway correction etc.).

TABLE 5.3:
RESPONSE PHASE (DURING FLOOD)

FLOOD STAGE-WISE RESPONSE MECHANISM

This mechanism outlines the progressive escalation of response activities in accordance with the approved Flood Fighting Plan 2026. All actions are to be coordinated through the Panjnad Headworks Emergency Control Room established at SCADA building near LGB.

TRIGGER POINT FOR START OF FLOOD RELATED ACTIVITIES AT PANJNAD HEADWORKS	CHENAB RIVER	SUTLEJ RIVER
	Downstream Trimmu Headworks attains Medium Level Flood situation	Downstream Islam Headworks attains Medium Level Flood situation

(a) LOW FLOOD STAGE (150,000 to 200,000 Cusecs)

Situation: River flow enters pond area; initial alert phase.
Objective: Finalize all preparatory measures and establish baseline monitoring.

ACTION	RESPONSIBLE AUTHORITY	FFP 2026 REFERENCE
Procure and position 100% of mandated Flood Fighting Material.	Executive Engineer, Panjnad Headworks Division	Chapter 07 Flood Fighting / Watching Arrangements
Initiate 24/7 flood watching at LMB & RMB using regular staff.	Sub-Engineer (Headworks & Station Area Section)	Chapter 7 & Chapter 9 (Duty Roster)
Engage contractor establishment for Minchin Bund (RD 60+000 to 65+000 & from RD 90+000 to 122+000) upon inundation.	Sub-Engineer Sec-III (Bund Sub-Div)	Chapter 7 & 9 & 13
Plug all inlet/outlet structures on Shikrani & Minchin Bunds.	Sub-Divisional Officer (Bund Sub-Div)	Chapter 14 (Action Plan)
Special Focus: Enhanced vigilance at Minchin Bund RD 60-65 & RD 100-122 for potential erosion.	Sub-Engineer Sec-III (Bund Sub-Div)	Chapter 7& 12 & 14
Close all the ramps / crossings to and from the flood embankments	Sub Engineers all	Chapter 5

(b) MEDIUM FLOOD STAGE (2.00 lac Cs to 3.00 lac Cs)

Situation: Floodplain inundation upstream; water approaches flood bund's toes.
Objective: Activate full flood-fighting infrastructure and district support.

ACTION	RESPONSIBLE AUTHORITY	FFP 2026 REFERENCE
Establish and man up all designated flood watching camps.	All Section Sub-Engineers	Chapter 7 & 9
Establish additional camp at Minchin Bund.	Sub-Engineer Sec-III (Bund Sub-Div)	Chapter 7
Hire private labour to supplement any staff shortages.	Executive Engineer, Panjnad Headworks Division	Chapter 7& 9 & 13
Requisition 08 Jeeps/Double Cabins & 04 Pickups for logistics and patrol.	Executive Engineer, Panjnad Headworks Division	Chapter 7
Mobilize district resources (machinery, labour).	Deputy Commissioners (Muzaffargarh, Bahawalpur, RYK)	District Flood Plan
Reinforce Section-III with staff from Section-II or attached divisions.	Sub-Divisional Officer (Bund Sub-Div)	Chapter 9 & 15
Deploy all pre-identified machinery.	Sub-Divisional Officers / Executive Engineer	Chapter 14

(c) HIGH FLOOD STAGE (300,000 to 450,000 Cusecs)

Situation: Threat to structural integrity; canal closures due to heavy silt content.
Objective: Full mobilization of divisional and inter-departmental resources.

ACTION	RESPONSIBLE AUTHORITY	FFP 2026 REFERENCE
Close all offtaking canals.	Executive Engineer, Panjnad Headworks Division	O&M Manual of Panjnad Headworks
Increase Machinery and manpower	Executive Engineer, Panjnad HeadworksDivision	Chapter 7 & 14
Deploy Revenue & Police officials to respective beats for law & order and support.	Deputy Commissioners (Muzaffargarh, Bahawalpur, RYK)	Chapter 7 & 14

(d) VERY HIGH FLOOD STAGE (450,000 to 600,000 Cusecs)

Situation: Severe threat requiring large-scale civilian and departmental support.
Objective: Augment manpower and heavy machinery for large-scale interventions.

ACTION	RESPONSIBLE AUTHORITY	FFP 2026 REFERENCE
Mobilize additional civil labour (Sipah-Khidmat).	Revenue Department (via Deputy Commissioners)	Chapter 7 & 9
Provide and deploy Dozers for emergency earthworks.	Agriculture Department (via Deputy Commissioners)	District Flood Plan

(e) EXCEPTIONALLY HIGH FLOOD STAGE (600,000 to 865,000 Cusecs)

Situation: Critical danger to all structures; risk of catastrophic failure.
Objective: Execute last-resort emergency measures with military support.

ACTION	RESPONSIBLE AUTHORITY	FFP 2026 REFERENCE
Civil Administration declares a final emergency.	Deputy Commissioners / PDMA	Provincial Disaster Plan & FFP Ch. 7.12
Requisition Army support for bund protection.	Deputy Commissioners / PDMA	Ch 7.13
Double the deployment of hired labour.	Revenue Department (via Deputy Commissioners)	Chapter 7
Maximize coordination with public, Police, and Revenue staff.	Executive Engineer / Deputy Commissioners	Chapter 7.12
Execute Breaching SOPs: Operate pre-identified breaching sections (RMB RD 28-30, RRE RD 19-21) upon trigger (e.g. LMB RD 15 Gauge: RL 349.25 ft with rising trend upstream etc or any damage to structure itself).	Executive Engineer, Panjnad Division	Chapter 11 (SOPs)

CHAPTER 6

FLOOD DAMAGES / RESTORATION WORKS POST SUPER FLOOD 2025 AT PANJNAD HEADWORKS

DETAIL OF DAMAGES INCURRED DURING SUPER FLOOD 2025
DETAIL OF FLOOD RESTORATION WORKS
FLOOD RESTORATION WORKS EXECUTED DURING SUPER FLOOD 2025
ONGOING FLOOD RESTORATION WORKS

CHAPTER 6:

FLOOD DAMAGES / RESTORATION WORKS POST SUPER FLOOD 2025 AT PANJNAD HEADWORKS

DETAIL OF DAMAGES INCURRED DURING SUPER FLOOD 2025

SR#			RESTORATION MEASURES
1	**HEADWORKS:** A 703,698 cusec peak flow achieved u/s and d/s water levels designed for an 865,000 cusec event, eliminating the safety margin on protective embankments and revealing severe downstream bottlenecks.	Discharge passing efficiency reduced due to higher TWL resulting from accreted bed levels and constricted water way at confluence of Chenab-Indus d/s Panjnad Headworks.	**1)** 01 no. of Physical Model Study is underway at IRI, Nandipur for checking the following: ● Correcting River Approach u/s Panjnad Headworks in order to recoup the discharge capacity by removing u/s right side bella formation

SR#			RESTORATION MEASURES
2	**RIGHT MARGINAL BUND (RMB)** ✓ J-Head Spur RD 40+900 ✓ J-Head Spur at RD 23+500 ("Confluence Defender") ✓ Reach RD 32+000 to 45+000 (High Velocity Impact Zone)	✓ **Severe Scouring:** J-Head Spurs at RD 23+500 and 40+900 experienced severe apron launching and foundation undermining from direct river attack. ✓ **Slope Instability:** Reach RD 32+000 to 45+000 suffered from slope sloughing and erosion due to sustained high-velocity impact.	**1.** A PC-I namely "Remodeling and Protection of LMB & RMB of Panjnad Headworks in critical reaches" is in P&D Board Lahore. Its eventual execution will rehabilitate RMB by the construction of wetting channel from RD 25-28. **2.** 01 no. of Physical Model Study is underway at IRI, Nandipur for checking the following: (the concept note for inclusion of the scheme in ADP 2026-27 has also been sent from this division) ● Checking advancement of River Chenab towards right side RMB. Scope includes: • Extension and conversion of existing sloping stud at RD 43+000 (RMB) into a hockey spur. • Extension and conversion of existing sloping stud at RD 39+000 (RMB) into a hockey spur. • Restoration of apron width (30 ft) for existing J-head spurs at RD 40+000 and RD 36+700. **3.** A concept note for inclusion of the following scheme in ADP 2026-27 has also been sent from this division: ● Restoration / Raising of River Training Structures of Panjnad Headworks (including all 14 structures of RMB)
3	**LEFT MARGINAL BUND (LMB)** ✓ J-Head Spur at RD 6+500 ✓ Reach RD 0+000 to 6+000 (Critical Seepage Zone) ✓ Reach RD 10+000 to 35+000 (River Morphology Impact Zone) ✓ Historic 1973 breach sites (RD 09-11, 19-21, 34-35)	✓ **Foundation Scouring:** apron of J-Head Spur at RD 6+500 was undermined by aggressive currents. ✓ **Seepage & Piping:** Reach RD 0+000 to 6+000 showed severe seepage and sand boils, risking internal erosion. ✓ **Reactivation of Weak Zones:** Reach RD 10+000 to 35+000 and historic breach sites experienced erosion due to a shift in river morphology.	**1)** A PC-I namely "Remodeling and Protection of LMB & RMB of Panjnad Headworks in critical reaches" is in P&D Board Lahore. Scope includes following for LMB: ✓ Straightening and strengthening of old breach sites (RD 10+100 – 11+200 and RD 19+000 – 20+000) on the LMB, along with provision of wetting channels. ✓ Provision of stone pitching on the river-side slope of the LMB in critical reaches RD 34+500 – RD 44+000 (9,500-ft) at the existing 1:3 slope, as adopting a 1:2 slope would require excessive cutting, increasing overall project's cost, and adversely affecting embankment's stability. ✓ Stone pitching of length 2000 ft (from RD 4+000 to 6+000) on the

SR#			RESTORATION MEASURES
			upstream shank of J-Head Spur at RD 6+500 (LMB) to control erosive action.
4	**SHIKRANI FLOOD BUND** ✓ Reach RD 37+000 to 38+000 (Freeboard Deficiency Zone) ✓ Reach RD 0+000 to 18+000 (High Seepage Risk Section)	✓ **Inadequate Freeboard** Reach RD 37+000 to 38+000 had its freeboard encroached, risking overtopping. ✓ **Seepage Emergence:** Reach RD 0+000 to 18+000 exhibited significant seepage lines due to a high hydraulic head.	**1)** Flood Restoration related work is ongoing through Machinery Division, Multan. Scope of work is to rehabilitate the said bund as per FFC criteria before 15.05.2026. **2)** A comprehensive strengthening scheme titled “Preventing Erosion of River Indus along Minchin Flood Bund (Taunsa-Guddu reach)” has been prioritized under FPSP-III, and the PC-I has been submitted by this Division for systematic upgradation in accordance with approved parameters.
5	**MINCHIN FLOOD BUND** ✓ Reach RD 62+000–65+000 ✓ Reach RD 98+000–100+000 ✓ Reach RD 96+000–98+000	✓ **Toe Erosion & Scour** Reaches RD 62+000–65+000 and RD 98+000–100+000 suffered active scouring from the river's main current. ✓ **Apron Damage:** Reach RD 96+000–98+000 experienced minor damage to its protective stone pitching and launching aprons.	**1)** Flood Restoration related work is ongoing through Machinery Division, Multan. Scope of work is to rehabilitate the said bund as per FFC criteria before 15.05.2026. 2) A comprehensive strengthening scheme titled “Preventing Erosion of River Indus along Minchin Flood Bund (Taunsa-Guddu reach)” has been prioritized under FPSP-III, and the PC-I has been submitted by this Division for systematic upgradation in accordance with approved parameters.

DETAIL OF FLOOD RESTORATION WORKS

FLOOD RESTORATION WORKS EXECUTED DURING SUPER FLOOD 2025

- **FLOOD EMBANKMENTS:**

Continuous watch and ward of all seven embankments was ensured during super flood 2025 at Panjnad Headworks as per approved Flood Fighting Plan. Slope failures occurred universally across all embankments from prolonged saturation, while Minchin and Shikrani Bunds suffered complete freeboard compromise, rendering them hydraulically inadequate.

- **RIVER TRAINING STRUCTURES:**

- **J-head Spur LMB RD 6+500** experienced apron launching due to an unexpected oblique attack from the main Chenab current, deflected by u/s right-bank Bella formation. Work executed under para 2.89 PWD Code.
- **J-head Spur RMB RD 40+900** suffered a massive 30-40 foot apron launch from turbulent force of Chenab River. Work executed under para 2.89 PWD Code.
- **J-head Spur RMB RD 23+500** suffered a massive 50-60 foot apron launch from the combined turbulent force of the Chenab-Sutlej confluence. Work executed under para 2.89 PWD Code.

ONGOING FLOOD RESTORATION WORKS

- **Flood Restoration of Shikrani Flood Bund:**

Aspect	Details
Damage	Super Flood 2025 caused severe erosion and hydraulic stress (RD 0–18).
Objective	Restore design profile (HFL 1973) and ensure 7 ft freeboard above post-rehab TWL (342.02 ft) to protect downstream areas.
Scope	Raising & strengthening of bund over 6,450 ft out of 40,000 ft.
Execution	Assigned to Machinery Circle Multan
Current Status	Work in progress under departmental specifications with field monitoring.
Way Forward	Work to be completed before flood season 2026.

- **Flood restoration of Minchin Flood Bund:**

Aspect	Details
Damage	Super Flood 2025 caused erosion and hydraulic stress along RD 6+700–25+000.
Objective	Restore design profile (HFL 1973) and ensure 7 ft freeboard above post-rehab TWL (342.02 ft) to protect downstream areas.
Scope	Raising & strengthening of bund over 18,300 ft out of 115,300 ft
Execution	Assigned to Machinery Circle Multan
Current Status	Work in progress under departmental specifications with field monitoring.
Way Forward	Work to be completed before flood season 2026.

CHAPTER 7

FLOOD FIGHTING / WATCHING ARRANGEMENTS FOR FLOOD 2026 AT PANJNAD HEADWORKS

7.1 Pre-Flood Arrangements
7.2 Watching Establishment
7.3 Arrangement at sensitive sites
7.4 Watching / Flood Fighting Material
7.5 Arrangement for Bathymetric Surveys / Sounding & Probing
7.6 Lighting Arrangements
7.7 Ration Arrangement
7.8 POL Arrangements
7.9 Transportation Arrangements
7.10 Law & Order Control Arrangement
7.11 Medical Arrangement for labour
7.12 Liaison with other Departments
7.13 Role of the Army
7.14 Duties of Telephone Attendant
7.15 Communication / Wireless Arrangements

7.1 PRE-FLOOD ARRANGEMENTS

This section has been covered in detail at section 5.2.

7.2 WATCHING ESTABLISHMENT

The Administrative Department constituted a committee vide letter no. SO(Floods)VII-22/2027 dated: 26.12.2025 to standardize the emergency response protocols and optimize the deployment of machinery and human resource across various irrigation infrastructure for Flood Fighting Plan (FFP) as well as the minimum requirement of Flood Fighting Material at each permanent and temporary camp site. The committee, vide its notification dated: 19.01.2026, proposed / fixed the following criteria for watching establishment:

Structure	Miles	Normal Flood		Low Flood		Medium / High Flood		Very High / Exceptionally High Flood	
		Men	Shift	Men	Shift	Men	Shift	Men	Shift
		1 person / 2 mile / shift		1 person / 1 mile / shift		2 person / 1 mile / shift		5 person / 1 mile / shift	
		(1 shift)		(1 shift)		(2 shift)		(3 shift)	
Right Guide Bund	0.84	0		1		2		4	
Left Guide Bund	0.84	0		1		2		4	
Left Marginal Bund (LMB)	13.6	7		14		27		68	
6+500 J-Head Spur (LMB)	1.42	1		1		2		5	
Right Marginal Bund (RMB)	14.11	7		14		28		70	
12+750 J-Head Spur (RMB)	1.51	1		2		3		8	
16+500 J-Head Spur (RMB)	1.11	1		1		2		5	
18+320 J-Head Spur (RMB)	0.88	0		1		2		4	
23+500 J-Head Spur (RMB)	1.06	1		1		2		5	
36+700 J-Head Spur (RMB)	0.32	0	**1**	0	**1**	0	**2**	0	**3**
48-49 J-Head Spur (RMB)	1.12	1		1		2		5	
(RRE) RD 10–35 RMB	5.05	2		5		10		25	
Colony Protection Bund (CPB)	3.52	2		4		7		18	
Shikrani Flood Bund (SFB)	8	4		8		16		40	
Minchin Flood Bund (MFB)	23.06	12		23		46		115	
TOTAL PER SHIFT		39		77		151		376	
G. TOTAL		**39**		**77**		**302**		**1128**	
NO. OF MATES		3		6		25		94	

7.3 ARRANGMENTS AT SENSITIVE SITES

Special establishment of camps, along with provision of flood fighting material, at vulnerable reach / location / structure will be ensured. Deployment of watching establishment and necessary machinery will be ensured. Round the clock vigilance will be ensured.

ESTABLISHED CAMP'S DETAIL

The Administrative Department constituted a committee vide letter no. SO(Floods)VII-22/2027 dated: 26.12.2025 to standardize the emergency response protocols and optimize the deployment of machinery and human resource across various irrigation infrastructure for Flood Fighting Plan (FFP) as well as the minimum requirement of Flood Fighting Material at each permanent and temporary camp site. The committee, vide its notification dated: 19.01.2026, proposed / fixed the following criteria for establishment of camp sites:

1. Normal Flood Season: 15 miles / vulnerable point
2. Low Flood: 15 miles
3. Medium Flood / High Flood: 7 miles
4. Very High / Exceptionally High: 5 Miles

As per this criteria, the location and number of camp sites to be established is as follows:

STRUCTURE	LENGTH (MILES)	VULNERABLE SITES		NO. OF CAMPS ESTABLISHED EXCEPT VULNERABLE POINTS			TOTAL
		REACH	NO. OF CAMPS	NORMAL / LOW FLOOD (15 Miles)	MEDIUM / HIGH FLOOD (7 Miles)	VERY HIGH / EXCEP. HIGH FLOOD (5 Miles)	
Left Marginal Bund (RD 0–68)	13.60	10-12	1	-	-	-	
		19-21	1				
		34-36	1				
Right Marginal Bund (RD 0–70)	14.11	32-45	1	-	1	1	
Right retired Embankment RD 10–35)	5.05	-	-	-	-	1	
Colony Protection Bund (RD 0-17+600)	3.52	-	-	-	-	-	
Shikrani Flood Bund (RD 0–40)	8.00	37-38	1	-	-	-	
Minchin Flood Bund (RD 6+700–122)	23.06	90-100	1	-	2	2	
Total	**67.34**		**6**	**-**	**3**	**4**	

Note: The Superintending Engineer will notify all the vulnerable points as per recommendation of Executive Engineer, and if the vulnerable site falls within 15 miles of embankment, then camp will be established at vulnerable site.

7.4 WATCHING / FLOOD FIGHTING MATERIAL

The Administrative Department constituted a committee vide letter no. SO(Floods)VII-22/2027 dated: 26.12.2025 to standardize the emergency response protocols and optimize the deployment of machinery and human resource across various irrigation infrastructure for Flood Fighting Plan (FFP) as well as the minimum requirement of Flood Fighting Material at each permanent and temporary camp site. The committee, vide its notification dated: 19.01.2026, proposed / fixed the following criteria for Flood Fighting material to be provided at every camp:

DETAIL OF MINIMUM REQUIREMENT OF FLOOD FIGHTING MATERIAL FOR PERMANENT CAMPS (15 MILES)

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
1.	Shouldari / Tent	No.	1	-	1	Balance quantity of Material will be procured before flood, 2026
2.	Chairs	No.	6	-	6	
3.	Table	No.	1	-	1	
4.	Generator (2-3 KVA)	No.	1	-	1	
5.	Pedestal Fans	No.	1	-	1	
6.	Charpois	No.	2	-	2	
7.	Symbolic Jackets	No.	50	-	50	
8.	Polythin Sheet	Kg	100	-	100	
9.	Bamboos 4'' dia	No.	100	-	100	
10.	Water Coller	No.	1	-	1	
11.	Portable umbrella	No.	2	-	2	
12.	Life Jacket	No.	5	-	5	
13.	Utensils (10 person)	No.	1	-	1	
14.	Jute/Plastic bags	No.	1000	-	1000	
15.	Walke Talkie Set	Set	2	-	2	
16.	Raincoats	No.	10	-	10	
17.	LED flood light	No.	10	-	10	
18.	Extension Cable 10'	No.	2	-	2	
19.	Rechargeable Torches	No.	20	3	17	
20.	Kassi	No.	20	2	18	
21.	Axes	No.	20	-	20	
22.	G.I Buckets	No.	5	-	5	
23.	7/44 Cable	Feet	500	-	500	
24.	Sutli	Kg	2	-	2	
25.	Sewing Needles	No.	10	-	10	
26.	Emergency Medical Kit	No.	1	-	1	
27.	Wire Crates (at only that camp near river action and reserve stock exists)	No.	100	-	100	

MINIMUM REQUIREMENT OF FLOOD FIGHTING MATERIALS FOR TEMPORARY CAMP: (7 OR 5 MILES DURING MEDIUM TO EXCEPTIONALLY HIGH FLOOD) (TO BE OUTSOURCED)

Sr. No.	ITEM	UNIT	Total Required Qty
1	Shouldari / Tent	No.	01
2	Walke Talkie Set	Set	01
3	Chairs	No.	06
4	Raincoats	No.	10
5	Table	No.	01
6	LED Flood Light	No.	10
7	Generator (2-3 KVA)	No.	01
8	Extension Cable (10 ft)	No.	02
9	Pedestal Fans	No.	01
10	Rechargeable Torches	No.	20
11	Charpois	No.	02
12	Kassi	No.	20
13	Symbolic Jackets	No.	50
14	Axes	No.	20
15	Water Cooler	No.	01
16	G.I Buckets	No.	05
17	Portable Umbrella	No.	02
18	7/44 cable	Feet	500
19	Utensils (10 person serving)	No.	01
20	Sutli	Kg	02
21	Jute / Plastic Bags	No.	500
22	Sewing Needles	No.	10

7.5 ARRANGEMENT FOR BATHMETRIC SURVEYS (SOUNDING & PROBING)

All equipment including boats, sounding rods, levelling instruments, arrows etc. will be made available to perform sounding and probing during flood.

7.6 LIGHTING ARRANGEMENTS

The Lighting Arrangement is implemented to ensure proper illumination of all vulnerable points, including the Left and Right Marginal Bunds, spurs, approach roads, and control structures, for effective supervision and safety during night operations. The Executive Engineer is responsible for ensuring the installation and functioning of these facilities, which involves hiring portable floodlights, diesel or petrol generators, and electrical fittings through resourceful government contractors in accordance with departmental procurement rules. Management of this equipment is delegated to the Sub Divisional Officer, who maintains a detailed logbook of all items issued and deployed at each site, including records of POL consumption for the generators. The Sub Engineer on duty is tasked with verifying the operational readiness of all lighting equipment each evening during the active flood phase. To guarantee uninterrupted 24-hour operations, a contingency plan is in place with standby generators available for immediate replacement in the event of any emergency breakdown.

7.7 RATION ARRANGEMENT

The Ration Arrangement is the responsibility of the Irrigation Department, Panjnad Headworks Division, to provide essential food items and drinking water sufficient for sustaining all deployed labour and field staff working in 24-hour shifts during active flood conditions. Procurement, storage, and distribution are conducted strictly in accordance with Government financial rules, departmental Standard Operating Procedures, and the instructions of the Chief Engineer, with no extravagant or non-essential items to be procured. The Sub Divisional Officer maintains a detailed, site-wise register that indicates the quantity of ration issued, the number of labourers served, the duration of deployment, and the balance stock, which is verified daily by the Executive Engineer. All expenditures are chargeable to the sanctioned Flood Fighting Funds.

7.8 PETROLEUM, OIL, AND LUBRICANT (POL) ARRANGEMENT

The POL Arrangement involves ensuring an adequate supply of Petrol, Oil, and Lubricants exclusively for departmental vehicles, hired transport, earth-moving machinery, and generators deployed during flood fighting operations. The Executive Engineer is responsible for the procurement and supply coordination with the Civil Administration. Strict accountability is maintained through detailed fuel consumption records for each vehicle and piece of equipment, which are duly supported with logbooks and verified by the Sub Divisional Officer. All requisitions for POL must be based on actual field requirements and receive prior approval from the Executive Engineer before issue. Any instance of wastage, pilferage, or misuse is subject to disciplinary action under relevant financial rules to ensure proper resource management.

7.9 TRANSPORTATION ARRANGEMENTS

The Transportation Arrangement is designed to ensure the timely conveyance of flood fighting materials, machinery, and labour across the flood sector. The plan is executed in phases, beginning with the immediate deployment of two departmental tractor-trolleys, supplemented by three trucks requisitioned through the government contractors during Phase-I and Phase-II. As the situation escalates to Phase-III and Phase-IV, the capacity is increased by arranging six additional trucks or tractor-trolleys, along with two pick-up vehicles, on a hire or requisition basis from the government contractors. A strict policy is enforced that no vehicle shall be diverted for non-official or private use under any circumstances.

7.10 LAW & ORDER ARRANGEMENTS

1. Deputy Commissioners of Bahawalpur, Muzaffargarh, and Rahim Yar Khan shall provide adequate police force in all sectors, camps, and relief centers for maintaining law and order during flood emergencies.
2. The Executive Engineer and his subordinate staff shall coordinate with District Police and Revenue Officers for securing all vulnerable points and ensuring safety of departmental assets and deployed labour.
3. The District Police shall assist in evacuation of people and livestock from low-lying or flood-prone areas and shall enforce necessary restrictions on movement along bunds and embankments.
4. Police shall remain on 24-hour alert and disseminate verified information regarding flood levels, road closures, and public safety through official communication channels.
5. District Police Officers shall ensure traffic regulation and provision of alternate routes in case of road submergence or damage.
6. The Executive Engineer shall promptly apprise the Deputy Commissioner of any breach, overtopping, or emergency requiring reinforcement of security or manpower.

7. The use of the public wireless system for emergency communication shall be authorized by the Deputy Commissioner during flood conditions.

To ensure public order, security, and the smooth flow of traffic at critical locations during a flood emergency, a coordinated police deployment is essential. For the Panjnad Headworks sector, Traffic Police will be requisitioned to manage the increased movement of official vehicles, machinery, and personnel. The deployment is strategically planned across key locations and will be coordinated with the concerned police stations and districts.

Sr. No.	Location of Deployment	Concerned Police Station & Tehsil & District	Police Personnel to be Deployed	
			SI/ASI	Constables
1	**Panjnad Headworks**	Alipur Saddar, Alipur, Muzaffargarh	To be decided by the concerned District Police Officer	To be decided by the concerned District Police Officer
2	**Right Marginal Bund (RMB)**	Alipur Saddar, Alipur, Muzaffargarh		
3	**Colony Protection Bund (CPB)**	Alipur Saddar, Alipur, Muzaffargarh		
4	**Left Marginal Bund (LMB)**	Uch Saddar, Ahmedpur East, Bahawalpur		
5	**Shikrani Flood Bund**	Uch Saddar, Ahmedpur East Bahawalpur		
6	**Minchin Flood Bund**			
a)	**RD 0-20**	Uch Saddar, Ahmedpur East Bahawalpur		
b)	**RD 20-30**	Channi Goth, Ahmedpur East Bahawalpur		
c)	**RD 30-122**	Tranda Muhammad Panah, Liaqatpur, Rahim Yar Khan		

7.11 MEDICAL ARRANGEMENTS

Medical Arrangements for labour and affected populations are the responsibility of the Chief Executive Officers (Health) of Muzaffargarh, Bahawalpur, and Rahim Yar Khan. This involves ensuring that first aid and medical assistance are available round-the-clock at all flood fighting sites. Key provisions include arranging preventive vaccination against waterborne and communicable diseases before and during the flood season, and stocking adequate essential medicines such as antibiotics, anti-tetanus, anti-snake venom, and Oral Rehydration Salts (ORS) at emergency centers. Furthermore, mobile medical units are to be stationed strategically along major bunds and relief camps for rapid response. The Health Department is also tasked with supervising sanitation, vector control, and the supply of safe drinking water. All health records are maintained and shared with the District Flood Control Room for ongoing monitoring and coordination.

7.12 LIAISON WITH OTHER DEPARTMENTS

Effective liaison at Panjnad Headworks ensures real-time coordination between Irrigation, District Administration, Army, and Police for rapid flood response. It enables unified action—when Irrigation

identifies a vulnerable bund, Police secure routes, Army deploys support, and civil administration mobilizes resources without delay. During controlled breaching, seamless coordination is critical: Irrigation prepares the site, DC authorizes, Army handles explosives, Highway Department cuts roads, and Police secure the area. Strong liaison also streamlines search, rescue, and relief operations—managing crowds, safeguarding convoys, and restoring services—while unified messaging controls panic and builds public trust, transforming individual efforts into a cohesive lifesaving system.

DEPARTMENT / AGENCY	SUB-UNIT / POSITION	KEY ROLE	FULLY ELABORATED RESPONSIBILITIES
District Administration	**Deputy Commissioner (DC)**	Authority for Public Safety & Relief & Breach Committee Convener	● Convene the Breach Operation Committee, authorizing controlled breaching of embankments based on hydrological data and technical advice from Engineers of Irrigation, C&W, Railways, and Army. ● Issue and oversee evacuation orders for populations in threatened areas, ensuring timely relocation to safe zones. ● Coordinate with Pakistan Army, Police, and other civil agencies for deployment of manpower, security, and emergency logistics under Article 245 of the Constitution. ● Ensure provision of accommodation, ration, fuel, transportation, and other logistic support to the Army team/unit deployed for any operation during flood situation. ● Supervise Assistant Commissioners and Revenue staff in field-level implementation of evacuation, and relief camp management operations. ● Oversee collection, storage, and equitable distribution of relief goods, ensuring smooth functioning of relief camps in collaboration with the Irrigation Department, if necessary. ● Liaise with Health, Food, Education, and other support departments to ensure public health, food security, and shelter for evacuees. ● Maintain real-time communication with field officers (SDOs, XEN) to monitor flood developments, manage emergencies, and coordinate inter-agency response.
	Assistant Commissioners & Revenue Dept.	Field Executors of Civil Admin	● Operate relief camps, coordinate evacuation, supervise distribution. ● Mobilize civilian labor and enforce bund watch schedules as per duty roaster of FFP.
Police Department	—	Law & Order Enforcement, Security Provider, and Emergency Support Force	● Maintain security at embankments, headworks, relief camps, and controlled breaching sites to prevent sabotage, disorder, or unauthorized access. ● Assist the Deputy Commissioner in enforcing evacuation orders, ensuring safe and orderly relocation of vulnerable populations. ● Escort relief convoys, Army units, and Irrigation teams into high-risk or flood-affected areas. ● Manage traffic control at headworks, road closures, diversions, and access to inundated

DEPARTMENT / AGENCY	SUB-UNIT / POSITION	KEY ROLE	FULLY ELABORATED RESPONSIBILITIES
			zones to facilitate emergency operations. ● Prevent theft, pilferage, or misuse of flood-fighting materials, machinery, and relief supplies. ● Provide communication relay support during network outages or disruptions. ● Coordinate with Irrigation officials to prevent illegal breaches, cuts, or tampering with embankments and canals. ● Support search and rescue operations by controlling crowds, securing perimeters, and facilitating deployment of rescue boats.·
Pakistan Army	IS Wing & Engrs. Battallion	Strategic Reserve & High-Risk Operations Force	● Execute controlled breaching operations, handling explosives safely. ● Conduct search and rescue operations and evacuate affected populations. ● Provide manpower, boats, and communication support, when requisitioned by either District Administration or the Irrigation Department. ● Deploy Liaison Officers to coordinate with District Administration and XEN. ● Receive logistical support (fuel, rations, accommodation) from civil administration.
C&W / Highway Department	Executive Engineer Highways Muzaffargarh	Road Infrastructure Authority	● Ensure all roads, bridges, and approaches remain open for emergency and relief convoy movement. ● Execute tactical road cuts (e.g., K.L.P. Road Alipur section at designated km points) to create controlled spillways for breaching operations. ● Provide machinery, equipment, and technical teams to support flood-fighting and emergency works, when requisitioned. ● Coordinate with District Administration, Irrigation Department, and Army for safe access and operational integration during flood emergencies
Health Department	Chief Executive Officer (CEO)	Medical & Public Health Lead	● Set up first-aid posts and mobile medical units at flood camps and affected areas. ● Conduct vaccination drives against waterborne and flood-related diseases. ● Ensure sanitation, clean water supply, and vector control in relief camps. ● Coordinate with District Administration and XEN for emergency medical response.
Food Department	—	Food Security Manager	● Ensure continuous supply and equitable distribution of food grains and essential commodities. ● Establish temporary ration depots in coordination with the District Administration. ● Monitor stock levels and maintain logistics for uninterrupted relief operations. ● Support relief camp management to meet nutritional needs of evacuees.·

DEPARTMENT / AGENCY	SUB-UNIT / POSITION	KEY ROLE	FULLY ELABORATED RESPONSIBILITIES
Agriculture Department	—	Agricultural Livelihood Protection	● Assess crop and farmland damage in flood-affected areas. ● Mobilize technical and material support to farmers for flood preparedness and recovery. ● Advise District Administration and XEN on prioritizing protection of high-value crops. ● Provide guidance on post-flood agricultural rehabilitation and resource allocation. ● Coordinate with other departments for integrated relief and recovery planning.·
Livestock Department	—	Animal Asset Protection	● Provide fodder and essential care for livestock to protect evacuees' livelihoods. ● Monitor and support the health of livestock in relief camps and affected areas. ● Coordinate with District Administration and XEN for emergency shelter and protection of animals. ● Advise on post-flood livestock rehabilitation and disease prevention measures. ● Facilitate mobilization of veterinary teams and resources during floods.·
Education Department	District Education Officer (DEO)	Shelter Infrastructure Provider	● Provide schools and other public buildings as temporary shelters and relief camps. ● Ensure infrastructure in schools is safe and suitable for occupancy during emergencies. ● Coordinate with Health and Food Departments to support evacuees housed in school facilities. ● Assist in post-flood rehabilitation and restoration of educational infrastructure·
MEPCO	—	Electrical Safety Authority	● Disconnect 11-kV distribution lines in predicted inundation zones upon final warning to prevent electrocution hazards. ● Coordinate with District Administration and XEN to ensure electrical safety at flood-affected sites and relief camps. ● Provide technical support for rapid power restoration to critical installations after flood recession.
PMD / FFD	—	Early Warning Provider	● Provide rainfall, river flow, and flood forecasts for Panjnad Headworks and surrounding areas. ● Issue officially approved "lag times" and early warning triggers to activate phased response in the Flood Fighting Plan (FFP). ● Liaise with Irrigation Department, XEN, and District Administration to ensure timely dissemination of flood alerts and technical guidance..

7.13 ROLE OF PAKISTAN ARMY

This has been detailed in section 7.12

7.14 DUTIES OF TELEPHONE ATTENDANTS

A total of six (6) telephone attendants/signallers shall be required to maintain round-the-clock communication during the flood season — three (3) at the Telephone Office in the Canal Colony and three (3) at the Headworks Control Room. The existing three signallers at Panjnad shall continue their duties, while three additional attendants shall be arranged either through inter-divisional transfer or local recruitment to meet the increased workload. The Headworks-based telephone attendant shall act as focal person for compiling and transmitting morning and evening gauge reports of bunds and Headworks to higher authorities. Contact information of existing 03 signallers of Panjnad Headworks Division, Panjnad is given below:

Sr. No.	Name of official	Mobile Number	Period	Time	
				From	To
1	Mumtaz Hussain	0301-4328801	15.06.2026 To 15.10.2025	08:00 AM	04:00 PM
2	Hussain Raza	0300-6831748		04:00 PM	12:00 AM
3	Muhammad Yousuf	0301-7516465		12:00 AM	08:00 AM

7.15 WIRELESS ARRANGEMENTS

ESTABLISHMENT OF FLOOD CONTROL ROOM

The Flood Control Room at Panjnad Headworks serves as the central command center for all flood-fighting and emergency response activities. It ensures timely decision-making, coordinated field actions, and uninterrupted communication among all concerned entities during flood situations. The Control Room is located in the dedicated building at SCADA office, Panjnad Headworks and is fully equipped with the SCADA system. It becomes operational on a 24/7 basis immediately after receipt of the first flood warning from the Flood Forecasting Division (FFD) Lahore or upon instructions from the Executive Engineer, Panjnad Headworks.

The Flood Control Room operates under the overall supervision of the Executive Engineer, Panjnad Headworks Division. Shift operations of 12-hour each are led by the Sub-Divisional Officers (Headworks and Bund Sub-Divisions) respectively, who perform duties in rotational shifts to ensure continuous oversight. Supporting staff includes three (03) signallers deployed in 08-hour shifts to maintain constant communication, and two (02) dak runners responsible for urgent physical message delivery between the Control Room and on-ground teams.

Key Contacts – Flood Control Room

Designation	Name	Contact No.	Duty Role
Executive Engineer (Overall In-Charge)	Engr. Faisal Nadeem	0333-7483658	Overall supervision & decisions
SDO Headworks (0600 to 1800 hours)	Engr. Syed Hassan Abbas Bukhari	0300-8595495	Operations & reporting
SDO Bund Sub-Division (1800 to 0600 hours)	Engr. Syed Hassan Abbas Bukhari	0300-8595495	Field coordination

Designation	Name	Contact No.	Duty Role
Signaller 1 (0800 to 1600 hours)	Mr. Mumtaz Hussain	0301-4328801	Communication desk
Signaller 2 (1600 to 0000 hours)	Mr. Husnain Raza	0300-6831748	Communication desk
Signaller 3 (0000 to 0800 hours)	Mr. Qazi Yousaf	0301-7516465	Communication desk

WIRELESS COMMUNICATION ARRANGEMENTS

This addresses the current challenge that the fixed wireless station at Panjnad Headworks has remained non-functional for the past eight years and is not linked with the Flood Warning Centre in Lahore or the upstream headworks. Consequently, flood warnings and updates are presently received through mobile communication channels. To ensure reliable field connectivity during flood emergencies, mobile wireless sets mounted on vehicles will be provided by the Police Headquarters and the District Civil Administration in Muzaffargarh. These units are allocated for use by the Chief Engineer, Bahawalpur, Superintending Engineer Panjnad, Executive Engineer Headworks, the SDO of the Headworks Sub Division, and the SDO of the Bund Sub Division. These mobile wireless units are mandated to remain operational round-the-clock during the active flood season to ensure the prompt transmission of field reports, gauge readings, and emergency alerts/decisions.

DAK RUNNING ARRANGEMENT

This feature is necessitated as parallel communication measure when communication gets down due to electrical, functional, and signal issues. The Dak Running Arrangement involves the deployment of a total of six (06) Dak Runners to ensure reliable manual delivery of messages and reports. Three runners are assigned to the Left Marginal Bund (LMB) and three to the Right Marginal Bund (RMB). On each bund, a pair of runners operates to carry official correspondence from the supervisory staff / Flood Control Room to on-ground teams. The remaining two Dak Runners are stationed specifically at the Headworks to facilitate emergency communication between the Control Room and the Headworks during all flood operations.

CHAPTER 8

DETAIL OF ENCROACHMENT AT PANJNAD HEADWORKS DIVISION PANJNAD

CHAPTER 8

DETAIL OF ENCROACHMENT AT PANJNAD HEADWORKS DIVISION PANJNAD

IDENTIFICATION OF LOCATIONS
LIST OF ENCROACHERS
STEPS TAKEN TO REMOVE ENCROACHMENTS
ACTION PLAN TO REMOVE ENCROACHMENTS
DETAIL OF NORMAL ENCROACHMENT
DETAIL OF CRITICAL ENCROACHMENT

IDENTIFICATION OF LOCATIONS

Encroachments are a continuous phenomenon; therefore, their locations are already known to this office. Panjnad Headworks division maintains updated lists of all encroachments, which are reviewed and revised on a monthly basis. These lists are regularly forwarded to the tehsil administration for formal clearance proceedings under the relevant acts and rules. Furthermore, any encroachment identified as critical is removed immediately upon construction to prevent potential risks to flood defense infrastructure.

LIST OF ENCROACHERS

1. LEFT MARGINAL BUND

SR. NO.	NAME OF ENCROACHER	FATHER'S NAME	CASTE	AREA OF ENCROACHMENT (Marla)	CATEGORY
1	Muhammad Siddique	Fida Hussain	Kaheeri	15	Residential
2	Bashir Ahmad	Muhammad Ramzan	Heer	10	Residential
3	Gul Sher	Bashir Ahmad	Heer	10	Residential
4	Muhammad Zaman	Bashir Ahmad	Heer	10	Residential
5	Ejaz Ahmad	Bashir Ahmad	Heer	10	Residential
6	Altaf Hussain	Ghulam Qadir	Heer	10	Residential
7	Bashir Ahmad	Ghulam Qadir	Heer	10	Residential
8	Siraj Ahmad	Bashir Ahmad	Heer	3	Residential
9	Muhammad Amjad	Mukhtar Ahmad	Heer	2	Residential
10	Bashir Ahmad	Muhammad Ramzan	Heer	6	Residential
11	Mukhtar Ahmad	Muhammad Ramzan	Heer	7	Residential
12	Ajmal Khan	Nobat Khan	Baloch	20	Residential
13	Muneer Ahmad	Allah Wasaya	Baloch	15	Residential
14	Bagu Khan	Mahiwal Khan	Baloch	20	Residential
15	Sarwar Khan	Fazal Khan	Baloch	15	Residential
16	Mangal Khan	Noor Ahmad	Baloch	15	Residential
17	Bashir Ahmad	Allah Dittah	Baloch	8	Residential
18	Deen Muhammad	Allah Dittah	Baloch	12	Residential
19	Manzoor Ahmad	Sher Muammad	Baloch	7	Residential
20	Fazal	Shaarey Khan	Baloch	15	Residential
21	Muhammad Aslam	Shaarey Khan	Baloch	20	Residential
22	Khalil Ahmad	Ghulam Sarwar	Baloch	10	Residential
23	Ameer Khan	Ghulam Sarwar	Baloch	10	Residential

SR. NO.	NAME OF ENCROACHER	FATHER'S NAME	CASTE	AREA OF ENCROACHMENT (Marla)	CATEGORY
24	Jahangir	Ghulam Sarwar	Baloch	10	Residential
25	Shabla Khan	Sarwar Khan	Baloch	10	Residential
26	Maloo	Mureed Ahmad	Baloch	15	Residential
27	Riaz Ahmad	Mureed Ahmad	Baloch	15	Residential
28	Kaley Khan	Bilal Khan	Baloch	15	Residential
29	Jind Waddah	Aashiq Hussain	Baloch	20	Residential
30	Muneer Ahmad	Allah Dittah	Baloch	10	Residential
31	Ajmal Kham	Mukhtar Khan	Baloch	12	Residential
32	Sajjad Bloch	Kalay Khan	Baloch	8	Residential

2. RIGHT MARGINAL BUND

SR. NO.	RD	NAME OF ENCROACHER	AREA ENCROACHED (MARLA)	CATEGORY
1	0-1	Ghulam Rasool S/O Ameer Bux	3	Residential
2		Nazeer Ahmed S/O Walo	5	Residential
3		Rajab Ali S/O Noor Muhammad	5	Residential
4		Muhammad Ashraf S/O Mahiwal	8	Residential
5		Darvaish Hussain S/O Karim Bux	10	Residential
6	1-2	Ameer Bux S/O Allah Ditta	15	Residential
7	2-3	Peer Bux S/O Hussain Bux	3	Residential
8	3-4	Muhammad Abbas S/O Ghulam Hussain	6	Residential
9		Abdul Aziz S/O Nazar	7	Residential
10		Muhammad Hussain S/O Gaman	9	Residential
11		Javed S/O Khadim Hussain	3	Residential
12		Hazoor Bux S/O Peerin Ditta	20	Residential
13	51-52	Saleem S/O Ahmad Bux	5	Residential
14		Ashiq Hussain Malana	10	Residential
15		Haji Nawaz Malana	12	Residential
16		Hazoor Bux Malana	20	Residential
17		Dildar Hussain Malana	10	Residential
18		Faqir Bux Malana	15	Residential
19		Altaf Hussain Malana	12	Residential
20		Peerin Ditta Malana	14	Residential
21		Muhamamd Bilal S/O Ghulam Sadiq	9	Residential
22		Kaora S/O Ameer Bux	7	Residential
23		Hazoor Bux Malana	12	Residential
24		Ghulam Haidar S/O Rasool Bux	15	Residential
25		Ghulam Abbas S/O Ghulam Nabi	20	Residential
26	55-56	Allah Ditta Dung	5	Residential
27		Ramzan Sial	8	Residential
28	56-57	Ghulam Akbar S/O Hayat Muhammad	2	Commercial
29		Rasheed Hajam S/O Hussain Bux	10	Residential
30		Hussain Bux Khulung	2	Commercial
31		Ghulam Hussain Dung	15	Residential
32	58-59	Jam Allah Ditta Dung	3	Commercial
33		Jam Allah Ditta Dung	1	Commercial
34		Jam Umer Wadda Dung	2	Commercial
35		Saifal Dung	2	Commercial
36	65-66	Nazeer Hussain Balouch	10	Residential
37		Haji Allah Bux Balouch	8	Residential
38		Ghulam Nazik Balouch	15	Residential
39	70-70+500	Abudul Latif Balouch	20	Residential
40		Ahmad Yar Balouch	2	Commercial
41		Sajjad Khan Balouch	5	Residential
42		Mumtaz Khan Balouch	10	Residential
43		Allah Ditta Balouch	12	Residential
44		Fida Hussain Balouch	10	Residential
45		Zulfiqar S/O Fida Hussain Balouch	15	Residential

SR. NO.	RD	NAME OF ENCROACHER	AREA ENCROACHED (MARLA)	CATEGORY
46		Ghafar S/O Fida Hussain	8	Residential
47		Muktar Bhindi Wala	20	Residential
48		Tahir Hussain S/O Allah Wasaya	15	Residential
49		Nazar Hussain S/O Allah Wasaya	12	Residential
50		Ashiq Hussain S/O Bagu Khan	10	Residential
51		Fazlu Khan Bhindi Wala	8	Residential
52		Amir Khan S/O Fazlu Khan	9	Residential
53		Imdad Khan S/O Fazlu Khan	14	Residential
54		Mulazim Hussain S/O Fazlu Khan	10	Residential

3. **HEADWORKS**

SR.#	NAME WITH PARENTAGE	CASTE	AREA ENCROACHED (MARLA)	CATEGORY
MAIN ROAD SIDE				
1	Muhammad Suleman S/o Haji Ahmad	Katpal	3	cottage
2	Mushtaq Ahmad S/o Abdul Hameed	Machi	1	cottage
3	Ghulam Haider S/o Muhammad Sajawul	Katpal	2	cottage
4	Naeem-ullah S/o Habib-ullah	Lishari	2	cottage
5	Allah Dad S/o Rab Nawaz	Lishari	2	cottage
6	Saif-ullah S/o Abdul Rehman	Lishari	1	cottage
7	Fayyaz Hussain S/o Basheer Shah	Qureshi	10*10 ft^2	cabin
8	Muhammad Shahid S/o Nazeer Ahmad	Lishari	1	cabin
9	Muhammad Latif S/o Abdul Aziz	Lishari	2	cottage
10	Muhammad Farhan S/o Abdul Ghafar	Gopang	12*10 ft^2	cabin
11	Muhammad Imran S/o Ameer Bakhsh	Lishari	2	cottage
12	Ashiq Hussain S/o Peer Bakhsh	Mukhrali	8*5 ft^2	cottage
13	Abdul Shakoor S/o Abdul Rehman	Machi	2	cottage
14	Abdul Rasheed	Qureshi	1	cottage
15	Muhammad Amir S/o Khuda Bakhsh	Lishari	9*8 ft^2	cottage
16	Shaukat Hussain S/o Muhammad Aslam	Siyal	3	cabin
17	Shaukat Ali S/o Haji Ahmad Ranjha	Lishari	2	cottage
18	Saeed Ahmad S/o Allah Dita	Lishari	1	cottage
19	Muhammad Yousif S/o Abdul Kareem	Lishari	1	cottage
20	Muhammad Rashid S/o Abdul Aziz	Lishari	1	cottage
21	Abdul Majeed S/o Ghulam Sawar	Lishari	2	cottage

22	Falak Sheer S/o Muhammad Nazim	Lishari	2	cottage
23	Ghulam Fareed S/o Allah Dita	Lishari	1	cottage
24	Muhammd UsmanS/o Abdul Ghafar	Gopang	2	cabin
25	Muneer Ahmad S/o Faiz Bakhsh	Lishari	3	cottage
26	Muhammad Yousif S/o Hazoor Bakhsh	Mohana	3	cottage
27	Shah Nawaz S/o Jan Muhammad	Lishari	1	cottage
NALKA ADDA ROAD SIDE				
28	Abdul Razaq	Gopang	1	cottage
29	Ali S/o Abdul Sattar	Gopang	2	cottage
30	Ali Amran S/o Ria Hussian	Gopang	2	cottage
31	Muhammd Iqbal S/o Abdul Majeed Khan	Gopang	10*10 ft^2	cabin
32	Sheer Ahmad	Gopang	2	cottage
33	Abdul Aziz Khan	Gopang	2	cottage
34	Muhammd Bilal S/o Azeem Bakhsh	Gopang	10	cabin
35	Fayyaz Ahmad S/o Azeem Bakhsh	Gopang	2	cottage
36	Muhammad Sajjad S/o Khalil Ahmad	Gopang	2	cottage
37	Muhammad Shahid S/o Allah Divaya Khan	Lishari	1	cottage
38	Ghulam Yaseen S/o Basheer Ahmad	Doli	1.5	cottage
39	Ghulam Shabeer S/o Abdul Aziz Khan	Gopang	10*10 ft^2	cabin
40	Muhammad Javed S/o Khadim Hussian	Malah	3	cottage
41	Muhammad Faisal S/o Abdul Aziz	Gabool	1.5	cottage
42	Muhammd Jawad S/o Abdul Majeed	Gabool	2	cottage
43	Faiz Bakhsh	Gopang	2	cottage
44	Muhammd Aslam	Machi	2	cottage
45	Muhammd Nawaz	Muhana	1	cottage
46	Muhammad Mujahid S/o Ghulam Qadir	Gabool	1.5	cottage
47	Muhammad Zafar S/o Ghulam Muhammad	Kasae	2	cottage
CONTROL ROOM SIDE				
48	Muhammad Bakhsh S/o Allah Dita	Katpal	10*8 ft^2	cabin
49	Khan Muhammad S/o Bahawul Bakhsh	Katpal	2	cottage
50	Muhammad Nawaz S/oMuhammad Zaman	Katpal	2	cottage

51	Muhammd Tahir S/o Muhammad Ramzan	Katpal	2	cottage
52	Allah Dita S/o Muhammad Bakhsh	Katpal	2.5	cottage
53	Muhammad Hashim S/o Muhammad Ramzan	Katpal	1.5	cottage
54	Talib Hussain S/o Muhammad Nawaz	Katpal	1	cottage
55	Muhammd Dilshad S/o Abdul Majeed	Gabol	1	cottage
56	Muhammd Bilal S/o Muhammad Bakhsh	Lishari	3	cottage
57	Jam Ghulam Shabir S/o Jam Jumma	Jhabail	2	cottage
58	Muhammd Waseem S/o Ghulam Yaseen	Lishari	2	cottage
59	Qazi Muhammad Akram	Thaheem	2	cottage
60	Muhammad Ilyas S/o Habib-ullah	Lishari	2	cottage
61	Muhammad Irshad S/o Abdul Ghafoor Khan	Doli	3	cottage
62	Sajjad Ahmad S/o Allah Bakhsh	Lishari	3	cottage
63	Muhammad Farman S/o Ghulam Qadir	Malah	3	cottage
64	Abdul Majeed	Bili mar	2.5	cottage
65	Muhammad Akram	Muhana	2.5	cottage
66	Jam Muhammad Rafique S/o Jam Juma	Jhabail	2.5	cottage
67	Muhammad Arif S/o Jam Mulazim Hussain	Jhabail	2	cottage
68	Muhammad Shahid S/o Ghulam Qadir	Ghabol	2	cottage
69	Jam Khalid S/o Muhammad Aslam	Jhabail	1.5	cottage
70	Muhammad Jumma	Machi	1	cottage
71	Mohsin S/o Abdul Majeed	Lishari	2	cottage
72	Muhammad Ijaz S/o Allah Bachaya	Lishari	2	cottage
73	Muhamamd Asif S/o Ghulam Qasim	Lishari	3	cottage
74	Muhammad Dilshad	Hashmeer	2	cottage
75	Khuda Bakhsh S/o Ghulam Muhammad	Katpal	2	cottage

4. COLONY PROTECTION BUND

No Encroachment on Colony Protection Bund

5. **SHIKRANI FLOOD BUND**

No Encroachment on Colony Protection Bund

6. MINCHIN FLOOD BUND

SR.#	LOCATION OF ENCROACHED LAND (RD)	NAME OF ENCROACHER	AREA ENCROACHED LAND (MARLA)	CATEGORY
1	6+000 to 8+000	M. Ijaz S/O Allah wassaya	5 Marla House	Residential
2	18+000 to 19+000	M Sajjad S/O Gul ahmad	8 Marla House	Residential
3	18+000 to 19+000	Wazzer Ahmad S/O Ghulam Rasol	7 Marla house	Residential
4	16+000 to 17+000	M. Saifal S/O M. Fiyaz	5 Marla (Shop + house)	Residential cum Commercial
5	29+000 to 30+000	M. Waqas S/O M. Ajmal	2 Marla shop	Commercial
6	34+000 to 35+000	Unknown	5 Marla shops	Commercial
7	36+000 to 37+000	Basheer Ahmad S/O Jam Ahmad Bakhs	4 Shops	Commercial
8	37+000 to 38+000	Ali Murtaza S/O Irshad Hussain	12 Wooden Tall	Commercial
9	61+000 to 62+000	Ghulam Shabbir s/o Nazir Ahmad Bhatar	10 Shop + house	Residential cum Commercial
10	62+000 to 63+000	Kato s/o Karam Khan Bloach	5 marla	Residential
11	99+000 to 100+000	Muhammad Asghar s/o Abdul Qadir Bhatti	2 Marla Shop	Commercial
12	100+000 to 101+000	Muhammad Irshad s/o Ghulam Nabi Bhatti	7 marla Pump	Commercial
13	102+000 to 103+000	Jam Khalil Ahmad s/o Ghulam Sarwar Malah	5 Marla (House / Shops)	Residential cum Commercial
14	103+000 to 104+000	Muhammad Farad s/o Faisal malah	4 Marla (House / Shops)	Residential cum Commercial
15	104+000 to 105+000	Abdullah s/o Phool Muhammad Bana Roya	3 Marla House / Shops	Residential cum Commercial
16	105+000 to 106+000	Jam Asif slo Qasim Dewala	2 Marla Shops	Commercial
17	106+000 to 107+000	Muhammad Ajmal slo Abdul Qadir Dewala	3 Marla Shops	Commercial
18	107+000 to 108+000	Ashiq Hussain s/o Muhammad Bux Darkhan	5 marla shops	Commercial

STEPS TAKEN TO REMOVE ENCROACHMENTS

The list of encroachment has been reported to District Civil Administration, Muzaffargarh & Bahawalpur for its removal vide this office letter Nos.

Sr No.	No. & Date	To.
1	SDO Bund Sub Div. No.14 dated 11.03.2025	AC Ahmadpur
2	SDO Panjnad Headworks Div. No.278 dated 20.09.2025	AC Ahmadpur
3	SDO Panjnad Headworks Div. No.16 we dated 03.02.2025	AC Alipur
4	SDO Panjnad Headworks Div. No.155 dated 03.03.2025	AC Alipur
5	SDO Bund Sub Div. No.18 dated 05.05.2025	AC Alipur
6	SDO Panjnad Headworks Div. No.190 dated 26.05.2025	AC Alipur
7	SDO Bund Sub Div. No.13 dated 11.03.2025	AC Liaqatpur
8	SDO headworks Sub Division no. 45 dated: 03.03.2026	AC Alipur
9	SDO headworks Sub Division no. 50 dated: 06.03.2026	AC Ahmedpur East
10	SDO headworks Sub Division no. 49 dated: 06.03.2026	AC Alipur

ACTION PLAN TO REMOVE ENCROACHMENTS

Monthly surveys are conducted along all flood bunds and spurs to identify encroachments, with updated records maintained showing precise locations and photographic evidence. Encroachment lists are forwarded monthly to the Tehsil Administration under relevant laws for formal clearance proceedings, with copies marked to district authorities for coordinated support. Critical encroachments posing immediate threat are removed immediately upon detection using divisional resources in coordination with local administration and police. Quarterly joint removal drives are scheduled with Tehsil Administration and Police for systematic clearance of non-critical encroachments. Cleared sites are regularly patrolled to prevent re-encroachment, with warning signs installed and FIRs pursued against repeat offenders. A comprehensive pre-monsoon clearance drive ensures all bunds remain fully accessible and structurally sound for flood fighting operations.

DETAIL OF NORMAL ENCROACHMENT

Total No. of encroachments	Removed	Balance	Action to be taken
169	15	154	Request for action as per law has been sent to ACs of Alipur, Ahmadpur and Liaqatpur vide SDOs office letters referred in table at the start of this chapter.

DETAIL OF CRITICAL ENCROACHMENT

Total No. of encroachments	Removed	Balance	Action to be taken
47	47	0	All kinds of critical encroachment have been removed.

CHAPTER 9

DUTY ROSTER FOR WATCHING OF BUNDS DURING HIGH FLOOD

SUPERVISORY STAFF	Shikrani Flood Bund				Minchan Flood Bund RD 6+700-122+000												
	0-10	10-20	20-30	30-40	6+700	10	20	30	40	50	60	70	80	90	100	110	122
Sub Divisional Officer	SUB DIVISIONAL OFFICER PANJNAD BUND SUB DIVISION PANJNAD																
Deputy Collector	PANJNAD CANAL DIVISION PANJNAD																
Sub Engineer	SBE UCH SECTION		SBE MASTOI SECTION		SBE CHANI GOTH SECTION			SBE LIAQATPUR SECTION			SBE METLA SECTION			SBE FEROZA SECTION			
Zilladar with his patwaries	ZILLADAR FEROZA				ZILLADAR LIAQAT						ZILLADAR FEROZA						
Official of Revenue Department	Deputy District Officer Revenue Ahmadpur East						Deputy District Officer Revenue Liaqatpur										
	Naib Tehsildar with staff						Tehsildar Liaqatpur with staff					Naib Tehsildar Liaqatpur with staff					
Police Department	SHO uch Sharif		ASI Uch Sharif				SHO Trinda Muhammad Panah					ASI Shiddani					
MATES /Beldars Irrigation Departmet High Flood	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12	1/12
MATES /Beldars Irrigation Department Very High Flood	2/15 3/25	2/15 3/25	2/15 3/25	2/15 3/25	2/15 3/25	2/15 3/25	2/15 3/25	2/15 3/25	2/15 3/25	1/6 2/16	3/25 3/35	3/25 3/35	3/25 3/35	3/22 4/32	3/22 4/32	3/22 4/32	3/22 4/32

CHAPTER 10

EMERGENCY TELEPHONE DIRECTORY

SR.#	DESIGNATION	NAME	OFFICE #	PERSONAL #
1	Minister Irrigation Punjab, Lahore	Mr. Mian Kazim Ali Pirzada	042-99212810 042-99212809	-
2.	Secretary Irrigation Punjab, Lahore	Mr. Dr. Wasif Khursheed	042-99212117 042-99212118	042-99200228
3.	Chief Engineer Drainage & Flood Zone, Lahore	Mr. Muhammad Akram	042-99230602 Fax # 042-99230731	-
4.	Director Flood / Secretary Punjab Flood Commission Lahore.	Mr. Naveed Akhtar	042-99231614	-
5.	Chief Engineer, Irrigation, Bahawalpur.	Mr. Muhammad Faisal Mushtaq	062-9250333	062-9250333
6.	Superintending Engineer, Panjnad Canal Circle Panjnad	Mr. Zameer Ahmad	-	0300-7246895
7.	Senior Most Staff Officer XEN Operation, Bahawalpur	Ms. Sidra Shahid	062-9250265	-
8.	Executive Engineer, Panjnad Headworks Division, Panjnad.	Mr. Faisal Nadeem	-	0333-7483658
9.	Sub Divisional Officer Headworks Sub Division Panjnad	Mr. Syed Hassan Abbas Bukhari	-	0300-8595495
10.	Sub Divisional Officer Bund Sub Division Panjnad	Mr. Syed Hassan Abbas Bukhari	-	0300-8595495
11.	Commissioner, Bahawalpur	Musarrat Jabeen	062-9250062	-
12.	Deputy Commissioner, Bahawalpur.	Dr. Farhan Farooq	062-9250061 062-9260063, 062- 9250492	062-9250062
13.	Assistant Commissioner, Ahmedpur East	Mr. Naveed haider	-	0333-6986326
14.	Assistant Commissioner, Alipur	Mr. Noman Mahmood	-	03136574674
15.	Assistant Commissioner, Liaqatpur	Muhammad Ibrahim Miladi Khar	(068) 5795625	-
16.	Deputy Commissioner, Rahimyar Khan	Mr. Zaheer Anwar Jappa	068-9230266	068-9230287
17	Commissioner, Dera Ghazi Khan.	Mr. Ashfaq Ahmad Chaudhry	064-9260340	064-9260341
18.	Deputy Commissioner, Muzaffargarh.	Mr. Usman Tahir Jappa	066-9200251 066-9200252 066-9250254	0304-0920091
19.	Superintendent of Police, Muzaffargarh.	Muhammad Asghar Aulakh	066-9200311	-
20.	Deputy Superintendent of Police (DSP) Alipur Circle	Mr.Azhar Iqbal	03338677333	03338677333
21.	S.H.O. Police Sadar, Alipur.	Mr.Aftab Sb	066-2700639	03336032401
22	SHO Police (on Shikrani & Minchin side)			
23.	Flood warning Centre Lahore.	-	042-997572091 0429-97572093	Fax: 042-997572092
24.	Sub Engineer Headworks	Mr.Hamza Ali		03006818101
25.	Sub Engineer Station Area	Mr.Imran Rafi		03004908438
26.	Sub Engineer Hydraulic section	Mr. Farhan Zahid		03056684400
27.	Sub Engineer workshop section	Mr. Irshad Ahmad	-	03047751986

28.	Sub Engineer Leave Reserve section	Mr. Muhammad Shahid	-	03036792929
29.	Sub Engineer section-I	Mr. Irfan Mushtaq		03039154837
30.	Sub Engineer section-II	Mr. Umer Farooq		03043129799
31.	Sub Engineer section-III	Mr. Irfan Mushtaq		
32.	Head Clerk Panjnad Headworks	Mr. Mumtaz Hussain Shah	03017625771	03017625771
33.	Signaler Panjnad Headworks	Mr. Muhammad Ashraf	03004255671	03004255671
34.	Signaler Panjnad Headworks	Mr.Qazi yousif	03017516465	03017516465
35.	Signaler Panjnad Headworks	Mr. Mumtaz Hussain	03014328801	03014328801
36	Signaler Panjnad Headworks	Mr. Hasnain Signaler	03006831748	03006831748
37	Executive Engineer MEPCO, Alipur	Rana Muhammad Iqbal	(066) 2700172	-
38	Executive Engineer MEPCO, Bahawalpur	Juniad Kaleem	062-9250444	-
39	Executive Engineer Highways, Muzaffargarh	Muhammad Awais	066-9200251-52	-
40	SDO Highways, Alipur	Mr. Rana Aslam		0348-6433264
41	CEO Health, Muzaffargarh	Zaffar Iqbal	066-9200236	
42	CEO Health, Bahawalpur			
43	Deputy Director (Development), Muzaffargarh.	Ms. Annum Hafeez	(066) 9200076	
44	PA to XEN Panjnad Headworks	Mr. Muhammad Aqib	03029360527	03029360527

CHAPTER 11
STANDARD OPERATING PROCEDURES (SOPs) FOR BREACHING SECTIONS AT PANJNAD HEADWORKS

11.1 History of a Breaching Section
11.2 Location, Design, Quantity and Variety of the Explosives Required for Detonation
11.3 Arrangement of Explosive and Security of Explosive Stores
11.4 List of Security Staff along with Detail of their Training
11.5 Detail of Mechanical Means as a Standby Arrangement in Case of Detonation Failure
11.6 Duty Roaster in Case of Critical Situation
11.7 Breaching Committee with their Action Plan
11.8 List Of The Villages Likely To Be Inundated In Case Of Operating Designated Breaching Sections Of Panjnad Headworks
11.9 Announcement & Detail of Evacuation Arrangements
11.10 Detail of Coordination with Civil / Army Authorities
11.11 Parallel Communication Arrangements
11.12 Index Plan Showing Breaching Sections of Panjnad Headworks

11.1 HISTORY OF A BREACHING SECTION

A breaching section is a pre-designated, intentionally weakened portion of a flood protection embankment, such as a marginal bund or levee, located near a headworks. It acts as a controlled “fuse” within the flood management system. These sections are constructed with embedded pipes or conduits for placing explosives and are designed as sacrificial components to be deliberately breached during extreme emergencies to divert floodwater away from the main structure. A controlled breach ensures a regulated outflow of water, directing it towards pre-identified, sparsely populated areas, thereby protecting downstream urban centers, infrastructure, and agricultural assets from widespread damage.

The process is carried out under strict protocols by a Breach Operation Committee. Upon approval, the inundation area is evacuated, the site is secured by the Pakistan Army, and explosives are placed in pre-installed liners. The breach is created through controlled detonation, while heavy machinery is kept as standby for mechanical cutting, if required. The released floodwater is then guided along a pre-planned route to minimize damage.

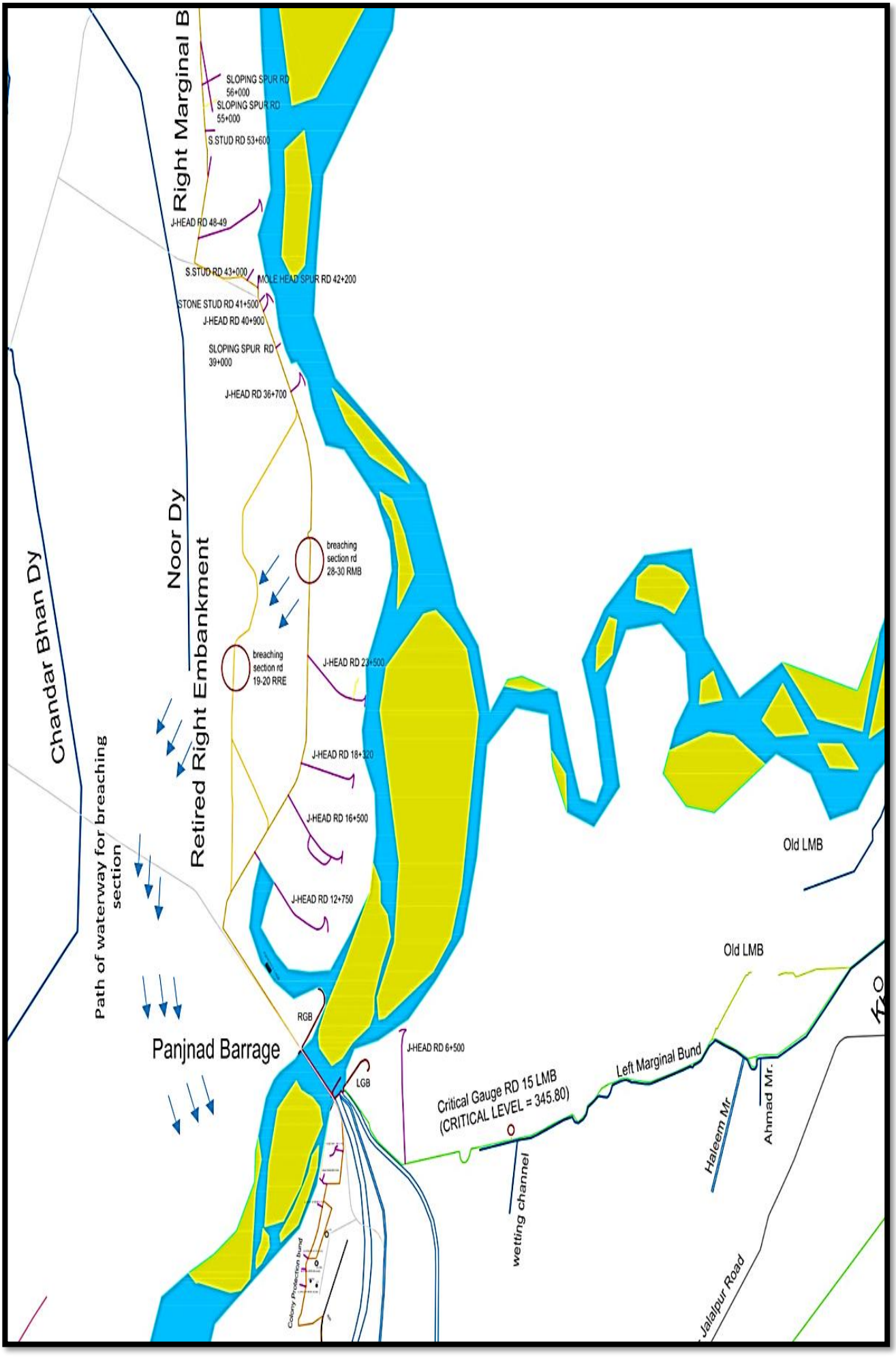
The operation is triggered only under critical conditions, including imminent structural failure, encroachment of the 7-ft freeboard on the Right Marginal Bund, or when the river level at RD-15 (Left Marginal Bund) reaches the critical gauge of 349.25 feet with a rising trend upstream, indicating unavoidable risk to the headworks.

The breaching section upstream of Panjnad Headworks was established in 1976 on the Right Marginal Bund (RMB) to protect the headworks from excessive hydraulic pressure during extreme flood events. The breaching sections were successfully operated during the flood of 1992 when water levels exceeded the critical gauge at RD-15 on the Left Marginal Bund (LMB). The explosive store constructed in 1976 is now abandoned, and explosives are currently maintained by the Pakistan Army (31 Corps, Bahawalpur). Breach operations are governed under Irrigation Department Notification No. SO(FLOODS)VI-33/97 dated 15.07.2025.

11.2 LOCATION, DESIGN, QUANTITY AND VARIETY OF THE EXPLOSIVES REQUIRED FOR DETONATION

Location:

- RMB: RD 28–30
- RRE: RD 19–21



INDEX PLAN OF THE BREACH SECTIONS

DESIGN OF BREACHING SECTIONS

The breaching sections are systematically engineered with a grid of explosive-filled liners to ensure a predictable and effective detonation. The configuration is as follows:

1. Overall Structure:
Panjnad Headworks has two breaching sections. Each breaching section is divided into **three distinct segments / parts**, with each segment / part located **500 feet apart** from the others.

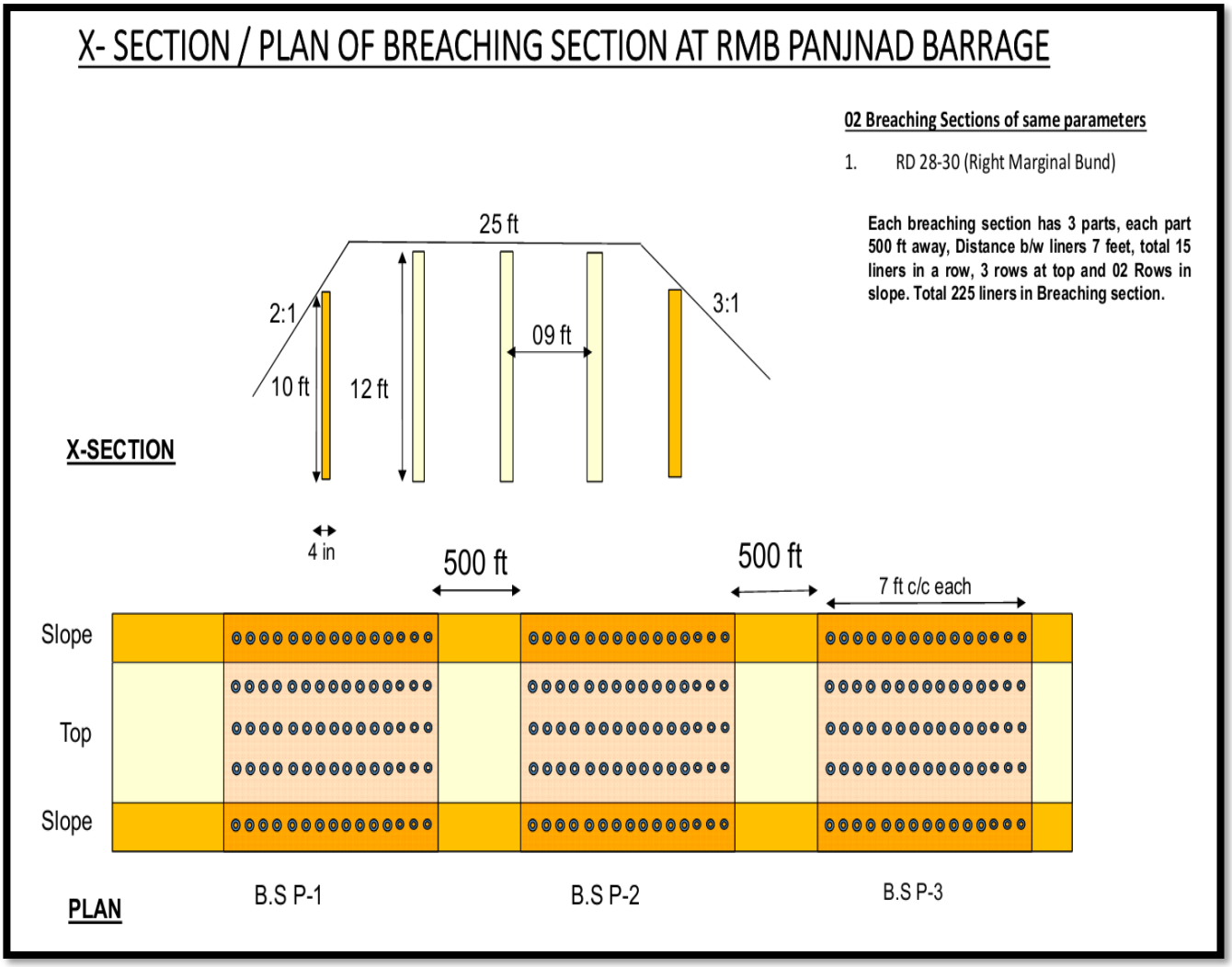
2. Liner Arrangement per segment:
Each of the three segments / parts within a breaching section contains a grid of liners, each of 04 inch diameter:

Per Row: 15 liners.
Number of Rows: 5 rows.
Spacing: The liners are installed at intervals of 7 feet from one another in a longitudinal row. The space between two liners on the top width cross section of the bund is 9 feet.

3. Placement on the Bund:
The five rows of liners are strategically placed across the embankment's profile:

Top of Bund: 3 rows run along the top width with each liner of 12-ft depth.
Side Slopes: 2 rows are fixed on the side slopes with each liner of 10-ft depth.

1. **Total Liner Count:**
Liners per segment / part: 15 liners/row × 5 rows = 75 liners.
Liners per Breaching Section: 75 liners/part × 3 parts = 225 liners.
Total for Panjnad: 225 liners/section × 2 sections = 450 liners in total.



QUANTITY & VARIETY OF EXPLOSIVE FOR DETONATION

Following the enhancement of Panjnad Headworks' discharge capacity from 700,000 to 865,000 cusecs, both the Left and Right Marginal Bunds were correspondingly raised. As part of this upgrade, the Right Marginal Bund (RMB) breaching section was elevated by approximately 3.0 feet, necessitating additional explosive material for effective detonation.

During the 2023 flood season, the Pakistan Army Engineering Corps (Bahawalpur) conducted a detailed assessment and determined the additional explosive requirements. An estimated sum of Rs. 8,671,748/- was submitted by Pak Army and subsequently paid by Panjnad Headworks Division in 2023 for procurement of the required quantities. As a result, the complete updated requirement of explosive material is now fully available and held by Pakistan Army, 31 Corps, Bahawalpur, ensuring immediate readiness for any emergency breaching operation.

SR. NO	ITEMS	AU	REQ. QTY	AVAIL. QTY	DEF. QTY	REMARKS
1	PE3A (450 gm)	Kg	2667.381	2667.381	Nil	The condition of explosive material is to be confirmed by the controlling agency, concerned Engr Battalion, 31 Corps Bahawalpur.
2	PE3A (225 gm)	Kg	1199	1199	Nil	
3	Wabox cord	Mtr	3563	3563	Nil	
4	Primer E1OZ	No.	997	997	Nil	
5	Safety Fuze No.11	Mtr	143	143	Nil	
6	Det elec Inst	No.	177	177	Nil	
7	Det Elec MS Delay	No.	614	614	Nil	
8	Wabox	Mtr	5129	5129	Nil	
9	TwinJute	Kg	3.6	3.6	Nil	
10	El Cable	Mtr	1000	1000	Nil	
11	Blasting Machine	No.	01	01	Nil	
12	Det No.8 non-Elec	No.	868	868	Nil	

11.3 ARRANGEMENT OF EXPLOSIVE AND SECURITY OF EXPLOSIVE STORES

All explosives are stored at Pakistan Army Ammunition Depot, Bahawalpur Cantt (~90 km from site). The explosives remain under the custody, control, and security of 31 Corps Engineering Battalion. Transportation, handling, and deployment are carried out strictly under Army protocols upon requisition by the Executive Engineer, Panjnad Headworks Division.

11.4 LIST OF SECURITY STAFF ALONG WITH DETAIL OF THEIR TRAINING

- Skilled Irrigation Department staff are responsible for installation of liners during normal conditions.
- In emergency situations, Pakistan Army assumes full operational control.
- Army personnel are trained in handling, placement, and detonation of explosives.
- Army ensures complete site security and execution of breach operations.

11.5 DETAIL OF MECHANICAL MEANS AS A STANDBY ARRANGEMENT IN CASE OF DETONATION FAILURE

At each breaching section, there should be arrangement of the following machinery:

- One (01) Bulldozers
- Two (02) Long-boom Excavators
- Three (03) Dumpers

These are arranged by the Executive Engineer, Panjnad Headworks Division at each breaching site.

11.6 DUTY ROASTER IN CASE OF CRITICAL SITUATION

During critical flood situations:

- Breach Operation Committee remains fully active
- Irrigation staff monitors gauges and bund conditions continuously
- Civil Administration District Muzaffargarh will coordinates all the evacuation
- Pakistan Army remains on standby for explosive deployment and execution
- All concerned officers (CE, SE, XEN, SDOs) remain available round-the-clock

11.7 BREACHING COMMITTEE WITH THEIR ACTION PLAN

The Breach Operation Committee serves as the central command authority for executing controlled flood breaches at Panjnad Headworks, operating through a structured, multi-stage protocol to balance critical infrastructure protection with public safety. Chaired by the Deputy Commissioner and comprising senior representatives from the Irrigation Department, Pakistan Army, and Highway/Railway Departments, the committee activates a phased response based on specific flood discharge thresholds. Starting with initial alerts at 300,000 cusecs, the protocol escalates to full evacuation and preparatory measures at 450,000 cusecs, culminating in a final warning at 500,000 cusecs—triggering coordinated Army-led preparation of pre-positioned explosives, civil administration-led evacuation of approx. 35 villages, and infrastructure cuts to manage water flow. The execution methodology mandates a specific sequence of cuts to ensure a smooth passage for the released floodwater: first, the K.L.P. Road Alipur-Panjnad section is cut over a stretch length of 500-ft between 3-Kms and 6.25-Kms from Panjnad Headworks (between mile 521 and 522) to create an initial spillway; second, the Right Retired Embankment (RRE) breaching section is operated; and finally, the Right Marginal Bund (RMB) breaching section is activated. This integrated approach ensures that the drastic measure of a controlled breach is executed systematically, prioritizing the preservation of the headworks and downstream populated areas while minimizing uncontrolled damage through pre-planned, collaborative action.

Breach Operations at Panjnad Headworks are governed by Irrigation Department's Notification No. SO(FLOODS)VI-33/97 dated: 15.07.2015 which outlines a detailed account of committee's composition, its action plan, and warning protocols.
Following tables depict the same information.

A. COMPOSITION OF THE BREACH OPERATION COMMITTEE

S.#	POSITION / DEPARTMENT	ROLE / RESPONSIBILITY
1	Deputy Commissioner (Concerned District)	**Convener** and final authority for activation of breaching sections
2	Executive Engineer, Panjnad Headworks	Member
3	Representative of respective Army Corps (not below Lt. Col.)	Member
4	Representative of Highway / Railway Department (not below BS–18)	Member

B. ACTION PLAN FOR BREACHING SECTIONS

B.1 Breaching Sections at RMB RD 28–30 & RRE RD 19–20

Category	Details
Preparations Required	● Final decision to operate breaching section is made by the Breach Operating Committee as per TORs of the notification dated: 15.07.2015 ● Explosive material at designated sites are supplied, installed, and executed by Pakistan Army ● One (01) bulldozer, 02 excavators and three (03) dumpers arranged by Executive Engineer Panjnad Headworks at each Breaching point.

B.2 Warning Protocol Table

Warning Level	Flood Forecast Level	Advance Time	Actions Required
First Warning	3.0 lac cusecs	72 hours	● Committee meets and issues first alert ● All departments become vigilant and remain in contact with the committee
Second Warning	4.5 lac cusecs	72 hours	● Committee issues second warning ● Departments complete all arrangements under the Contingency Plan
Final Warning	5.0 lac cusecs	72 hours	● Committee issues final warning ● Cuts in KLP Road Alipur section ● 11-kV line disconnected ● Evacuation of expected inundation zone ● Committee announces breaching-section activation time

C. ADDITIONAL INFRASTRUCTURE ACTIONS

C.1 K.L.P ROAD CUTTING PLAN

Infrastructure	Required Action	Responsibility
K.L.P Road (Panjnad–Alipur Section)	● Road to be cut at two points of 100-ft each with at least 8-ft depth between KM 3.0 and KM 6.25 from Headworks (between mile 521 and 522) to drain breaching-section discharge into River Chenab d/s headworks ● Two (02) long boom excavators arranged by Highway Department	Executive Engineer, Highways Muzaffargarh

C.2 11-KV DISTRIBUTION LINE DISCONNECTION

Infrastructure	Required Action	Responsibility
11-kV MEPCO Distribution Line	● Disconnect immediately after final warning to prevent electrical hazards in inundated areas	Executive Engineer, MEPCO Distribution Division, Alipur & Bahawalpur

D. CRITERIA FOR OPERATION OF BREACHING SECTION

Breaching section will be operated when one or more of the following conditions are met:

SR#	CRITERIUM
i.	The discharging Capacity of the structure, for which breaching section is located, is exceeded and the safety of the structure is threatened;
ii.	The Critical Gauge (@ 349.25 at RD 15-LMB) as indicated in the FFP is achieved or exceeded and is rising;
iii.	The safety of the major population centre(s) is threatened due to high flood levels and in view of the Executive Engineer concerned of the Irrigation Department, operation of breaching section can help in reduction of flood levels.

11.8 LIST OF THE VILLAGES LIKELY TO BE INUNDATED IN CASE OF OPERATING DESIGNATED BREACHING SECTIONS OF PANJNAD HEADWORKS

The following villages and public assets are likely to be affected in the event that the breaching section at RD 28–30 of the RMB, and RD 19-21 RRE at Panjnad Headworks are activated during an extreme emergency. The Deputy Commissioner, Muzaffargarh, shall ensure complete clearance of the designated waterway to allow unobstructed passage of floodwaters during the breaching operation.

SR. NO.	VILLAGES	HOUSES	POPULATION
1.	Darkhan	8 Nos.	30 Nos.
2.	Ghajan	35 Nos.	200 Nos.
3.	Jalbani	35 Nos.	175 Nos.
4.	Jattuwala	40 Nos.	250 Nos.
5.	Arain	6 Nos.	50 Nos.
6.	Chandie	11 Nos.	75 Nos.

SR. NO.	VILLAGES	HOUSES	POPULATION
7.	Pauli	20 Nos.	140 Nos.
8.	Mochi and Nai	11 Nos.	50 Nos.
9.	Baluch	28 Nos.	300 Nos.
10.	Lashari Baluch	17 Nos.	250 Nos.
11.	Moger	10 Nos.	70 Nos.
12.	Chandiu	8 Nos.	66 Nos.
13.	Lashari	15 Nos.	150 Nos.
14.	Baluch	20 Nos.	120 Nos.
15.	Oalak	10 Nos.	70 Nos.
16.	Gazer	8 Nos.	60 Nos.
17.	Makwal	25 Nos.	400 Nos.
18.	Rongha	45 Nos.	400 Nos.
19.	Shah	10 Nos.	60 Nos.
20.	Mahesar	12 Nos.	70 Nos.
21.	Gopang	70 Nos.	600 Nos.
22.	Larr	50 Nos.	430 Nos.
23.	Ghallu	35 Nos.	400 Nos.
24.	Bobore	30 Nos.	180 Nos.
25.	Muhajir	8 Nos.	48 Nos.
26.	Babbare	40 Nos.	224 Nos.
27.	Kakreji	10 Nos.	60 Nos.
28.	Chot	10 Nos.	60 Nos.
29.	Nag	20 Nos.	120 Nos.
30.	Johr	20 Nos.	120 Nos.
31.	Billimar	40 Nos.	160 Nos.
32.	Chanjan	25 Nos.	100 Nos.
33.	Ronghay	25 Nos.	100 Nos.
34.	Mohana	20 Nos.	120 Nos.
35.	Moochi	15 Nos.	72 Nos.
Total:-		**766 Nos.**	**5636 Nos.**

11.9 ANNOUNCEMENT & DETAIL OF EVACUATION ARRANGEMENTS

Irrigation Department's Notification No. SO(FLOODS)VI-33/97 dated: 15.07.2025 clearly sets out the warning protocols (illustrated in table B.2 of section 11.6). Based on those triggers, the Civil Administration, with the help of Pak Army and other law enforcement agencies, is responsible for timely and safe evacuation of the areas likely to be inundated (mentioned in Flood Inundation Maps shared by FRAU, Lahore and given in section 11.7 additionally)

11.10 DETAIL OF COORDINATION WITH CIVIL / ARMY AUTHORITIES

Effective liaison at Panjnad Headworks ensures real-time coordination between Irrigation, District Administration, Army, and Police for rapid flood response. It enables unified action—when Irrigation identifies a vulnerable bund, Police secure routes, Army deploys support, and civil administration mobilizes resources without delay. During controlled breaching, seamless coordination is critical: Irrigation prepares the site, DC authorizes, Army handles explosives, Highway Department cuts roads, and Police secure the area. Strong liaison also streamlines search, rescue, and relief operations—managing crowds, safeguarding convoys, and restoring services—while unified messaging controls panic and builds public trust, transforming individual efforts into a cohesive lifesaving system.

For more detailed account, please refer to section 7.12 of this document.

11.11 PARALLEL COMMUNICATION ARRANGEMENTS

The Wireless Communication Arrangements address the current challenge that the fixed wireless station at Panjnad Headworks has remained non-functional for the past eight years and is not linked with the Flood Warning Centre in Lahore or the upstream headworks. Consequently, flood warnings and updates are presently received through mobile communication channels. To ensure reliable field connectivity during flood emergencies, mobile wireless sets mounted on vehicles will be provided by the Police Headquarters and the District Civil Administration in Muzaffargarh. These units are allocated for use by the Chief Engineer, Bahawalpur, Superintending Engineer Panjnad, Executive Engineer Headworks, the SDO of the Headworks Sub Division, and the SDO of the Bund Sub Division. These mobile wireless units are mandated to remain operational round-the-clock during the active flood season to ensure the prompt transmission of field reports, gauge readings, and emergency alerts/decisions.

11.12 INDEX PLAN

Please refer to Section 11.2 for location details of breaching sections on RMB and RRE.

PART-B

CHAPTER 12
VULNERABLE SITES ON FLOOD EMBANKMENTS / RIVER TRAINING STRUCTURES

12.1 VULNERABLE BREACH SITES ON FLOOD EMANBKMENTS

Sr.#	LOCATION	REACH	VULNERABILITY TYPE
1	**Right Marginal Bund (RMB)**	RD 32+000–45+000	High Velocity Impact Zone
2	**Left Marginal Bund (LMB)**	RD 0+000–36+000	Recently changed River Morphology Impact Zone Old Breach Sites of 1973
		RD 10-12	
		RD 19-21	
		RD 34-36	
3	**Shikrani Flood Bund (SFB)**	RD 37+000–38+000	Freeboard Deficiency Zone / Outlet & Inlet Plugging area
4	**Minchin Flood Bund (MFB)**	RD 90+000–100+000	Bund reach closer to active riverine creek

12.1.2 VULNERABLE RIVER TRAINING STRUCTURES OF PANJNAD HEADWORKS

STRUCTURE	LOCATION	NATURE OF DAMAGE DURING 2025	EMERGENCY WORKS / OUTCOME DURING 2025	VULNERABILITY TYPE (PRE-2026)
J-Head Spur	LMB RD 6+500	Severe scouring & apron launch from river's oblique attack;	Emergency recouping with stone & crates; stability restored.	River Morphology shifted toward left flank; may cause damage in flood 2026 Earthern Shank portion is deficient in top RL
J-Head Spur	RMB RD 40+900	severe apron launch & pitching sloughing.	Emergency recouping prevented RMB breach.	Historic vulnerable point
J-Head Spur	RMB RD 23+500	Massive 50–60 ft apron launch from turbulent Chenab–Sutlej confluence.	Extensive emergency recouping	Maximum stress due to combined currents of Chenab-Sutlej
J-head Spur	RMB 36+700	-	-	The spur's nose is under direct, sustained river attack.
Sloping Stud	RD 42+200	Flow engagement at protruding structures, creating **localized scour**.	-	If not strengthened, stud failure can expose the main bund to direct attack.
Sloping Stud	RD 43+000	Flow engagement at protruding structures, creating **localized scour**.	-	If not strengthened, stud failure can expose the main bund to direct attack.

12.2 OPERATION OF BREACHING SECTION

This has been covered in detail in Chapter 11.

12.3 BREACHES DUE TO RAISING OF FLOOD WATER / DETERIORATION OF FLOOD EMBANKMENTS

EMBANKMENT / STRUCTURE	CRITICAL REACH (APPROX. RD / LOCATION)	NATURE OF RIVER ENGAGEMENT & THREAT	IMPLICATION FOR EMBANKMENT SAFETY
Right Marginal Bund (RMB)	**RD 32+000 to RD 45+000**	• **Main Creek of River Chenab** flows directly alongside. • **High-velocity currents** cause sustained hydraulic stress and seepage. • **Steep 1:3 slope** is unstable under this attack.	• Direct toe erosion, • slope sloughing, and • high seepage risk leading to potential breach.
	(J-head Spurs) RD 40+900 & RD 36+700 & RD 23+500	• River current **directly attacking spur heads** and aprons. • Identified as a **previously ignored weak reach**.	• Apron scour and failure can lead to rapid retrogressive erosion towards the main bund.
	(Sloping Stud locations) RD 43+000 & RD 42+200	• Flow engagement at protruding structures, creating **localized scour**.	• If not strengthened, stud failure can expose the main bund to direct attack.
Left Marginal Bund (LMB)	**RD 0+000 to RD 36+000**	• **High differential head (25 ft)** with Abbasia Link Canal. • River/Canal proximity induces **extreme seepage and piping**.	• Internal erosion (piping) risk, which is a sudden and catastrophic failure mode.
	RD 9+000 to 11+000 & RD 19+000 to 21+000 & RD 34-36 (Old Breach Loops)	• **Changing river morphology** since 2023 has now been hitting the LMB and LGB directly • The Riverine Flow impinges **obliquely** on the LMB causing stress and sloughing.	• The alignment attracts direct current during high flow, requiring extreme vigilance and machinery deployment.
Minchin Flood Bund	**RD 95+000 to 100+000**	• **Active attack of River Chenab's main current.** • Embankment in this reach is under active erosion. • Freeboard encroachment upto 33-34 inches	• slope sloughing and potential section failure. • Top RL deficient from FFC criteria
Shikrani Flood Bund	**RD 0+000 to 18+000**	• **High differential head (>16 ft)** with Panjnad Main Line Canal. • Prolonged saturation during floods. • Freeboard encroachment upto 2.95 feet	• High risk of **seepage and piping** through the embankment body, a critical internal failure risk. • Top RL deficient from FFC criteria

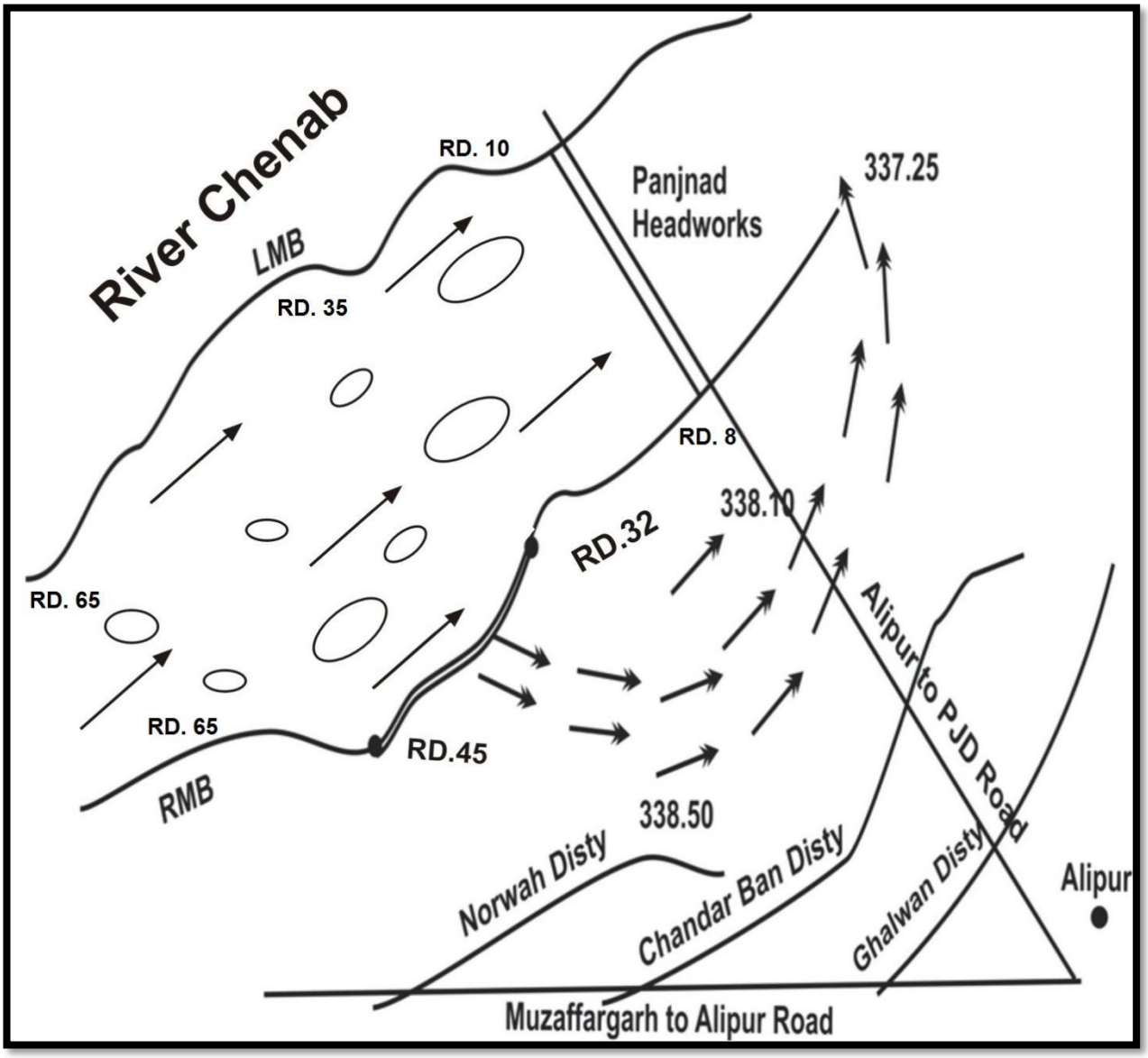
EMBANKMENT / STRUCTURE	CRITICAL REACH (APPROX. RD / LOCATION)	NATURE OF RIVER ENGAGEMENT & THREAT	IMPLICATION FOR EMBANKMENT SAFETY
System-Wide Impact Zone	**Area immediately downstream of Panjnad Headworks** (Indus-Chenab Confluence)	• **Constricted waterway** causes **tail-water ponding**. • Raises water levels against **all downstream embankments** (CP Bund, Shikrani, Minchin).	• **Encroaches on freeboard** system-wide, increasing overtopping risk even at lower discharges.
	Upstream of Panjnad Headworks **(Right-bank Bella)**	• **Bella formation** redirects Chenab River flow **towards the left bank**. • Creates a **deep channel** upstream of LGB, directing **oblique, high-energy flow** towards LMB and headworks bays.	• Puts **extreme and oblique stress on LMB**, LGB, offtaking canals; • Reduces effective bay width, and • increases scour potential at the headworks' glacis.

CHAPTER 13

EMERGENCY CONTINGENCY PLAN FOR VULNERABLE SITES

VULNERABLE SITE#1
RD: 32-45 R.M.B RIVER CHENAB

13.1 PLAN SHOWING ROUTE OF FLOOD WATER COMING OUT OF THE BREACH SUPPORTED WITH LEVELS AT RD. 32-45 OF RMB PANJNAD HEADWORKS

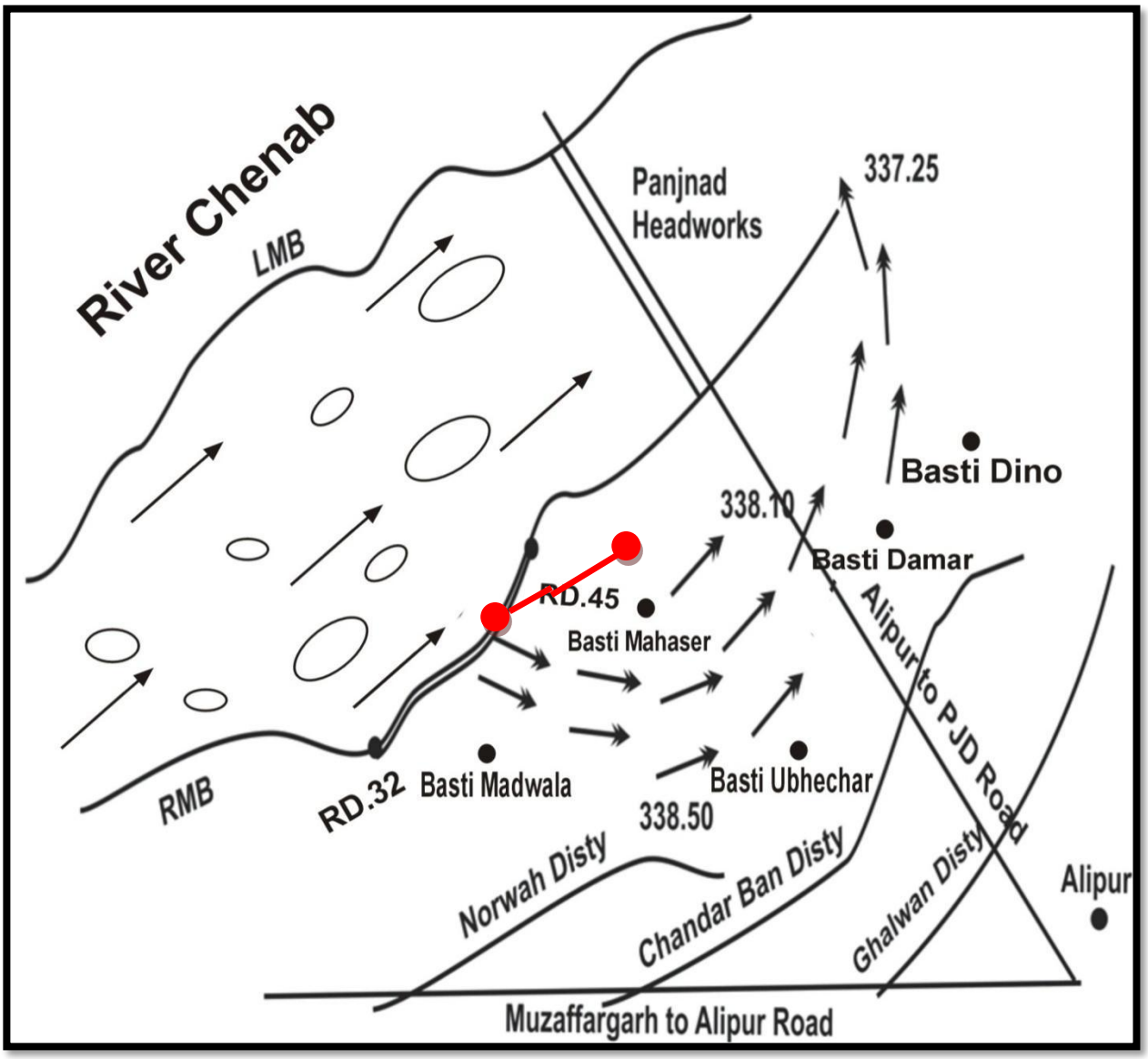


13.2 DETAIL OF VILLAGES /ABADIES LIKELY TO BE AFFECTED:

The following villages / public property can be affected if breach occurs between RD. 32-45 of RMB of Panjnad Headworks.

Sr. No.	Villages	Houses (Nos.)	Population (Nos.)
1.	Basti Madwala	240	16800
2.	Basti Mahser	103	850
3.	Basti Ubaichar	31	230
4.	Basti Dumber	154	9500
5.	Basti Dino	47	2200
6.	Darkhan	8	350
7.	Ghajan	36	2200
8.	Jalbani	36	1850
9.	Jattuwala	42	2700
10.	Arain	6	550
11.	Chandie	11	850
12.	Pauli	21	1500
13.	Mochi and Nai	9	500
14.	Baluch	29	3300
15.	Lashari Baluch	17	2600
16.	Doger	8	650
17.	Chandie	8	660
18.	Lashari	16	1600
19.	Baluch	21	1300
20.	Oalak	21	250
21.	Gazer	21	250
22.	Makwal	26	500
23.	Rongha	47	520
24.	Shah	15	80
25.	Mehesar	15	80
26.	Gopang	73	650
27.	Laar	52	500
28.	Ghallu	36	450
29.	Bobrey	31	220
30.	Muhajir	10	60
31.	Babbar	42	300
32.	Kakreji	15	100
33.	Chot	15	100
34.	Nag	21	150
35.	Johr	21	150
36.	Billimar	42	200
37.	Chajan	26	150
38.	Ronghe	26	150
39.	Mohana	21	150
40.	Mochi	10	100
Total:-		**1435**	**71950**

Location Plan of Villages



13.3 STRATEGY AND ACTION TAKEN:

13.3.1 ARRANGEMENTS

The vulnerable reach at RD 32–45 on the Right Marginal Bund (RMB), Panjnad Headworks will be treated as a priority section requiring enhanced flood protection and continuous monitoring. A dedicated watching establishment will be deployed in accordance with flood intensity, ranging from single-shift surveillance during normal conditions to round-the-clock, multi-shift monitoring during high and exceptionally high floods. A flood protection camp will be established within the reach to ensure immediate response capability, and additional camps will be activated as conditions escalate. Camp locations will be aligned with the vulnerable reach to ensure direct and effective coverage.

Required flood fighting material will be pre-positioned at the site, with additional resources mobilized during peak flood conditions to avoid shortages. Continuous patrolling and inspection will be carried out to detect early signs of seepage, erosion, or structural distress. Machinery and transport will be kept readily available for emergency strengthening, repair, or evacuation operations. Adequate lighting arrangements, supported by standby systems, will be ensured for uninterrupted night operations. Communication will be maintained through wireless/mobile systems linked with the Flood Control Room, with backup arrangements through Dak runners in case of communication failure.

Ration and drinking water will be provided for all deployed staff working in continuous shifts, while POL supply will be ensured for all operational machinery and vehicles under strict monitoring. Law and order arrangements will be coordinated with local administration to secure the reach and

regulate movement during emergencies. Medical support, including first aid and emergency response services, will be ensured for staff and affected population. Close coordination will be maintained with District Administration, Police, and other departments for evacuation, reinforcement, or controlled breaching in case of escalation, ensuring a prompt and effective response to any flood-related mishap.

13.3.2 ESTABLISHMENT OF FLOOD FIGHTING CAMP

A permanent camp will be established between RD 32-45, preferably at RD 40 of Right marginal Bund (RMB) Panjnad Headworks.

13.3.3 DUTIES OF OFFICERS / OFFICIALS AND THEIR CAMP SITE

SR. NO.	LOCATION OF CAMP	CAMP SUPERVISOR	CAMP IN-CHARGE	OVERALL, IN-CHARGE
1	RD. 40 RMB	Farhan Zahid Sub Engineer Hydraulic Section. Cell # 0305-6684400	Syed Hassan Abbas Bukhari Sub Divisional Officer Panjnad Headworks Cell # 0300-8595495	Faisal Nadeem Executive Engineer Panjnad Headworks Division Panjnad Cell # 0333-7483658

13.3.4 DEPARTMENTAL MACHINERY AVAILABLE

Upon requisition from the Executive Engineer, Panjnad Headworks Division, the required Departmental Machinery will be entrusted with flood related activities.

13.3.5 MACHINERY AVAILABLE FROM PRIVATE SOURCES

Nearest urban centers for logistical support are Alipur and Uch Sharif. Heavy machinery will be arranged through contractors of the Irrigation Department as and when required, in accordance with Government of Punjab policies and prevailing flood stages. The Agriculture Department will be requested to provide a dozer as stipulated in the District Flood Plan to meet any emergency, and the Deputy Commissioner, Muzaffargarh will be approached to direct the District Machinery Pool Officer for timely arrangement of the same.

13.3.6 FLOOD FIGHTING MATERIAL REQUIRED
13.3.7 FLOOD FIGHTING MATERIAL AVAILABLE

Flood Fighting Material will be made available at each vulnerable site' camp per detail mentioned in section 7.4 of this document. The same is reproduced here for clarity.

DETAIL OF MINIMUM REQUIREMENT OF FLOOD FIGHTING MATERIAL FOR PERMANENT CAMPS (15 MILES)

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
1.	Shouldari / Tent	No.	1	-	1	Balance quantity of Material will be procured before flood, 2026
2.	Chairs	No.	6	-	6	
3.	Table	No.	1	-	1	
4.	Generator (2-3 KVA)	No.	1	-	1	
5.	Pedestal Fans	No.	1	-	1	
6.	Charpois	No.	2	-	2	
7.	Symbolic Jackets	No.	50	-	50	
8.	Polythin Sheet	Kg	100	-	100	
9.	Bamboos 4'' dia	No.	100	-	100	
10.	Water Coller	No.	1	-	1	

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
11.	Portable umbrella	No.	2	-	2	
12.	Life Jacket	No.	5	-	5	
13.	Utensils (10 person)	No.	1	-	1	
14.	Jute/Plastic bags	No.	1000	-	1000	
15.	Walke Talkie Set	Set	2	-	2	
16.	Raincoats	No.	10	-	10	
17.	LED flood light	No.	10	-	10	
18.	Extension Cable 10’	No.	2	-	2	
19.	Rechargeable Torches	No.	20	3	17	
20.	Kassi	No.	20	2	18	
21.	Axes	No.	20	-	20	
22.	G.I Buckets	No.	5	-	5	
23.	7/44 Cable	Feet	500	-	500	
24.	Sutli	Kg	2	-	2	
25.	Sewing Needles	No.	10	-	10	
26.	Emergency Medical Kit	No.	1	-	1	
27.	Wire Crates (at only that camp near river action and reserve stock exists)	No.	100	-	100	

13.4 DETAIL OF OTHER INFRASTRUCTURE LIKE ELECTRIC, SUI GAS, TELEPHONE INSTALLATIONS, ROAD NETWORK, OTHER BUILDINGS, CANALS AND DRAINAGE NETWORKS.

- **ROADS / INFRASTRUCTURES LIKELY TO BE AFFECTED IN CASE OF BREACHES**

1. Noorwah Disty (Muzaffargarh Canal Division)
2. Chandarban Disty (Muzaffargarh Canal Division)
3. Ghalwan Disty (Muzaffargarh Canal Division)
4. Pacca Road from Muzaffargarh to Alipur
5. Pacca Road from Alipur to Panjnad

- **SCHOOLS / COLLEGES / OTHER EDUCATIONAL INSTITUTIONS**

1. Government High School Changan
2. Government High School Mudwala
3. Government Primary School Ubaicharr
4. Government Primary School Nazroowali Hatti
5. Government Primary School Masser

- **OTHER BUILDING ETC.**

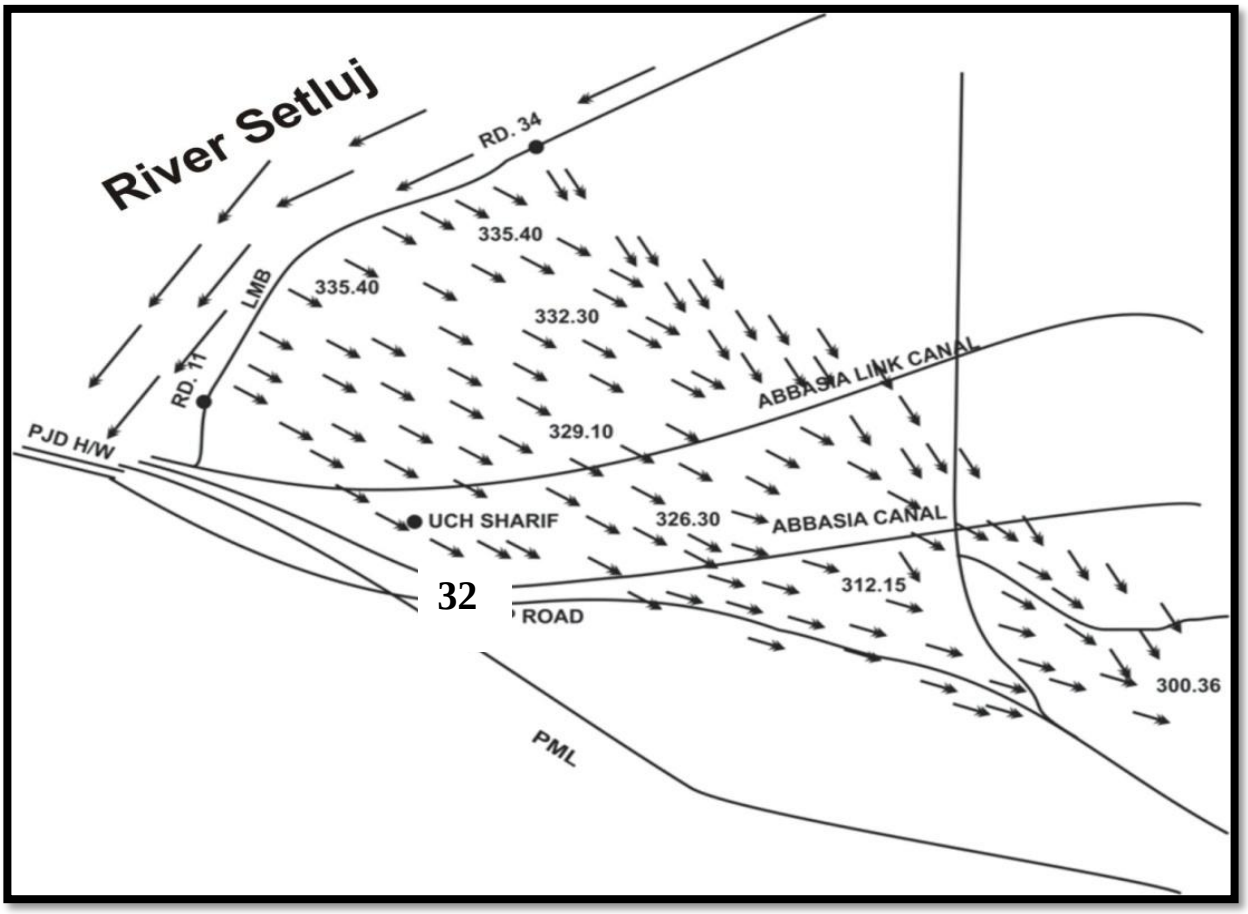
1. RHC Mudwala
2. Veterinary Hospital Mudwala
3. BHU Changan
4. Veterinary Hospital Changan
5. Veterinary Hospital Nazroowali Hatti
6. Electric Pools 11KVA
7. Communication Towers
8. 66,000-W highly dangerous transmission line

VULNERABLE SITE #2

RD: 10-12 & 19-21 and RD 34-36 LEFT MARGINAL BUND (LMB)

13.1 PLAN SHOWING ROUTE OF FLOOD WATER COMING OUT OF THE BREACH SUPPORTED WITH LEVELS AT RD. 10-36 OF LMB PANJNAD HEADWORKS

In August 1973, a second highest ever recorded flood of 802,516 Cs was experienced due to combined high flood conditions in all rivers i.e the River Chenab and Sutlej. It caused breaches in the left marginal bunds at various locations between RD. 10-36 of LMB which was the main reason for immense losses to human life and property, irrigation system, roads and railways. To save the important city of Khanpur, Rahim Yar Khan, cuts were made in the main railway line, Sadiq Branch and other distributaries to spread the flood water in comparatively less developed areas. The flood water damaged the entire D/S floor of Abbasia Canal regulator, the divide wall and bays No. 9 to 12 of Panjnad Canal Head Regulator due to the swirling action of backflow. Above mentioned situation was created only during 1973. From RD 0-6 Abbasia link canal runs parallel in the toe of LMB depth about 24 feet leading to serious boiling and seepage.



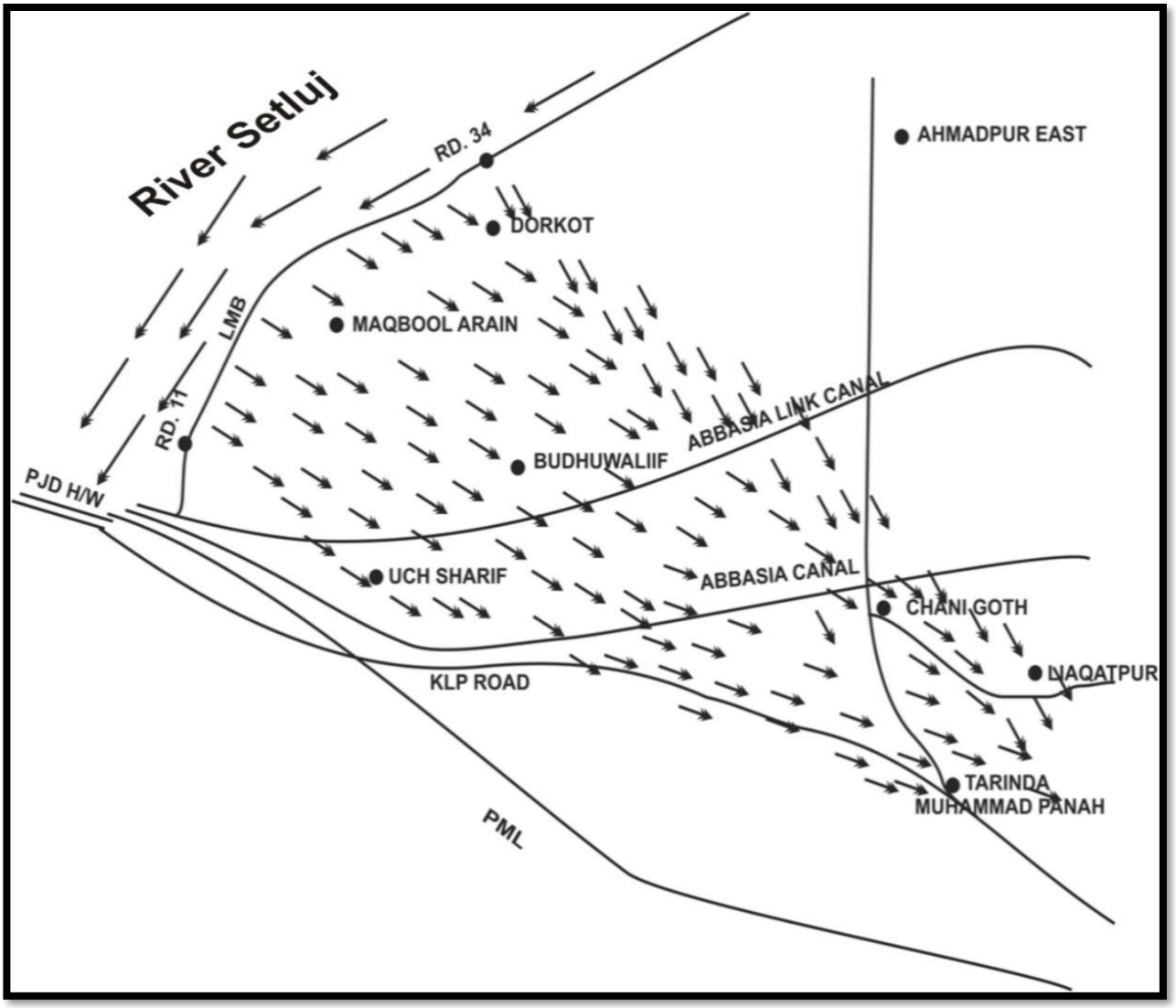
13.2 DETAIL OF VILLAGES / ABADIES LIKELY TO BE AFFECTED:

The following villages / public property can be affected if breach occurs between RD. 0-34 of LMB of Panjnad Headworks.

Sr. No.	Area / Tehsil	Major Settlements / Towns & Villages
1	Uch Sharif	Nalka Adda, Uch Sharif, Basti Pir Jahanian, Basti Makhdoom Sahib, Basti Bukhari, Basti Rind, Basti Balochan, Tibbi Laran, Khairpur Daha, Khairpur Jadeed

Sr. No.	Area / Tehsil	Major Settlements / Towns & Villages
2	Ahmedpur East	Ahmedpur East, Dera Nawab Sahib, Tibbi Laran belt, Basti Jatoi, Basti Sheikh, Basti Khokhar, Basti Arain
3	Channi Goth	Channi Goth, Basti Channar, Basti Jakhra, Basti Araeen, Basti Noonari, Basti Gujjar, Hasilpur Road settlements
4	Taranda Muhammad Panah	Taranda Muhammad Panah, Basti Rajput, Basti Sheikh, Basti Jat, Basti Bhutta, surrounding rural abadis
5	Liaquatpur	Liaquatpur, Firoza, Janpur, Kachi Muhammad Khan, Basti Mahar, Basti Khichi, Basti Pathan, Basti Kalwar, Basti Amanullah
6	Khanpur	Khanpur, Zahir Pir, Bagho Bahar, Basti Sial, Basti Machhi, Basti Rajputan, Basti Sheikhan, Basti Mian Sahib
7	Rahim Yar Khan	Rahim Yar Khan, Chak 4-P, 7-P, 13-P, 19-P, 21-P, Basti Qadir Bakhsh, Basti Allah Dino, Basti Kalyar
8	Sadiqabad	Sadiqabad, Chak 6/NP, Chak 8/NP, Chak 10/NP, Basti Rahim Bakhsh, Basti Bhutta, Basti Kalhora

Location Plan of Villages



13.3 STRATEGY AND ACTION TAKEN:

13.3.1 ARRANGEMENTS

The vulnerable reach at RD 0-34 on the Left Marginal Bund (LMB), Panjnad Headworks will be treated as a priority section requiring enhanced flood protection and continuous monitoring. A dedicated watching establishment will be deployed in accordance with flood intensity, ranging from single-shift surveillance during normal conditions to round-the-clock, multi-shift monitoring during high and exceptionally high floods. Three flood protection camps will be established within the reach to ensure immediate response capability, and additional camps will be activated as conditions escalate. Camp locations will be aligned with the vulnerable reaches to ensure direct and effective coverage.

Required flood fighting material will be pre-positioned at every vulnerable site, with additional resources mobilized during peak flood conditions to avoid shortages. Continuous patrolling and inspection will be carried out to detect early signs of seepage, erosion, or structural distress. Machinery and transport will be kept readily available for emergency strengthening, repair, or evacuation operations. Adequate lighting arrangements, supported by standby systems, will be ensured for uninterrupted night operations. Communication will be maintained through wireless/mobile systems linked with the Flood Control Room, with backup arrangements through Dak runners in case of communication failure.

Ration and drinking water will be provided for all deployed staff working in continuous shifts, while POL supply will be ensured for all operational machinery and vehicles under strict monitoring. Law and order arrangements will be coordinated with local administration to secure the reach and regulate movement during emergencies. Medical support, including first aid and emergency response services, will be ensured for staff and affected population. Close coordination will be maintained with District Administration, Police, and other departments for evacuation, reinforcement, or controlled breaching on RMB / RRE in case of escalation, ensuring a prompt and effective response to any flood-related mishap.

13.3.2 ESTABLISHMENT OF FLOOD FIGHTING CAMP

Three permanent camps will be established between RD 0-34 LMB, preferably at old breach sites of Left Marginal Bund (LMB) Panjnad Headworks.

STRUCTURE	LENGTH (MILES)	VULNERABLE SITES		NO. OF CAMPS ESTABLISHED EXCEPT VULNERABLE POINTS			TOTAL
				NORMAL / LOW FLOOD	MEDIUM / HIGH FLOOD	VERY HIGH / EXCEP. HIGH FLOOD	
		REACH	NO. OF CAMPS	(15 Miles)	(7 Miles)	(5 Miles)	
Left Marginal Bund (RD 0–68)	13.60	10-12	1	-	-	-	
		19-21	1				
		34-36	1				

13.3.3 DUTIES OF OFFICERS / OFFICIALS AND THEIR CAMP SITE

SR #	LOCATION OF CAMP	CAMP SUPERVISOR	CAMP IN-CHARGE	OVERALL, IN-CHARGE
1	RD. 10-12 LMB	Imran Rafi Sub Engineer Station Area Section Cell # 0305-6684400	Syed Hassan Abbas Bukhari Sub Divisional Officer Panjnad Headworks Cell # 0300-8595495	Faisal Nadeem Executive Engineer Panjnad Headworks Division Panjnad Cell # 0333-7483658
2	RD. 19-21 LMB			
3	RD. 34-36 LMB			

13.3.4 DEPARTMENTAL MACHINERY AVAILABLE

Upon requisition from the Executive Engineer, Panjnad Headworks Division, the required Departmental Machinery will be entrusted with flood related activities.

13.3.5 MACHINERY AVAILABLE FROM PRIVATE SOURCES

Nearest urban centers for logistical support are Alipur and Uch Sharif. Heavy machinery will be arranged through contractors of the Irrigation Department as and when required, in accordance with Government of Punjab policies and prevailing flood stages. The Agriculture Department will be requested to provide a dozer as stipulated in the District Flood Plan to meet any emergency, and the Deputy Commissioner, Bahawalpur will be approached to direct the District Machinery Pool Officer for timely arrangement of the same.

13.3.6 FLOOD FIGHTING MATERIAL REQUIRED
13.3.7 FLOOD FIGHTING MATERIAL AVAILABLE

Flood Fighting Material will be made available at each vulnerable site' camp per detail mentioned in section 7.4 of this document. The same is reproduced here for clarity.

DETAIL OF MINIMUM REQUIREMENT OF FLOOD FIGHTING MATERIAL FOR PERMANENT CAMPS (15 MILES)

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
3.	Shouldari / Tent	No.	1	-	1	Balance quantity of Material will be procured before flood, 2026
4.	Chairs	No.	6	-	6	
3.	Table	No.	1	-	1	
4.	Generator (2-3 KVA)	No.	1	-	1	
5.	Pedestal Fans	No.	1	-	1	
6.	Charpois	No.	2	-	2	
10.	Symbolic Jackets	No.	50	-	50	
11.	Polythin Sheet	Kg	100	-	100	
12.	Bamboos 4'' dia	No.	100	-	100	
10.	Water Coller	No.	1	-	1	
11.	Portable umbrella	No.	2	-	2	
12.	Life Jacket	No.	5	-	5	
14.	Utensils (10 person)	No.	1	-	1	
14.	Jute/Plastic bags	No.	1000	-	1000	
15.	Walke Talkie Set	Set	2	-	2	
16.	Raincoats	No.	10	-	10	
17.	LED flood light	No.	10	-	10	

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
18.	Extension Cable 10’	No.	2	-	2	
19.	Rechargeable Torches	No.	20	3	17	
20.	Kassi	No.	20	2	18	
21.	Axes	No.	20	-	20	
22.	G.I Buckets	No.	5	-	5	
23.	7/44 Cable	Feet	500	-	500	
24.	Sutli	Kg	2	-	2	
25.	Sewing Needles	No.	10	-	10	
26.	Emergency Medical Kit	No.	1	-	1	
27.	Wire Crates (at only that camp near river action and reserve stock exists)	No.	100	-	100	

13.4 DETAIL OF OTHER INFRASTRUCTURE LIKE ELECTRIC, SUI GAS, TELEPHONE INSTALLATIONS, ROAD NETWORK, OTHER BUILDINGS, CANALS AND DRAINAGE NETWORKS.

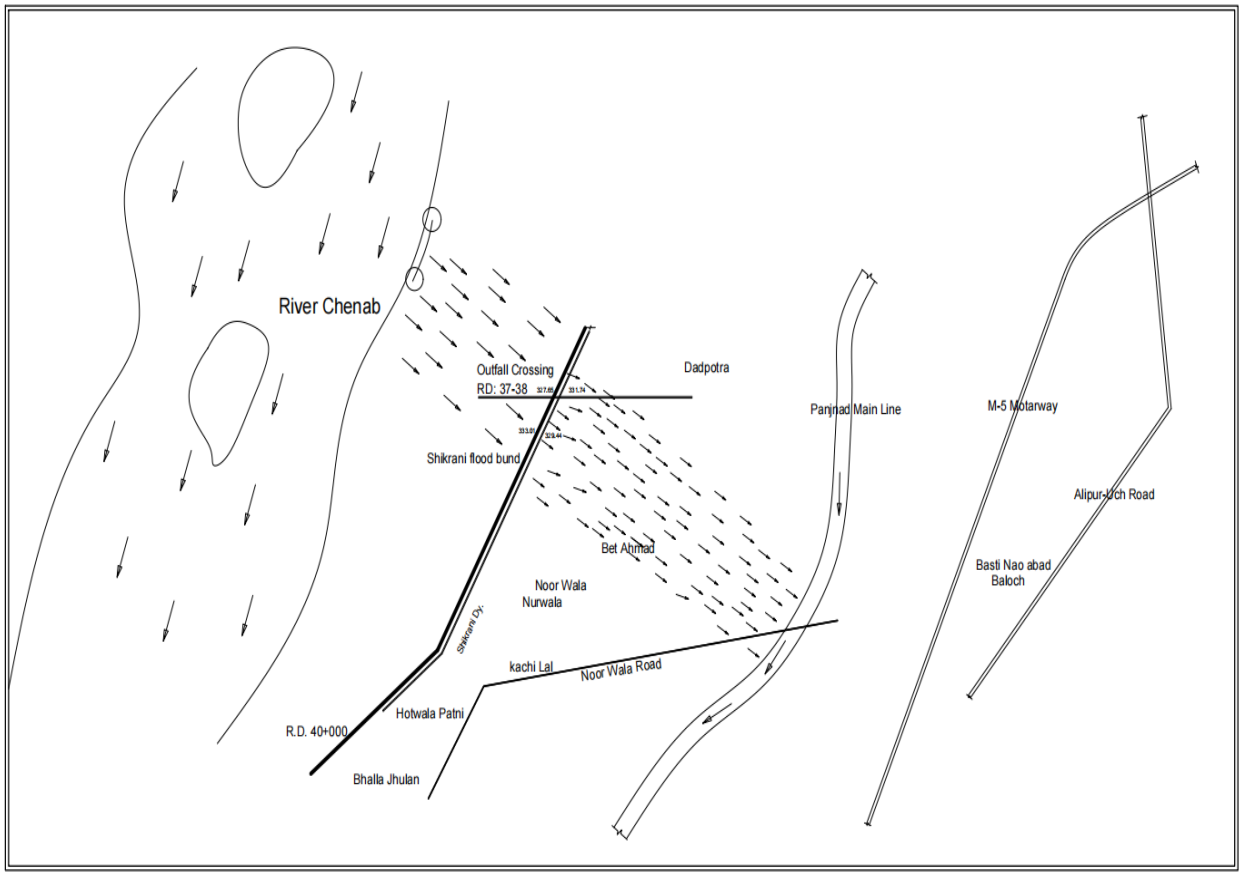
Sr. No.	Area	Infrastructure Type	Key Installations / Assets
1	Uch Sharif	Road Infrastructure	KLP Road, Uch–Ahmedpur East Road, Uch–Channi Goth links
		Irrigation / Flood Works	LMB, flood embankments, spurs
		Public Buildings	Schools, BHUs, mosques/shrines
		Utilities	Grid station, tube wells, water supply
		Industrial / Business	Rice mills, cotton ginning units, small oil mills, local markets
		Farmhouses / Agriculture	Large agricultural farms (cotton, wheat, sugarcane belt), private tube well farms
		Administrative	Municipal office, police station
2	Channi Goth	Road Infrastructure	KLP Road junction, Ahmedpur East & Hasilpur links
		Irrigation / Flood Works	Canal distributaries, drainage paths
		Public Buildings	Schools, BHU/RHC
		Utilities	Feeders, tube wells
		Industrial / Business	Grain markets, cotton ginning factories, rice mills
		Farmhouses / Agriculture	Medium to large farms along road and canal belt
		Administrative	Police post, revenue offices
3	Taranda Muhammad Panah	Road Infrastructure	KLP Road, Taranda–Liaquatpur link
		Irrigation / Flood Works	Canal network, drainage channels
		Public Buildings	Schools, BHU
		Utilities	Tube wells
		Industrial / Business	Small agro-based units, ginning factories
		Farmhouses / Agriculture	Large private farms, livestock units
		Administrative	Police station
4	Firoza	Road Infrastructure	KLP Road, Firoza–Liaquatpur link
		Irrigation / Flood Works	Abbasia canal influence
		Public Buildings	Schools, BHU

Sr. No.	Area	Infrastructure Type	Key Installations / Assets
		Utilities	Feeders, tube wells
		Industrial / Business	Cotton ginning, seed processing units, grain markets
		Farmhouses / Agriculture	Irrigated farms (cotton, wheat, sugarcane)
5	Liaquatpur	Road Infrastructure	KLP Road, Liaquatpur–Khanpur, Janpur links
		Irrigation / Flood Works	Abbasia system, distributaries
		Public Buildings	THQ Hospital, schools, offices
		Utilities	Grid stations, water supply
		Industrial / Business	Flour mills, ginning factories, rice mills, oil mills, major grain markets
		Farmhouses / Agriculture	Large estates, orchards, livestock farms
		Administrative	AC office, police, municipal
6	Khanpur	Road Infrastructure	KLP Road, Khanpur–RYK, Zahir Pir links
		Irrigation / Flood Works	Canal and drainage system
		Public Buildings	THQ Hospital, schools, colleges
		Utilities	Grid station, water supply
		Industrial / Business	Textile-related units, ginning factories, flour mills, cold storages, markets
		Farmhouses / Agriculture	Extensive irrigated farms, orchards (mango belt nearby)
		Administrative	AC office, police
7	Rahim Yar Khan	Road Infrastructure	N-5/KLP Road, railway network
		Irrigation / Flood Works	Abbasia canals, drainage network
		Public Buildings	Sheikh Zayed Hospital, universities, schools
		Utilities	Multiple grid stations, WASA
		Industrial / Business	Sugar mills, textile units, fertilizer depots, large markets, warehouses
		Farmhouses / Agriculture	Corporate farms, orchards (mango, dates), livestock farms
		Administrative	DC office, police HQ
		Transport Hub	Railway station, major bus terminals

VULNERABLE SITE# 3

RD 37-38 SHIKRANI FLOOD BUND

13.1 PLAN SHOWING ROUTE OF FLOOD WATER COMING OUT OF THE BREACH SUPPORTED WITH LEVELS.



13.2 DETAIL OF VILLAGES ABADIES LIKELY TO BE AFFECTED:

Detail has been given as,

Balla Jhallan, Noorpur, Shehbazpur, Taranda Muhammad Panah, Gul Muhammad Langah, Tibbi Jhullan, Nala Jhullan, Thul Hamza, Janpur

SR#	NAME OF MAJOR SETTLEMENT	NAME OF MAJOR INFRASTRUCTURE
1.	Balla Jhallan	Rural Health Care Centres
2.	Noorpur	Schools, Mosques, Graveyards
3.	Shehbazpur,	Motorway M-5 (Uch-Taranda M. Panah)
4.	Taranda Muhammad Panah	Panjnad Main Line and alllied system
5.	Gul Muhammad Langah	Bhalla Jhallan-Taranda Road
6.	Tibbi Jhullan	Municipal Committees
7.	Nala Jhullan	Police Stations
8.	Thul Hamza	Tehsil & District Administration offices
9.	Janpur	

13.3 STRATEGY AND ACTION TAKEN:

In case of breach, Administrative Department/ Pak Army will be asked to make evacuation arrangement for public and to cut the roads/ distributaries/ water courses which are making hindrance in flow of flood water through breaches on lower level sites.

13.3.1 ARRANGEMENTS

The vulnerable reach at **RD 37–38 of Shikrani Flood Bund (SFB)** will be treated as a critical section and managed with enhanced flood protection arrangements and continuous monitoring. A dedicated watching establishment will be deployed according to flood intensity, ranging from single-shift observation during normal conditions to round-the-clock, multi-shift vigilance during high and exceptionally high floods. One flood protection camp will be established at the site to ensure prompt response, while additional camps will be mobilized if the situation intensifies. The camp will be strategically located to ensure effective coverage of the vulnerable stretch.

Flood fighting material will be stocked at the site in advance, with additional resources arranged during peak flood conditions to avoid any deficiency. Regular patrolling and inspection will be carried out to detect seepage, erosion, or any signs of structural distress at an early stage. Machinery and transport will be kept readily available for emergency strengthening, repair, and evacuation works. Adequate lighting arrangements, along with standby backup systems, will be ensured to facilitate uninterrupted night operations. Communication will be maintained through mobile and wireless systems linked with the Flood Control Room, while Dak runners will be deployed as a contingency in case of communication breakdown.
Ration and safe drinking water will be provided for all staff deployed on continuous duty, and POL supply will be ensured for all vehicles, machinery, and generators under strict control and monitoring. Law and order will be maintained in coordination with the local administration to secure the area and regulate movement during emergency situations. Medical arrangements, including first aid and emergency response services, will be ensured for both staff and affected population. Close liaison will be maintained with District Administration, Police, and other concerned departments for evacuation, reinforcement, or controlled breaching, ensuring a prompt and effective response to any flood emergency.

13.3.2 ESTABLISHMENT OF FLOOD FIGHTING CAMPS

STRUCTURE	LENGTH (MILES)	VULNERABLE SITES		NO. OF CAMPS ESTABLISHED EXCEPT VULNERABLE POINTS			TOTAL
				NORMAL / LOW FLOOD	MEDIUM / HIGH FLOOD	VERY HIGH / EXCEP. HIGH FLOOD	
		REACH	NO. OF CAMPS	(15 Miles)	(7 Miles)	(5 Miles)	
Shikrani Flood Bund (RD 0+000–40+000)	8.00	37-38	1	-	-	-	-

13.3.3 DUTIES OF OFFICERS / OFFICIALS AND THEIR CAMP SITES

SR #	LOCATION OF CAMP	CAMP SUPERVISOR	CAMP IN-CHARGE	OVERALL, IN-CHARGE
1	RD. 37-38 SFB	Umer Farooq Sub Engineer Section-II Cell # 0304-3129799	Syed Hassan Abbas Bukhari Sub Divisional Officer Bund S/D Cell # 0300-8595495	Faisal Nadeem Executive Engineer Panjnad Headworks Division Panjnad Cell # 0333-7483658

13.3.4 DEPARTMENTAL MACHINERY AVAILABLE

Upon requisition from the Executive Engineer, Panjnad Headworks Division, the required Departmental Machinery will be entrusted with flood related activities.

13.3.5 MACHINERY AVAILABLE FROM PRIVATE SOURCES

Nearest urban centers for logistical support are Alipur and Uch Sharif. Heavy machinery will be arranged through contractors of the Irrigation Department as and when required, in accordance with Government of Punjab policies and prevailing flood stages. The Agriculture Department will be requested to provide a dozer as stipulated in the District Flood Plan to meet any emergency, and the Deputy Commissioner, Bahawalpur will be approached to direct the District Machinery Pool Officer for timely arrangement of the same.

13.3.6 FLOOD FIGHTING MATERIAL REQUIRED
13.3.7 FLOOD FIGHTING MATERIAL AVAILABLE

Flood Fighting Material will be made available at each vulnerable site' camp per detail mentioned in section 7.4 of this document. The same is reproduced here for clarity.

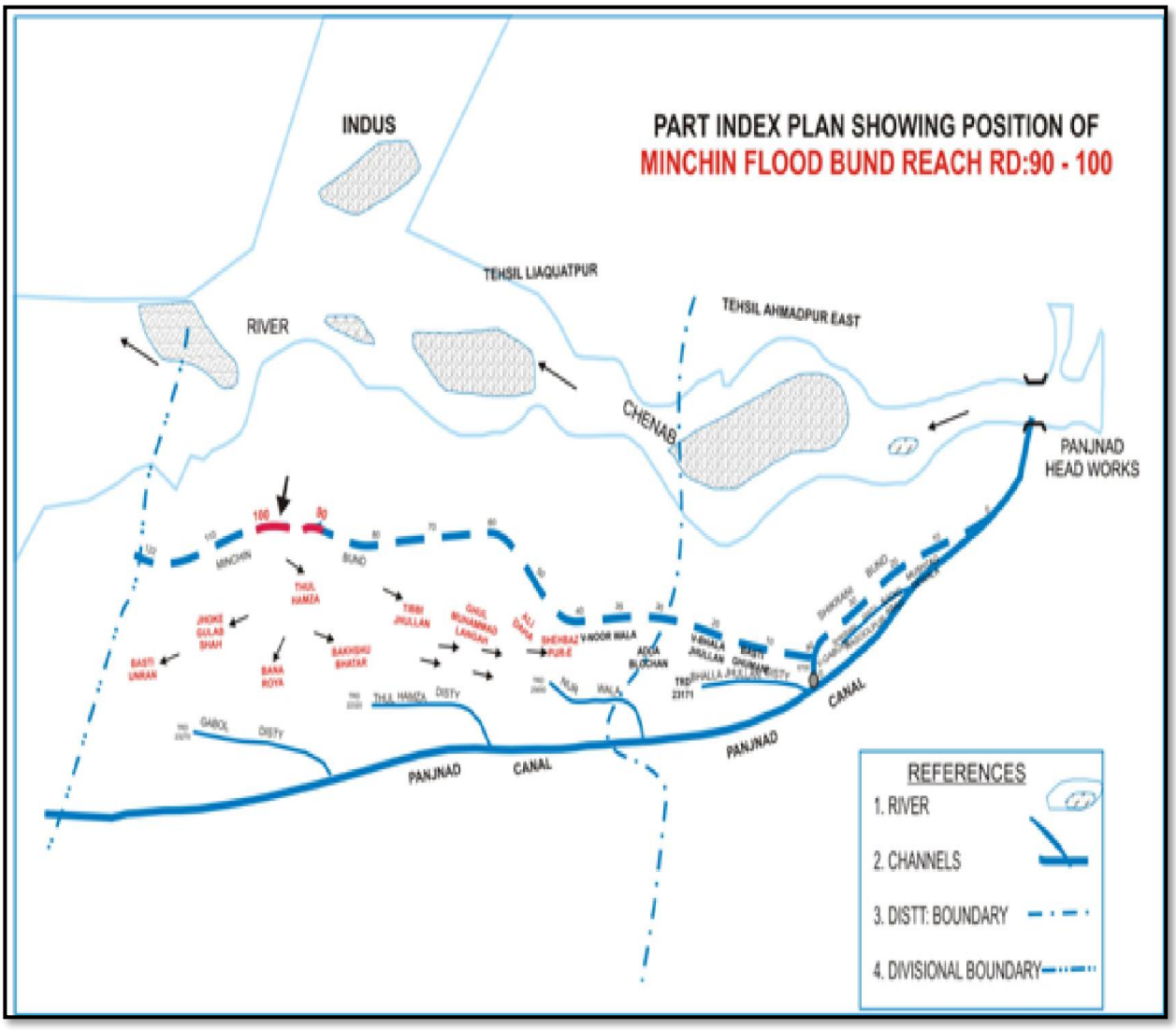
DETAIL OF MINIMUM REQUIREMENT OF FLOOD FIGHTING MATERIAL FOR PERMANENT CAMPS (15 MILES)

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
5.	Shouldari / Tent	No.	1	-	1	Balance quantity of Material will be procured before flood, 2026
6.	Chairs	No.	6	-	6	
3.	Table	No.	1	-	1	
4.	Generator (2-3 KVA)	No.	1	-	1	
5.	Pedestal Fans	No.	1	-	1	
6.	Charpois	No.	2	-	2	
13.	Symbolic Jackets	No.	50	-	50	
14.	Polythin Sheet	Kg	100	-	100	
15.	Bamboos 4'' dia	No.	100	-	100	
10.	Water Coller	No.	1	-	1	
11.	Portable umbrella	No.	2	-	2	
12.	Life Jacket	No.	5	-	5	
15.	Utensils (10 person)	No.	1	-	1	
14.	Jute/Plastic bags	No.	1000	-	1000	
15.	Walke Talkie Set	Set	2	-	2	
16.	Raincoats	No.	10	-	10	
17.	LED flood light	No.	10	-	10	
18.	Extension Cable 10'	No.	2	-	2	
19.	Rechargeable Torches	No.	20	3	17	
20.	Kassi	No.	20	2	18	
21.	Axes	No.	20	-	20	
22.	G.I Buckets	No.	5	-	5	
23.	7/44 Cable	Feet	500	-	500	
24.	Sutli	Kg	2	-	2	
25.	Sewing Needles	No.	10	-	10	
26.	Emergency Medical Kit	No.	1	-	1	
27.	Wire Crates (at only that camp near river action and reserve stock exists)	No.	100	-	100	

VULNERABLE SITE #4

RD: 90-100 MINCHIN FLOOD BUND

13.1 PLAN SHOWING ROUTE OF FLOOD WATER COMING OUT OF THE BREACH SUPPORTED WITH LEVELS.



13.2 DETAIL OF VILLAGES ABADIES LIKELY TO BE AFFECTED:

Detail has been given as,

Detail of Basti/ Village	R.L. S
Noor Wala	327.30
Adda Blochan	325.20
Ali Daha	320.20
Ghul Muhammad Langah	322.20
Tibi Jhulan	319.50
Bakhshu Bhatar	316.40
Thulhamza	317.30 (Hospital & School=1+4=5 Nos)
Bana Roya	317.20
Jhoke Ghulab	311.90
Unran	312.50

13.3 STRATEGY AND ACTION TAKEN:

In case of breach, Administrative Department/ Pak Army will be asked to make evacuation arrangement for public and to cut the roads/ distributaries/ water courses which are making hindrance in flow of flood water through breaches on lower level sites.

13.3.1 ARRANGEMENTS

The vulnerable reach at RD 90–100 of Minchin Flood Bund (MFB) will be accorded top priority and managed with enhanced flood protection measures and continuous surveillance. A dedicated watching establishment will be deployed in line with flood intensity, starting from single-shift monitoring during normal conditions and extending to round-the-clock, multi-shift vigilance during high and exceptionally high floods. One flood protection camp will be established within the reach to ensure immediate response, while additional camps will be activated as the situation escalates. The camp will be positioned to provide direct and effective coverage of the vulnerable stretch.

Flood fighting material will be pre-positioned at the site, and supplementary resources will be mobilized during peak flood conditions to prevent any shortfall. Regular patrolling and inspections will be undertaken to promptly identify seepage, erosion, or any structural weakness. Machinery and transport will remain readily available for emergency strengthening, repair, and evacuation operations. Adequate lighting arrangements, along with standby systems, will be ensured to support uninterrupted night operations. Communication will be maintained through wireless and mobile systems connected to the Flood Control Room, with Dak runners serving as a backup in case of communication failure.

Provision of ration and safe drinking water will be ensured for all staff deployed in continuous shifts, while POL supply will be maintained for all machinery and vehicles under strict monitoring and control. Law and order will be managed in coordination with the local administration to secure the area and regulate movement during emergencies. Medical facilities, including first aid and emergency response services, will be made available for staff as well as the affected population. Close coordination will be maintained with District Administration, Police, and other relevant departments for evacuation, reinforcement, or controlled breaching, ensuring a timely and effective response to any flood-related contingency.

13.3.2 ESTABLISHMENT OF FLOOD FIGHTING CAMPS

STRUCTURE	LENGTH (MILES)	VULNERABLE SITES		NO. OF CAMPS ESTABLISHED EXCEPT VULNERABLE POINTS			TOTAL
				NORMAL / LOW FLOOD	MEDIUM / HIGH FLOOD	VERY HIGH / EXCEP. HIGH FLOOD	
		REACH	NO. OF CAMPS	(15 Miles)	(7 Miles)	(5 Miles)	
Minchin Flood Bund (RD 6+700–122)	23.06	90-100	1	-	2	2	-

13.3.3 DUTIES OF OFFICERS / OFFICIALS AND THEIR CAMP SITES

SR #	LOCATION OF CAMP	CAMP SUPERVISOR	CAMP IN-CHARGE	OVERALL, IN-CHARGE
1	RD. 90-100 LMB	Irfan Mushtaq Sub Engineer Section-III Cell # 0303-9154837	Syed Hassan Abbas Bukhari Sub Divisional Officer Panjnad Headworks Cell # 0300-8595495	Faisal Nadeem Executive Engineer Panjnad Headworks Division Panjnad Cell # 0333-7483658

13.3.4 DEPARTMENTAL MACHINERY AVAILABLE

Upon requisition from the Executive Engineer, Panjnad Headworks Division, the required Departmental Machinery will be entrusted with flood related activities.

13.3.5 MACHINERY AVAILABLE FROM PRIVATE SOURCES

Nearest urban centers for logistical support are Alipur and Uch Sharif. Heavy machinery will be arranged through contractors of the Irrigation Department as and when required, in accordance with Government of Punjab policies and prevailing flood stages. The Agriculture Department will be requested to provide a dozer as stipulated in the District Flood Plan to meet any emergency, and the Deputy Commissioner, Bahawalpur will be approached to direct the District Machinery Pool Officer for timely arrangement of the same.

13.3.6 FLOOD FIGHTING MATERIAL REQUIRED
13.3.7 FLOOD FIGHTING MATERIAL AVAILABLE

Flood Fighting Material will be made available at each vulnerable site' camp per detail mentioned in section 7.4 of this document. The same is reproduced here for clarity.

DETAIL OF MINIMUM REQUIREMENT OF FLOOD FIGHTING MATERIAL FOR PERMANENT CAMPS (15 MILES)

S. No	Item	Unit	Total required Qty	Available Qty	Balance Qty	Remarks.
7.	Shouldari / Tent	No.	1	-	1	Balance quantity of Material will be procured before flood, 2026
8.	Chairs	No.	6	-	6	
3.	Table	No.	1	-	1	
4.	Generator (2-3 KVA)	No.	1	-	1	
5.	Pedestal Fans	No.	1	-	1	
6.	Charpois	No.	2	-	2	
16.	Symbolic Jackets	No.	50	-	50	
17.	Polythin Sheet	Kg	100	-	100	
18.	Bamboos 4'' dia	No.	100	-	100	
10.	Water Coller	No.	1	-	1	
11.	Portable umbrella	No.	2	-	2	
12.	Life Jacket	No.	5	-	5	
16.	Utensils (10 person)	No.	1	-	1	
14.	Jute/Plastic bags	No.	1000	-	1000	
15.	Walke Talkie Set	Set	2	-	2	
16.	Raincoats	No.	10	-	10	
17.	LED flood light	No.	10	-	10	
18.	Extension Cable 10'	No.	2	-	2	
19.	Rechargeable Torches	No.	20	3	17	
20.	Kassi	No.	20	2	18	
21.	Axes	No.	20	-	20	
22.	G.I Buckets	No.	5	-	5	
23.	7/44 Cable	Feet	500	-	500	
24.	Sutli	Kg	2	-	2	
25.	Sewing Needles	No.	10	-	10	
26.	Emergency Medical Kit	No.	1	-	1	
27.	Wire Crates (at only that camp near river action and reserve stock exists)	No.	100	-	100	

CHAPTER 14

ACTION PLAN DURING FLOOD AT PANJNAD HEADWORKS

14.1 RESHIFTING / RECOUPING OF RESERVE STOCK OF STONE DEPARTMENTALLY
14.2 DETAIL OF INLET AND OUTLET CROSSING ALONGWITH THEIR CLOSING METHODOLOGY
14.3 DEPLOYMENT OF MACHINERY (NORMAL TO LOW FLOOD)
14.4 DEPLOYMENT OF MACHINERY (MEDIUM TO HIGH FLOOD)
14.5 DEPLOYMENT OF MACHINERY (VERY HIGH TO EXCEPTIONALLY HIGH FLOOD)
14.6 POLICE DEPLOYMENT PLAN
14.7 DETAIL OF SYNTHETIC BAGS (WITH CAPACITY OF 500 KG AND 1000 KG)
14.8 DETAIL OF POLYTHENE SHEET TO PROTECT UPSTREAM SLOPE AGAINST WAVE ACTION AND TO CONTROL SEEPAGE THROUGH EMBANKMENTS
14.9 RECOMMENDATION FOR OPERATION DURING FLOOD

14.1 RESHIFTING / RECOUPING OF RESERVE STOCK OF STONE DEPARTMENTALLY

Sr #	Name of structure		Quantity in (lac Cft.)			
		Sanctioned Reserve Stock Limit	Minimum Requirements 70% of Reserve stock	Available	Deficient Qty	Remarks
1	RD:0-3000 R.M.B.	0.62	0.434	0.62	-	1. The total available quantity of stone exceeds the minimum required threshold of 70% of the sanctioned quantity.
2	J-Head spur RD:16500 R.M.B.	2.65	1.855	2.65	-	
3	J-Head spur RD:18320 R.M.B.	0.131	0.0917	0.131	-	
4	J-Head spur RD:23500 R.M.B.	1.85	1.295	1.523	0.327	
6	J-Head spur RD:36700 R.M.B.	0.5	0.35	0.5	-	
7	J-Head spur RD:40900 R.M.B.	0.4	0.28	0.4	-	
8	RD:41000, 43000 R.M.B.	0.55	0.385	0.55	-	
9	Sloping spur RD:41500 R.M.B.	0.09	0.063	0.09	-	
10	Stone Stud RD:43000 R.M.B.	0.06	0.042	0.06	-	
11	Stone Stud RD:53600 R.M.B.	0.355	0.2485	0.355	-	
12	RD:53000, 55000 R.M.B.	0.15	0.105	0.15	-	
13	Stone Stud RD:55000 R.M.B.	0.33	0.231	0.33	-	
14	RD:55000, 56000 R.M.B.	0.46	0.322	0.46	-	
15	Stone Stud RD:56000 R.M.B.	0.78	0.546	0.78	-	
16	L.G.B u/s Panjnad Headworks.	1.38	0.966	1.38	-	
17	L.G.B d/s Panjnad Headworks.	0.09	0.063	0.09	-	
18	Junction Groyne u/s Panjnad Headworks.	0.51	0.357	0.51	-	

19	Junction Groyne d/s Panjnad Headworks.	0.19	0.133	0.19	-	2. The stock at junction Grayone is shifted along Abbasia Link & Abbasia Canal at RD 0-1.
20	R.G.B U/S Panjnad Headworks.	1.84	1.288	1.84	-	
21	Stack Yard Nalka Adda + near new regulation colony	7.66	5.362	7.66	-	
22	J-Head spur RD:6+500 L.M.B.	2.74	1.918	2.74	-	
23	Mole Head spur RD:5+500 C.P.B.	0.145	0.1015	0.145	-	
24	Stack Yard Colony Area.	2.65	1.855	2.65	-	
25	RD:37-39 R.M.B.	0.58	0.406	0.58	-	
26	J-Head Spur RD:48-49.	1.5	1.05	1.5	-	
27	J-Head Spur RD: 12+750	1.24	0.868	1.24	-	
	Total	**29.451**	**20.616**	**29.124**	**0.327**	

14.2 DETAIL OF INLET AND OUTLET CROSSING ALONGWITH THEIR CLOSING METHODOLOGY

DETAIL OF INLET & OUTLET STRUCTURES

The Shikrani and Minchin Flood Bunds are intersected by several critical hydraulic structures that manage subsurface and surface water flow, requiring diligent oversight and a clear closure procedure during the flood season.

- **Shikrani Flood Bund:**

This embankment is crossed by **one (01) inlet** of the main seepage drain located between RD 37-38. This inlet allows for the controlled passage of subsurface water (seepage) from the riverside to the country side, preventing a buildup of hydrostatic pressure against the bund.

- **Minchin Flood Bund:**

This longer embankment is penetrated by several more structures:

- ✓ It is crossed by **three (03) inlets** of the main seepage drain at RDs 62-63, 90-91, and 120-121. These function similarly to the inlet on the Shikrani Bund, providing essential pressure relief for the extensive Minchin Bund.
- ✓ Additionally, there are **two (02) outlets** from the Noor Wala Distributary that cross the bund. These are surface water channels that convey irrigation water from the canal system through the flood embankment to the agricultural areas on the other side.

OPERATIONAL PROTOCOL AND CLOSURE METHODOLOGY:

All these inlets and outlets are vital control points that are manually checked by departmental labour during the flood season. The standard procedure for securing them is as follows:

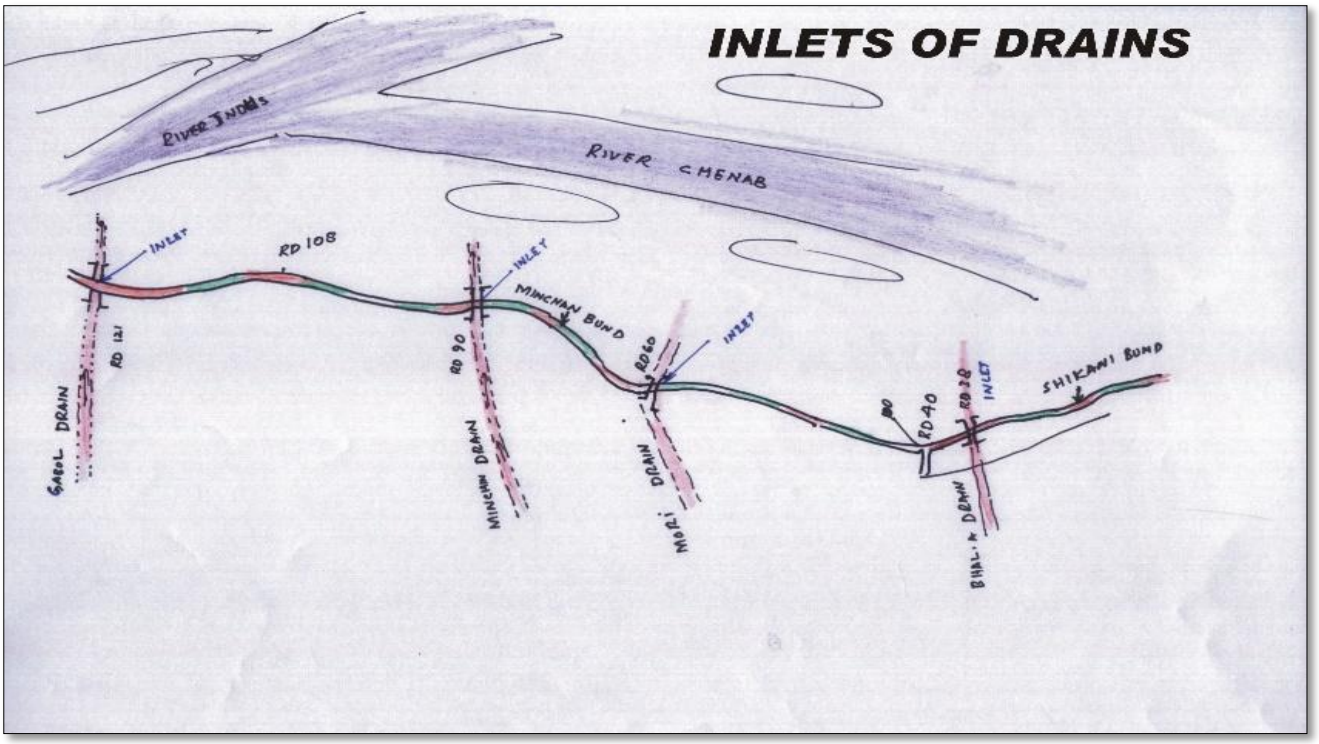
- ✓ **Timing:**

All inlets/outlets will be plugged before flood water reaches them. This proactive measure is critical to prevent floodwaters from back-feeding through the structures and potentially breaching the embankments from the landward side.

- ✓ **Method:**

As per previous practice, the necessary machinery—including excavators and dumpers—is arranged from a Government Contractor. This work is executed under the Operation and Maintenance (O&M) grant allocated for the maintenance and repair of flood bunds.

- ✓ **Action:**
- ✓ Using this machinery, the inlets and outlets are systematically closed with earth fill or other suitable materials to create a temporary, watertight seal integrated with the bund, ensuring its integrity during the flood peak.


INLETS OF DRAINS
RIVER CHENAB
INLET
RD 108
RD 121
GABOL DRAIN
INLET
MINCHAN BUND
RD 90
MINCHAN DRAIN
RD60
INLET
MORI DRAIN
RD40
RD 38
INLET
SHIKARI BUND
BHAL-K DRAIN

14.3 DEPLOYMENT OF MACHINERY (NORMAL TO LOW FLOOD)

DEPLOYMENT OF MACHINERY (NORMAL TO LOW FLOOD)						
Sr. No.	**Structure Name**	**Length (Miles)**	**Excavators**	**Trolleys**	**Dumpers**	**Tractor with Front blade (1 per 15 mile)**
1	**Right Marginal Bund (RMB)**	14	S.E shall allow deputation of one (1) excavator & four (4) Trolleys during low flood at camps/vulnerable points & LMB / RMB.		-	1
2	**Left Marginal Bund (LMB)**	13.8			-	1
3	**Right Guide Bund (RGB)**	0.841			-	-
4	**Left Guide Bund (LGB)**	0.841			-	-
5	**Right Retired Embankment (RRE)**	5.046			-	-
6	**Colony Protection Bund (CPB)**	3.52			-	-
7	**Shikrani Flood Bund (SFB)**	8			-	-
8	**Minchin Flood Bund (MFB)**	23.06			-	1
Total		**64.062**			**-**	**3**

14.4 DEPLOYMENT OF MACHINERY (MEDIUM TO HIGH FLOOD)

DEPLOYMENT OF MACHINERY (MEDIUM TO HIGH FLOOD)						
Sr. No.	**Structure Name**	**Length (Miles)**	**Excavators**	**Trolleys**	**Dumpers**	**Tractor with Front blade**
			1 per 7 mile reach	4 per 7 mile reach	2 per 7 mile reach	1 per 7 mile reach
1	**Right Marginal Bund (RMB)**	14	2	8	4	2
2	**Left Marginal Bund (LMB)**	13.8	3	8	4	2
3	**Right Guide Bund (RGB)**	0.841	0	0	0	0
4	**Left Guide Bund (LGB)**	0.841	0	0	0	0
5	**Right Retired Embankment (RRE)**	5.046	2	8	4	2
6	**Colony Protection Bund (CPB)**	3.52				
7	**Shikrani Flood Bund (SFB)**	8				
8	**Minchin Flood Bund (MFB)**	23.06	3	12	6	3
Total		**64.062**	**10**	**36**	**18**	**9**

14.5 DEPLOYMENT OF MACHINERY (VERY HIGH TO EXCEPTIONALLY HIGH FLOOD)

DEPLOYMENT OF MACHINERY (VERY HIGH TO EXCEPTIONALLY HIGH FLOOD)								
Sr. No.	**Structure Name**	**Length (Miles)**	**Excavators**		**Trolleys**	**Dumper**	**Tractor with Front blade**	
			V.High	Exc. High	4 per 5 mile reach	2 per 5 mile reach	V. High	Exc. High
			1 per 5 mile reach	2 per 5 mile reach			1 per 5 mile reach	2 per 5 mile reach
1	**Right Marginal Bund (RMB)**	14	3	6	11	6	3	6
2	**Left Marginal Bund (LMB)**	13.8	3	6	11	6	3	6
3	**Right Guide Bund (RGB)**	0.841	0	0	0	0	0	0
4	**Left Guide Bund (LGB)**	0.841	0	0	0	0	0	0
5	**Right Retired Embankment (RRE)**	5.046	1	2	4	2	1	2
6	**Colony Protection Bund (CPB)**	3.52	2	4	8	4	2	4
7	**Shikrani Flood Bund (SFB)**	8						
8	**Minchin Flood Bund (MFB)**	23.06	5	9	18	9	5	9
Total		**64.062**	**14**	**27**	**52**	**27**	**14**	**27**

14.6 POLICE DEPLOYMENT PLAN

Sr. No.	Location of Deployment	Concerned Police Station & Tehsil & District	Police Personnel to be Deployed	
			SI/ASI	Constables
1	**Panjnad Headworks**	Alipur Saddar, Alipur, Muzaffargarh	To be decided by the concerned District Police Officer	To be decided by the concerned District Police Officer
2	**Right Marginal Bund (RMB)**	Alipur Saddar, Alipur, Muzaffargarh		
3	**Colony Protection Bund (CPB)**	Alipur Saddar, Alipur, Muzaffargarh		
4	**Left Marginal Bund (LMB)**	Uch Saddar, Ahmedpur East, Bahawalpur		
5	**Shikrani Flood Bund**	Uch Saddar, Ahmedpur East Bahawalpur		
6	**Minchin Flood Bund**			
a)	**RD 0-20**	Uch Saddar, Ahmedpur East Bahawalpur		
b)	**RD 20-30**	Channi Goth, Ahmedpur East Bahawalpur		
c)	**RD 30-122**	Tranda Muhammad Panah, Liaqatpur, Rahim Yar Khan		

14.7 DETAIL OF SYNTHETIC BAGS (WITH CAPACITY OF 500 KG AND 1000 KG)

These bags are used for constructing emergency flood defenses, sealing seepage points, and raising embankment heights. The current stock of large-capacity synthetic bags is critically low against the established requirement. Procurement of shortfall quantity is a must to-do before onset of flood 2026.

BAG CAPACITY	QUANTITY REQUIRED	QUANTITY AVAILABLE	SHORTFALL
1000 Kg	5,000	0	5,000
500 Kg	10,000	0	10,000

14.8 DETAIL OF POLYTHENE SHEET OF BLACK COLOUR TO PROTECT UPSTREAM SLOPE AGAINST WAVE ACTION AND TO CONTROL SEEPAGE THROUGH EMBANKMENTS

Objective

The objective is to protect the river-side slopes of the embankments from erosion caused by wave action and to control seepage through the body of the bund, thereby ensuring structural integrity during a flood event.

Primary Applications

The primary application is the deployment of polythene sheets as an impermeable barrier along vulnerable bund length. This involves covering the slope from toe of bund/embankment to its top level and anchoring it securely to prevent displacement, effectively shielding the soil from water scour and mitigating seepage pathways.

Material Type

The specified material is black polythene sheet (polyethylene). The black color is critical for its enhanced resistance to ultraviolet (UV) degradation, ensuring greater durability when exposed to sunlight before and during deployment.

Quantity Required

The total quantity required is 8,24,000 square feet (Sft). This amount has been calculated to provide complete coverage for the identified 20,000-foot length of bund, including sufficient material for proper anchoring in trenches at the top and bottom of the slopes.

Procurement before onset of flood 2026

The entire required quantity of 824,000 Sft of black polythene sheet must be procured and pre-positioned at strategic locations along the bund well before the onset of the 2026 flood season to ensure immediate availability for emergency response.

14.9 RECOMMENDATIONS FOR OPERATION DURING FLOOD

Recommendations for Operation During Flood

i. The Superintending Engineer (SE) will notify all vulnerable points on the recommendations of Executive Engineer (XEN) and if the vulnerable site falls within 15 miles of embankment, then camp will be established at vulnerable site.

ii. Superintending Engineer shall allow deputation of one (1) excavator and four (4) Trolleys during low flood at Camps/ vulnerable points and LMB/RMB.

iii. The Superintending Engineer (SE) shall approve one additional shift during low to high flood based on necessity of site but he shall clearly mention the reach where additional shift is allowed.

iv. For emergent situation when very high flood levels are attained at lower flood discharges, additional camps may also be established with the approval of Superintending Engineer.

v. The concerned division shall procure flood fighting material as per requirement of seasonal flood fighting camps.

vi. Jackets with official emblem of the PID should be purchased by the concerned Division, to be used during the worst-case scenario, i.e., for exceptionally high flood.

vii. All others camps and supplies along with establishment i.e. Beldars and mates shall be outsourced before the flood season for operational efficiency during the flood fighting activities.

viii. The above mentioned yard stick of human resource is inclusive of 100% of regular flood establishment of the division at normal and low flood and for medium and above flood situation 50% of total regular establishment of the division and backup division in Flood Fighting Plan.

ix. The **Trigger Point** upstream of a Canal Division for commencing preparations shall be mentioned in the flood fighting plan and it shall be such point upstream with lag time of 3 days / 72 hours. The division shall initiate preparation corresponding to discharge magnitude expected to receive at their jurisdiction with respect to discharge at trigger point with 2025 flood data.

6

SE MBN

x. Superintending Engineers shall approve additional resources above the approved FFP on the recommendations of Executive Engineer based on site necessity with copy to TPM and respective Chief Engineer but must mentioned the reach and justify the reason for additional resources in approval.

xi. Executive Engineers (XEN) shall decide the location and relocation of flood camps.

xii. The machinery mentioned above should be hired to remain standby for 24/7 to fight any extreme situation. The working of deployed machinery during normal situation shall be with prior approval of Superintending Engineer.

xiii. Communication means must be arranged through the Government. It is recommended to allocate a unique frequency for irrigation department.

xiv. In the event that water levels reach the 'High Flood' threshold even if the recorded discharge remains below established benchmarks, all field preparations and personnel deployments must immediately escalate to Critical Level protocols.

(Abdul Qayyum Qadume)
Member / SE, Mailsi Canal Circle, Multan

(Zeeshan Ali)
Member/ SE, Project Circle DG Khan

(Mohib Ullah Ali)
Member / SE, Sukhrawa Canal Circle, Sahiwal

(Imtiaz Hussain)
Member / SE, Bahawalpur Canal Circle

(Sammar Iqbal)
Member / SE, LCC(West) Canal Circle, Faisalabad

(Hafiz Ijaz Ahmed)
Member / SE, Mandi Bahauddin Canal Circle

(Mudassar Rehan)
Member / SE Link Circle, Lahore

(Khurram Amin)
Convener / Chief Engineer, Drainage & Flood Zone, Lahore.

CHAPTER 15
BACKUP DIVISIONS AT PANJNAD HEADWORKS DURING FLOOD 2026

ARRANGEMENT OF BACKUP DIVISION DURING FLOOD

To effectively manage the massive scale of flood defense operations and prevent the over-strain of the Panjnad Headworks Division, a formal institutional support mechanism is established. This framework designates specific Backup Divisions and outlines a clear protocol for their integration, ensuring a seamless and reinforced response during high-stress flood conditions.

A) DESIGNATED BACKUP DIVISIONS & THEIR SECTORS:

The following divisions are pre-identified under the authority of the Chief Engineer, Bahawalpur Irrigation Zone, to provide immediate support:

SR. NO.	BACKUP DIVISION	ASSIGNED SECTOR
1.	**Abbasia Link Canal Division**	Left Marginal Bund (LMB) and Left Guide Bund (LGB).
2.	**Panjnad Canal Division**	Right Marginal Bund (RMB) and Right Guide Bund (RGB).
3.	**Tubewell Operation Division (TOD), Khanpur**	Shikrani Flood Bund and Minchin Flood Bund.

B) ACTIVATION PROTOCOL & TRIGGERS:

- **Activation Authority:**

Chief Engineer, Bahawalpur Zone, on the recommendation of the Superintending Engineer, Panjnad Canal Circle.

- **Activation Trigger:**

Formal activation is mandated upon the declaration of Phase-III (High Flood) or higher, or when the flood situation necessitates reinforcement as deemed by the Executive Engineer, Panjnad Headworks Division.

- **Notice Period:**

Designated staff from backup divisions must be ready to deploy to Panjnad Headworks with 24 hours' notice.

- The following segregation of supervisory deployment will be followed upon activation:

✓ **Executive Engineer Level:** One Executive Engineer from the concerned backup division will be deployed to supervise Sub-Divisional Officers (SDOs) and Sub Engineers on the sector/embankment assigned to his division.

✓ **Sub-Divisional Officer (SDO) Level:** Each SDO shall supervise a team of Sub-Engineers based on the following criteria:

a) 01 Sub-Engineer for every 10 RDs (Reduced Distance) at maximum of an embankment.

b) The 14 allied structures on the RMB, 01 on LMB, and 06 on CP Bund are to be supervised by the Sub-Engineer (SEN) whose assigned 10-RD beat includes the structure's location.

c) Chief Engineer, Irrrigation Zone, Bahawalpur holds the authority to modify this backup division plan, including the reassignment of embankments, or any part thereof, as deemed necessary by the flood situation.

d) The Chief Engineer, Irrigation Zone, Bahawalpur is ultimate authority to requisition and deploy any additional SDOs and Sub-Engineers required from any division within the zone to supplement the designated backup divisions.

Sr.#	Embankment / Structure	Backup Division	Total Length / RDs	Sub-Engineers Required (1 Per 10 RDs)	No. Of SDOs (1 Per 3-4 SENs)	Total Supervisory Staff
1.	Left Marginal Bund (LMB)	**Abbasia Link Canal Division Liaqatpur**	RD 0 - 68	7	3	10
2.	Left Guide Bund (LGB)		RD 0 - 4+205	1	1	2
3	Colony Protection Bund (CPB)		RD 0 - 17+600	2	1	3
	Division Subtotal		**RDs: 89+687**	**10**	**5**	**15**
4	Right Marginal Bund (RMB)	**Panjnad Canal Division Panjnad**	RD 0 - 70	7	3	10
5	Right Guide Bund (RGB)		RD 0 - 4+205	1	1	2
	Division Subtotal		**RDs: 74+087**	**8**	**4**	**12**
6	Shikrani Flood Bund	**Tube well Operation Division (TOD) Khanpur**	RD 0 - 40	4	1	5
7	Minchin Flood Bund		RD 6+700 - 122+000	12	3	15
	Division Subtotal		**RDs: 155+300**	**16**	**4**	**20**
GRAND TOTAL			**RDs: 319+074 (97.25 Kms)**	**34**	**13**	**47**

C) ROLES AND RESPONSIBILITIES OF BACKUP DIVISIONS:

Upon activation, the backup divisions will assume the following critical roles:

- **Reinforcement of Supervisory Staff:**

✓ Deploy teams of Sub Divisional Officers (SDOs) and Sub-Engineers to take command of pre-allocated embankments and flood camps, working under the overall operational command of the Executive Engineer, Panjnad Headworks Division.

- **Technical Assistance and Specialized Expertise:**

✓ Provide additional technical manpower for critical tasks such as structural integrity inspections, seepage detection and control, and supervision of ongoing emergency works including stone pitching and apron recouping operations.

✓ All personnel assigned to embankments are required to transmit water level readings from every mile gauge to the main Control Room on an hourly basis.

- **Logistical and Resource Support:**

✓ Assist in the management and distribution of flood-fighting materials within their assigned sectors.

✓ Provide supplementary communication and transportation assets (Official Vehicles & machinery etc) to enhance mobility and coordination along the lengthy embankments.

- **Continuity of Operations:**

✓ Ensure that 24/7 patrolling, vigilance, and emergency response capabilities are maintained without degradation, even as the core Panjnad Headworks Division staff focus on the most critical emergencies at the barrage itself.

D) COORDINATION MECHANISM:

- A liaison officer from each backup division will coordinate with the Panjnad Headworks Division Control Room for seamless communication.
- Joint briefing sessions will be conducted between Panjnad Headworks and backup division officers at the time of handover to ensure complete situational awareness and a unified command structure.

This pre-planned, institutionalized support system transforms the flood response from a single-division effort into a consolidated zone-wide operation, significantly enhancing the resilience and management capacity of the entire Panjnad defense network.