IRRIGATION SECTOR

Faisalabad Regional Development Plan
MAIN REPORT

The Urban Unit

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1. Introduction to Irrigation

Water is termed as the building block of life. It is evident from history that mankind has always strived to tame this valuable resource for effective and equitable use. The earliest reference to the use of irrigation can be traced back to the Holocene Epoch, approximately 10,000 years ago with pitcher water being used for agriculture.

However, it wasn't until the 2000 B.C.E, that the Egyptian civilization successfully controlled the flow of water through constructed structures, directing the water from Nile for controlled irrigation of crops across the Nile Delta. The canals and irrigation channels in the Nile Delta is considered a major endeavor for the Egyptian pharaohs.

Figure 1: A frieze depicting ancient Egyptians using water of Nile for irrigation of crops

A similar irrigation mechanism was being developed and practiced by the Indus Valley civilization, which flourished in the present day Pakistan approximately 2000 B.C.E. The ancient Indus civilization practiced irrigation for agriculture, even developing storage reservoirs (at Girnar 3000 B.C.E) to control and direct the water from River Indus. Traces and remnants of these ancient irrigation marvels still exist today at the Mohenjo Daro archeological site.

1.1. Indus Basin Irrigation System

Today, Pakistan is home to the world's largest continuous irrigation system commonly called the Indus Basin Irrigation System. Starting from the glaciers of North Pakistan, the flow eventually reaches the Arabian Sea via a vast network of rivers, tributaries, irrigation channels and structures. The system comprises of four components; including the storage and diversion works, irrigation conveyance system, distribution system and the drainage system. Together these make up one of the most engineered irrigation and water conveyance system of the world. The details of the components building the Indus Basin Irrigation System are tabulated below:

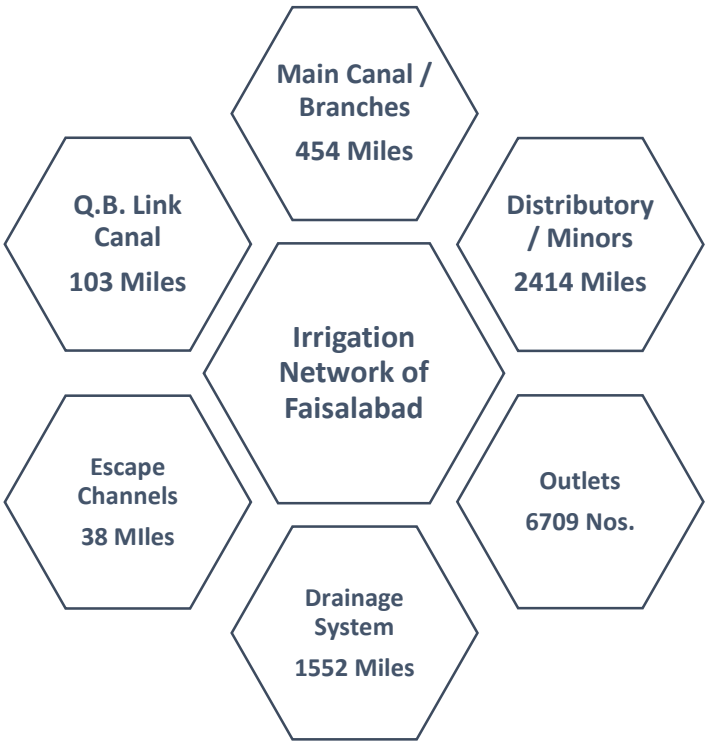
Table 1: Components of Indus Basin Irrigation System

Sr.	Component / Item	Quantity
1	Storage Reservoirs	3 Nos. Live Capacity of 15.7 MAF
2	Barrages, Head works, Syphons	23 Nos.
3	Main Irrigation Canals	45 Nos. Total Length (approx..) of 60,800 km
4	Water Courses	107,000 Nos. Total Length (approx.) of 1,600,000 km

1.2. Irrigation Network of Faisalabad Zone

The irrigation system of Punjab has been divided into a number of administrative zones. Faisalabad Division falls under the Faisalabad zone which is further divided in four circles; Lower Chenab Canal East Circle, Lower Chenab Canal West Circle, Qadirabad Balloki Link Circle and the Drainage Circle Faisalabad. These irrigation circles combine to form the administrative limits of the irrigation system of Faisalabad Division, with a Gross Command Area of 3,762,000 Acres and a Cultivable Command Area of 3,031,000 Acres.

Faisalabad region is surrounded by the two main rivers of Punjab; Chenab River towards the north and Ravi River towards the south. The entire district lies in the Rechna Doab (the area between Ravi River and Chenab). The Rechna irrigation system comprises of Upper Chenab Canal (UCC), Lower Chenab Canal (LCC), Marala-Ravi Link canal, Bomban–Wala Ravi Badian Depalpur (BRBD) Canal, and Trimmu-Sidhnai Link canal. The irrigation system is designed for an irrigation intensity of 50-75% whereas the actual figures indicate excess of 130%.



1.2.1. Canal System of Faisalabad Division

The major canal system of the Faisalabad Division comprises of the Lower Chenab Canal and its associated administrative circle. The Lower Chenab Canal (LCC) Circle originates from the Khanki Head works located in Gujranwala district on River Chenab. The Lower Chenab Canal is irrigating an approximate 3,031,000 acres of Cultivable Command Area (CCA) through a network of branches, distributaries and minors. The Lower Chenab Canal and its associated Branch canal network comprises of the following channels.

Table 2: Canal system of Lower Chenab Canal

Main Canal	LCC East System	LCC West System
Lower Chenab Canal	Upper Gugera Branch Canal	Rakh Branch Canal
	Lower Gugera Branch Canal	Jhang Branch Upper Canal
	Burala Branch Canal	Jhang Branch Lower Canal
	Main Ali Branch Canal	Bhowana Branch Canal

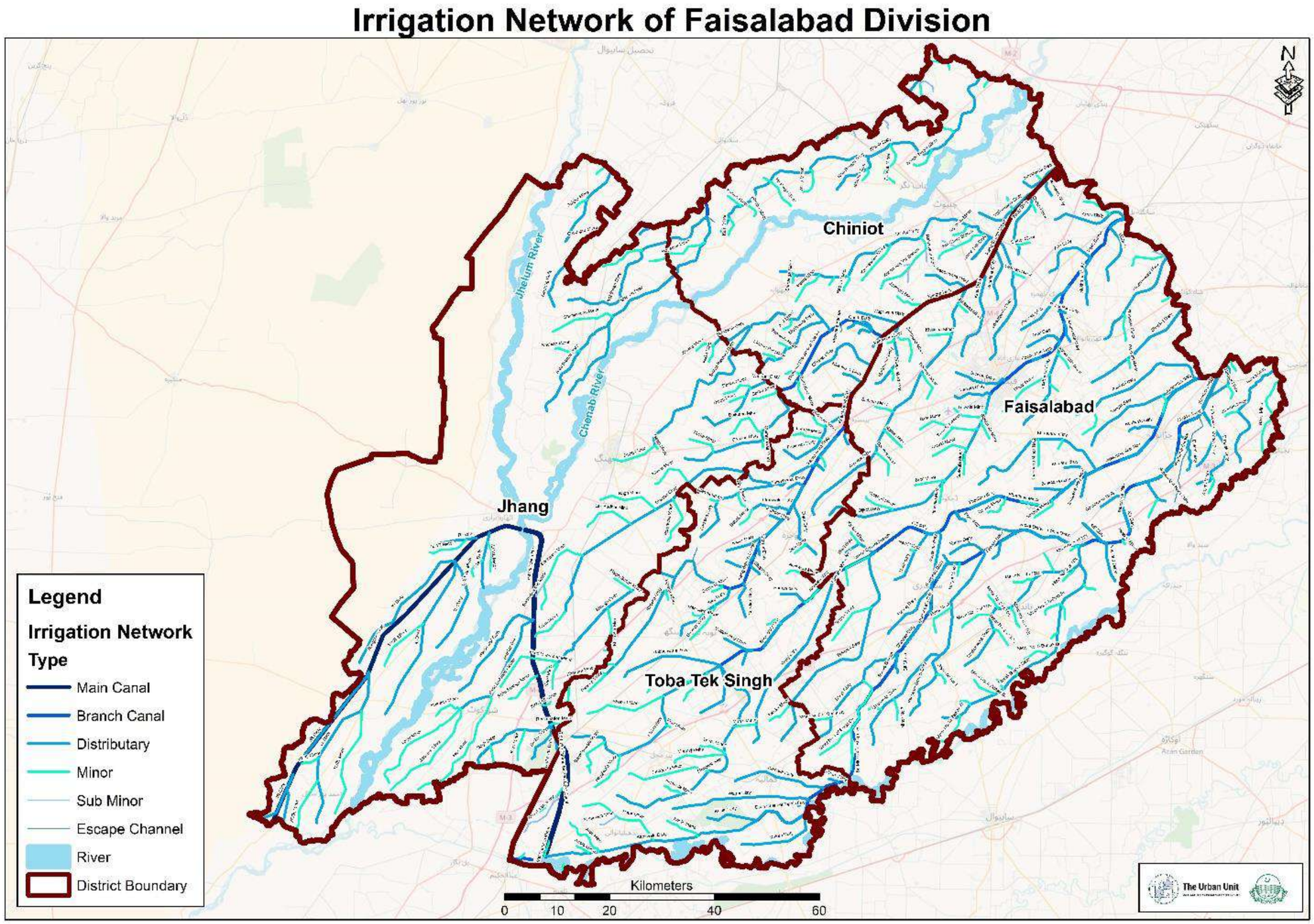
1.2.2. Drainage System of Faisalabad Division

Drainage system is one of the most important and often neglected component of the irrigation system. Faisalabad division comprises of 3 major drainage systems, corresponding to the divisions of Qadirabad Barrage, Faisalabad Drainage and the Samundari Drainage; with a total length of drains adding up to 1552 miles. The details of these drainage systems are tabulated below.

Table 3: Detail of drainage system of Faisalabad Division

Sr.	Division	District	Drainage System	Length
1	Qadirabad Barrage	Gujranwala / Hafizabad	Rasul Nagar Drainage System	39.92
2	Faisalabad Drainage	SKP / NKB / FSD	Jaranwala Main Drainage System	250.83
		HFZ / FSD	Marh Chiniot Drainage System	87.45
		Hafazibad	Ahmad Pur Vagh Drainage System	73.65
		Hafazibad	Ahmad Pur Kot Nikka Drainage System	50.02
		Hafazibad	Mar Salar Drainage System	85.51
			Deg Nallah Drainage System	150.04
		NKB / FSD	Independent Drains System	25
3	Samundari Drainage	Hafizabad	AKN Drainage System	57.28
		Jhang	Marh Chiniot Drainage System	34.74
		FSD / Jhang	Chak Bandi Drainage System	143.3
		FSD / T.T.S	Samundri Main Drainage System	275.52
		T.T.S.	Gojra Khewra Drainage System	159.34
		FSD / T.T.S / Jhang	Khairwala Drainage System	110.34
			Independent Drains System	9.35
Total Length				1552.29

The figure below shows the complete irrigation network profile of Faisalabad Division.



2. Scope of the Study & Methodology

This section refers to the project area under consideration, scope of the study, adopted methodology and brief of the field visits for data collection.

2.1. Area of Concern

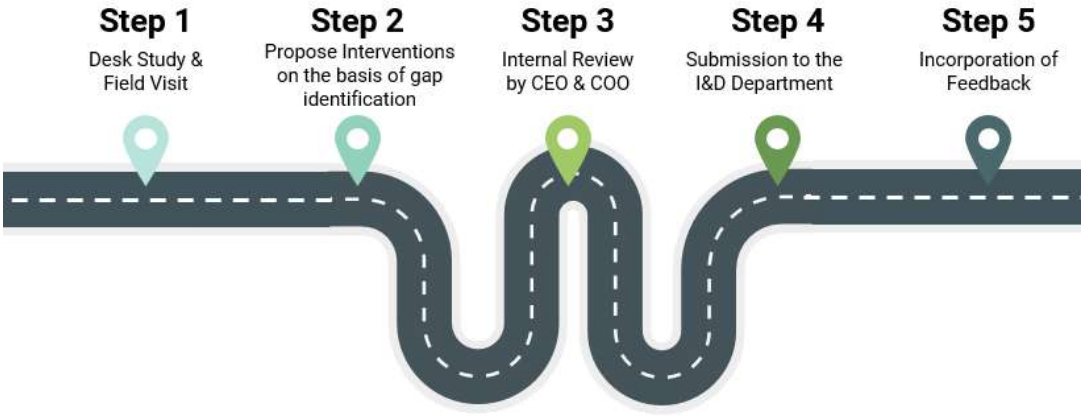
The area of concern under the project 'Regional Development Plan of Faisalabad' comprises of the whole Faisalabad Division, including the four major districts of Faisalabad, Toba Tek Singh, Jhang and Chiniot along with their subsequent tehsils. The irrigation network including all structures and appurtenances falling in the jurisdiction of Faisalabad Division is considered in case of this study.

2.2. Scope of Study

The scope of this study follows a tri-fold approach, encompassing three key domains that contribute toward the ultimate output of the report. The aforementioned features are as follows:

- Rehabilitation of the existing irrigation infrastructure, to preserve and prolong the life of existing structures and appurtenances
- Update monitoring practices and real-time updates mechanism through incorporation of SCADA based Telemetry systems
- Focus on nature based solutions for sustainability and incorporation of green initiatives as per international best practices

2.3. Methodology



2.4. Field Visits

Field visits to assess the condition of irrigation infrastructure and its related facilities was conducted from 22nd to 25th of November 2022, followed by a second visit from 12th to 16th of December 2022. The Water Resources Team of the Urban Unit assessed the condition of surface and drainage infrastructure in the Faisalabad Region.

3. Existing Situation

The Water Resources Team conducted detailed visit of the Faisalabad Division during the months of November and December, to assess the condition of the irrigation infrastructure and its associated facilities. Stakeholder meetings were also conducted with the Irrigation Department of Punjab, for discussion and to effectively capture insights of the stakeholders.

Figure 2: Team Urban Unit during field visit of Faisalabad Irrigation Zone

3.1. Major Issues Identified

Key issues pertaining to the three domains of the irrigation system were identified by the team during the visits, including issues related to water distribution and irrigation infrastructure, issues related to the capacity of the field staff and issues related to the civil infrastructure of the irrigation department. Some major issues identified have been tabulated below.

Table 4: Major issues identified during field visit

Issues pertaining to the Irrigation & Water Distribution Infrastructure	Issues pertaining to the Capacity of Field Staff of the Irrigation Department
Throwing of solid waste and debris in surface drain and canal	Severe shortage of field technical staff (Baildar)
Silting and deteriorated canal sections and banks	Requirement of conveyance for field staff for survey and surveillance
Outdated design of outlets and use of mechanical control gates	Less travel allowance for field staff
Issues related to water allowance specially in the tail section of the canals	Less protection of field staff from offenders
Outdated gauge reading mechanism, conventional practices	Unsafe night visits of field staff
Un-kept and deteriorating irrigation structures and pedestrian crossings	Dire improvement needs to enhance morale of field staff

Weeds and vegetal growth on the embankments of canals and drains	Lack of HSE gadgets, life jackets, boats, first aid box, snake bite treatments for field staff
Losses due to evaporation and higher irrigation intensity	Less budget and lack of political and community support
Lack of machinery and resources for effective rehabilitation of the system	Less cooperation form Police & some-where lack of coordination

3.2. Condition of Irrigation Infrastructure

The section below indicates the actual on-site condition of different hydraulic structures as identified during the field visit.

3.2.1. Condition of Canals and Drainage System

It was observed during the visit that lining of canals was a major issue for the irrigation system, and major work has been undertaken by the Irrigation department to address this issue. Unlined canals were adding additional losses and made the conveyance of water ineffective. Large reaches of canal were unlined and required proper lining to increase the conveyance efficiency of water. Berms of canals were also damaged due to lack of care and excessive flow or due to passage of animals into canals.

Drainage network of Faisalabad division requires intense care due to unrestrained flow of industrial effluents that are contaminating the groundwater and agricultural lands. Unlined channels are conveying waste water from the main drains and finally dumping this water into river which is against the internationally adopted environmental practices. Exploration of nature based green solutions is the need of the hour, to filter the water and to control the movement of hazardous waste through these long reaches, as per international green practices.

Figure 3: Current situation of the Sangla Branch Drainage System

3.2.2. Condition of Cross & Head Regulators

The vast distribution infrastructure including a number of outlets was damaged due to lack of routine maintenance. Erosion was evident due to damaged structure around the outlets, and the dismantling of structure was worsening the condition. Devastating impacts can be predicted due to ineffective distribution of water through these outlets. Mechanical infrastructure of most gates was found eroded and outdated due to lack of care.

Civil structure of many head regulators was found dismantled and required immediate repairs to avoid erosion and overflows. Metallic parts and mechanical machinery was also eroded due to lack of routine maintenance on some head/cross regulators.

Figure 4: Condition of gates of cross and head regulators

3.2.3. Condition of Canal Falls

A canal fall was observed during the visit of irrigation infrastructure of Chiniot. It was observed that the foundation of adjoining bridge was completely destroyed due to erosion of soil and seepage of water through cracks. Unrestrained flow of water was damaging nearby agricultural lands. Inspection Huts were also visited by team to assess the standard of facilities. Condition of these huts was satisfactory however routine maintenance was required on many sites.

Figure 5: Condition of Canal Fall in Chiniot District

3.2.4. Condition of Buildings and Civil Facilities

Rest houses and employees housing societies of Irrigation Department were also visited during the survey to assess the civil infrastructure and associated facilities of the department. It was observed that the rest house in Jhang was completely deteriorated and required reconstruction as per new design. There was no boundary wall and gate for security. All connections of municipal facilities like gas and electricity were disconnected by the relative department. There were severe structural cracks in the building. A similar situation was observed in the offices of irrigation department in Jhang. These facilities required maintenance and repair make them safer for the employees.

Figure 6: Condition of rest house and office of irrigation department

3.2.5. Condition of Aqueducts

A number of Aqueducts were observed during the visit of irrigation infrastructure of Faisalabad. It was observed that the foundation of adjoining bridge was completely destroyed due to erosion of soil and seepage of water through cracks.

Figure 7: Condition of Aqueducts in Faisalabad

It is evident from the site visit and attached pictures that the condition of all of these structures is compromised in one aspect of another. Immediate interventions are needed to maintain and restore these structural elements, whether hydraulic, mechanical and civil, to workable state.

4. Interventions for Irrigation System

This section of the report refers to the proposed interventions to rehabilitate and update the existing infrastructure, as per the scope of the report.

4.1. Rehabilitation of Existing Infrastructure

It is evident from the previous section of the report that the condition of majority of the infrastructure is in deteriorating condition and needs critical rehabilitation measures. Rehabilitation of infrastructure involves undertaking measures (repairs, re-design etc.) for restoration of the condition of deteriorating elements and appurtenances. Intervention pertaining to rehabilitation have been proposed keeping in view the relevant condition of the structure as well as the international best practices, with the aim to prolong the life of the existing structures and appurtenances.

4.1.1. Rehabilitation of Canal Falls

Canal fall is a solid masonry structure which is constructed on the canal if the natural ground slope is steeper than the designed channel bed slope. If the difference in slope is smaller, a single fall can be constructed. If it is of higher then falls are constructed at regular suitable intervals. The most common type of Canal Fall is the English Type, different components of which are represented by the concept drawing below.

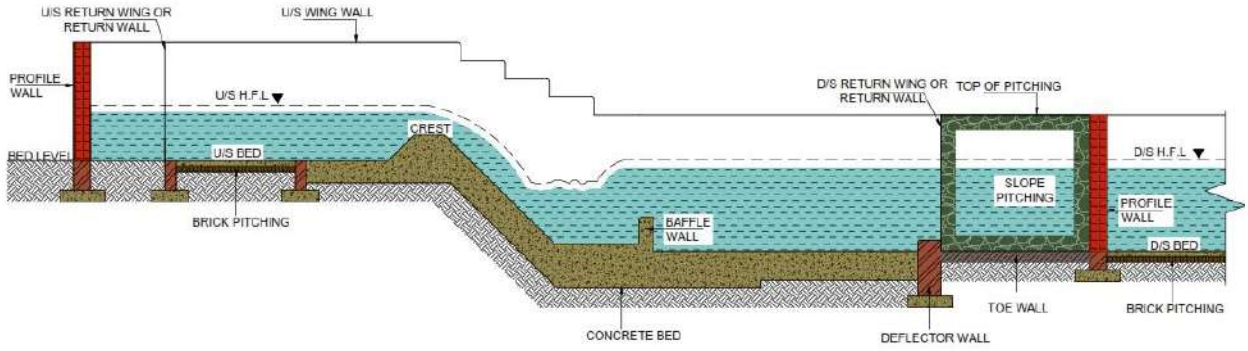


Figure 8: Conceptual Plan of Canal Falls

A straight glacis fall is extended as baffle platform with a baffle wall. This English type Canal Fall is suitable for any discharge value. The baffle wall is constructed near the toe of the straight glacis at required distance in designed height. The main purpose of the baffle wall is to create hydraulic jump from straight glacis to baffle platform.

The Canal Fall as observed in Chiniot during the field visit was found to be in deteriorating condition with multiple components of the structure in failing state. The improvement needs along with the scope for the project and the abstract of cost is shown in the table below.

Table 5: Interventions for Canal Falls

Improvement Needs	Improvement Mechanism	Estimated Cost (PKR)
❖ Removal of damaged structure ❖ Stabilization of soil ❖ Installation of New pile ❖ Provision of slope	❖ Excavation for removal of damaged structure ❖ Compaction of soil for stabilization ❖ Design and installation of new piles ❖ Concrete slab for proper slope as per design	55.61 Million/-

4.1.2. Rehabilitation of Head & Cross Regulators

The existing condition of head regulators and their associated components like gates and valves were assessed during the field visit, and almost all of these were found to be in deteriorating condition. These head regulators have both mechanical gates for control of flow and level of water, downstream to the site. The improvement needs for 226 head regulators along with the scope for the project and the abstract of cost is shown in the table below.

Table 6: Interventions for Head Regulators & Gates

Improvement Needs	Improvement Mechanism	Cost (PKR)
❖ Deteriorated supporting bricks structure ❖ Deteriorated plaster ❖ Corroded metallic parts ❖ Paint blistering on metal portion ❖ Corroded chequered plates	❖ Thorough repair & maintenance ❖ Re-plastering of surface and edges C:S (1:4) ❖ Pointing as required ❖ Removal of the affected portion ❖ Re-painting of required parts ❖ Provision of new chequered plates	440 Million/- (226 Nos.)

4.1.3. Rehabilitation of Aqueducts

The existing condition of Aqueducts and their associated components like walls and syphon were assessed during the field visit, and almost all of these were found to be in deteriorating condition. The improvement needs for 73 Aqueducts along with the scope for the project and the abstract of cost is shown in the table below.

Table 7: Interventions for Aqueducts

Improvement Needs	Improvement Mechanism	Cost (PKR)
❖ Wax & other floating material ❖ Civil slabs are spalling ❖ Damaged segments and sections ❖ Plastering is deteriorated	❖ Timely cleaning is required ❖ Removal of the affected portion & maintenance ❖ Re-painting as required ❖ Re plastering C:S 1:4 as required	191 Million/- (73 Nos.)

4.1.4. Rehabilitation of Rest House of Irrigation Department (Jhang)

Team Urban Unit visited the Rest House of Irrigation Department in Jhang for its assessment and found it to be in deteriorating condition. The structure was old and needed immediate interventions for its rehabilitation and restoration.

The improvement needs along with the scope for the project and the abstract of cost is shown in the table below.

Table 8: Interventions for Canal Rest House Jhang

Improvement Needs	Improvement Mechanism	Estimated Cost (PKR)
❖ Dismantling of deteriorated Structure ❖ Construction of New Rest House ❖ Construction of Boundary Wall ❖ Provision of Main Gate for security ❖ Allocation of staff for security and maintenances ❖ Restoration of Electricity and Gas Connections ❖ Installation of Name Plate on two to three points	❖ Dismantling of old structure ❖ Utilization of remains of old structure for the rehabilitation of boundary wall ❖ Provision of gated structure for proper security ❖ Design of New building as Pakistan Building Code or ACI Standards ❖ Construction of Building (with proper quality check) ❖ Provision of all required sanitary and electrical connections ❖ Provision of furniture and other related needful items	32 Million/-

4.1.5. Rehabilitation of Irrigation Department Office Building

Team Urban Unit also visited the Office Building of the Irrigation Department in Jhang for its assessment and found it to be in deteriorating condition, needing immediate interventions for its rehabilitation and restoration.

The improvement needs along with the scope for the project and the abstract of cost is shown in the table below.

Table 9: Interventions for Office Building of Irrigation Department

Improvement Needs	Improvement Mechanism	Estimated Cost (PKR)
❖ Dismantling of deteriorated Structure ❖ Dismantling of deteriorated windows and doors ❖ Repair and Maintenance of old structure as per the design standards ❖ Provision of New Furniture for staff ❖ Provision of New Record Room with furniture ❖ Provision of a Library	❖ Dismantling of old structure ❖ Maintenances of damaged parts of the Building ❖ Construction of Building (with proper quality check) ❖ Provision of all required sanitary and electrical connections ❖ Provision of furniture and other related needful items	4.5 Million/-

4.1.6. Cost for Rehabilitation Projects and Interventions

Table 10: Cost for Rehabilitation Projects and Interventions

Sr.	Schemes	Rough Cost
1	Complete Rehabilitation of District Jhang Rest House	32 Million PKR
2	Repairing of Head & Cross Regulators (226 Nos.)	440 Million PKR
3	Repairing of Aqueducts (73 Nos.)	191.07 Million PKR
4	Complete Repairing of Office Building of Irrigation Department	4.5 Million PKR
5	Reconstruction of Damaged Canal Fall	55.6 Million PKR
Total Cost (M) PKR		**723.17 Million PKR**

4.2. Incorporation of Nature Based Solutions for Sustainability

Incorporation of nature based solutions are proposed as a viable nature based solution for the treatment of waste water in the drainage system of Faisalabad. Reliance on green solutions and plant-based initiatives have been recently explored worldwide with clear results in the form of reduction of toxicity and improvement of both water quality parameters (D.O., B.O.D etc.) and the biodiversity associated with the ecosystem. Hence, constructed wetlands approach has been proposed as an innovative green solution, with pilot projects identified on selected drainage reaches in Faisalabad division as per the international best practices.

4.2.1. Constructed Wetlands

A constructed wetland is a nature based solution, which is essentially an excavation filled with an organic or inorganic particulate media into which reeds are planted. They are generally lined with a rubber (butyl) or plastic (HDPE) material to contain the contaminated water and thus protect ground water and adjacent subsoil. Effluent may be delivered into the system as a continuous flow or in controlled batches. The effluent may move either horizontally across or vertically up or down, through the media depending on treatment requirements. Microbial degradation, or processing, of contaminants is the principle means of treatment and is undertaken by bacterial communities which grow as biofilms on the surface of the particulate media.

4.2.1.1. Treatment Principle

Constructed wetland treatment systems offer many different mechanisms of treatment ranging from physical, biological, biochemical and chemical processes and a variety of these mechanisms may be active in any one bed. The most common method of treatment is the biological treatment by the use of plants. Plants accompanied by bacterium (or other microorganisms) are used to de-toxify the waste water through natural processes of phytoremediation.

4.2.1.2. Conceptual Design of the Constructed Wetlands

As constructed wetlands are treatment systems that use natural processes involving wetland vegetation, soils, and their associated microbial assemblages to improve water quality, the concept plan involves components like reed beds, introduction of eco-friendly plant species for water purification, and lining of the drain reach. A sample concept plan along with raised bed planters are shown in the figures below.

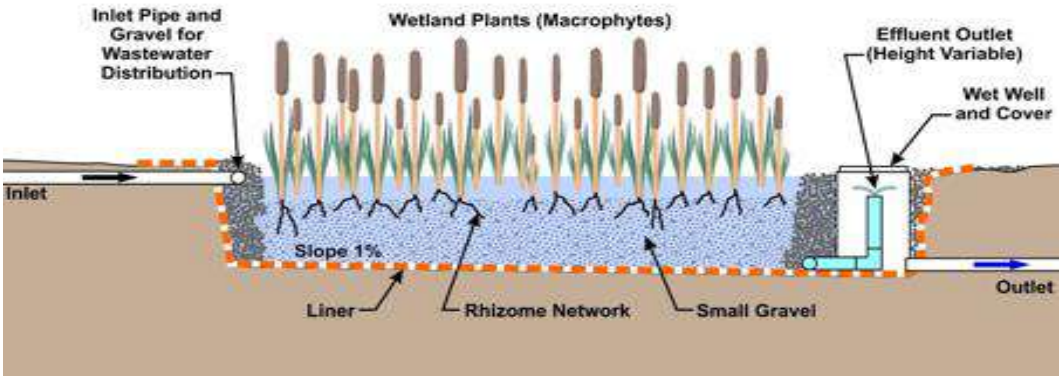


Figure 9: Concept design of a Constructed Wetland

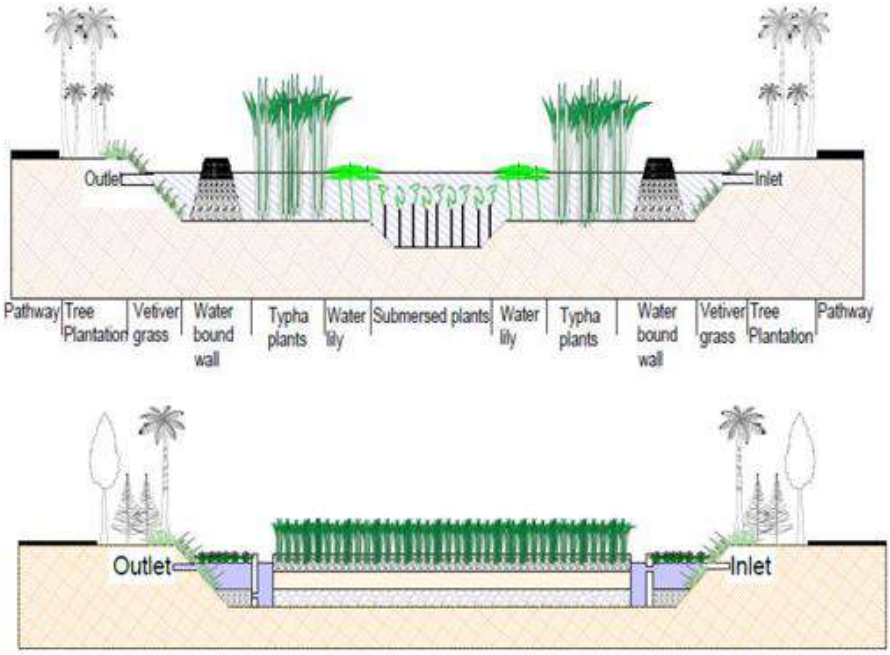


Figure 10: Concept plan of a raised reed bed type Constructed Wetland

4.2.1.3. Proposed Plant Species for a Constructed Wetland

The following plant species have been recommended for a constructed wetland due to their affinity for water and high tolerance to toxins and sludge.

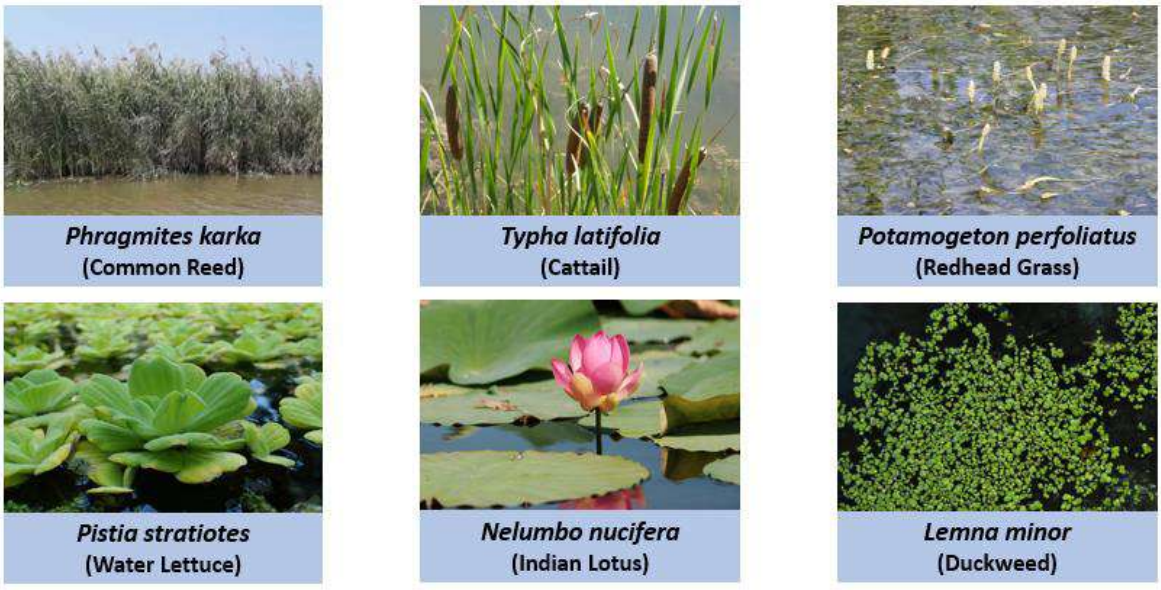


Figure 11: Recommended plants species for use in Constructed Wetlands

4.2.1.4. Selected Reaches for Constructed Wetlands

Jaranwala Drain, Sangla Drain and Samundri Drains are selected for the constructed wetlands. Area required for the construction of constructed wetland is 2 hector for each. Five wetlands on each drain are proposed for the removal of hazardous chemicals and pollutants from industrial waste water. A total of 30 Hectares land is required for this whole project.

It should be noted that the selection of sites will be based on the acquisition of land and detailed study of industrial effluents. Details of the selected reaches for constructed wastelands are as follows:

Table 11: Details of drainage reaches for construction of wetlands

Sr.	Name of Drain	Starting Location	Coordinates of Starting Point	Coordinates of End Point	Total Length of Reach (Km)
1	Jarawala Drain	Intersection point of Sangla & Jarawala Drain	31.51927, 73.40592	31.282222, 73.33083	29.5
2	Sangla Drain	Intersection point of Sangla & Jarawala Drain	31.51927, 73.40592	31.691389, 73.508056	29.5
3	Samundri Drain	Mandihar Chak 387 GB	31.123889, 72.981389	30.987222, 72.865278	22.5

The starting and ending points of these reaches as marked on the imagery are shown below.

Figure 12: Selected reached for construction of wetlands, Jaranwala Drain, Sangla Drain, Samundri Drain (Left to Right)

4.2.1.5. Typical Design Layout

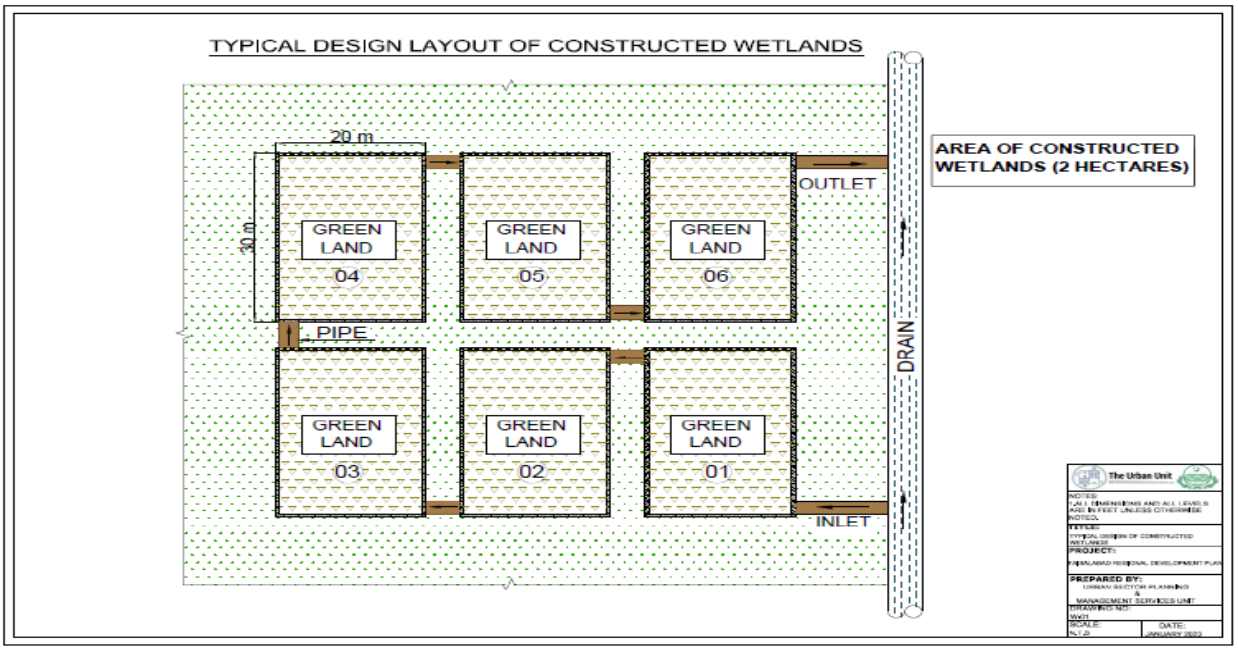


Figure 13: Typical design layout of a constructed wetland

4.2.1.6. Cost for Projects & Interventions

Sr.	Schemes	Rough Cost
1	Land Acquisition and Resettlement	384 Million PKR
2	Constructed Wetlands	42.58 Million PKR
3	Floating Beds on running channel	13.5 Million PKR
Total Cost (M) PKR		**440.08 Million PKR**

4.3. Updating of Monitoring & Control Mechanism through Telemetry

The canals system of Pakistan spans over hundreds of kilometers and is one of the most sophisticated in the world. However, orthodox and conventional methods for monitoring and control are in practice, creating a distinct gap in the operational capacity, drastically reducing the effectiveness of the operation. Manual gauging and staging methods are used to measure the water stage and levels in the canals or rivers, creating windows for a great possibility of human error and data tempering which in turn will affect effective decision making. Another issue with such system is the amount of human resource needed for an operation of such a massive scale. Interventions pertaining to effective canal monitoring are thus necessary to ensure optimal and transparent monitoring of actual status of water in these canals.

Globally, telemetry systems are utilized as an effective real-time monitoring tool for water quantity, quality, sediment flow, snow and ice melt and for improved decision making. The system also has centralized working capabilities from which access to comprehensive data, real-time predictive and preventative information concerning measurement, process, devices and mechanical equipment would be possible in a good manner.

4.3.1. Telemetry System

Telemetry is the automatic measurement and wireless transmission of data from remote sources. In telemetry system, various metrics such as flow of water, depth and quality etc. are converted into electrical signals by transducers/sensors installed in the field. Electronic sensors/transducers then transmit that data to receivers or control room with the help of communication system for monitoring and analysis.

4.3.1.1. Components of a Telemetry System

The proposed telemetry system for canals will be comprised of three main components; master control room, communication system and field sensors. The desired role of these devices in the system are conversion of sensor signals into digital data. The system should be having centralized working capabilities from which access to comprehensive data, real-time preventative information concerning measurement, process, devices would be possible. The data management would also be part of this system for effective monitoring of the system and provide integrated information flow for effective monitoring of the real time flow in canals.

Figure 14: Measuring discharge with ADCP at Paleru

The communication media would be Global system for Mobiles (GSM) based on mobile data, for sending the digital data from the remote sensors to the Master Control Room which will be established in the irrigation office. The human machine interface (HMI) would also be proposed. Master Control Room will have capability to monitor, data acquire, and archiving of the sensors of the water flow monitoring in canals.

A detail of the general components and associated sensors for the system have been shown in the table below:

Table 12: Components and associated sensors in a telemetry system

Sr.	Component Description
1	Data Logger (OR Controller)
2	Range Finder (non-contact ultrasonic range finder used to measure depth of flow)
3	GSM/GPRS Telemetry data transmission modems/ SIM cards
4	Rechargeable Battery 12 V
5	Solar Panel 300 W
6	Charging Regulator 12 V
7	Pressure Transducer
8	Control system + Motor
9	Water Quality and Gauge reading sensors meter
10	Allied Cables, Mountings, Surge Suppressors
11	Master Control Room

4.3.1.2. Integration of Telemetry with SCADA

The monitoring capabilities of the telemetry system are unparalleled in reducing the manual effort of gauge reading and staging of water levels in different hydraulic reaches. However, the telemetry system can be further integrated with Supervisory Control & Data Acquisition (SCADA) systems for remote monitoring and control. Mechanical components of irrigation system like gated weirs, cross and head regulators involve mechanical operation which is time consuming and labor inducing. These mechanical gates can be equipped with sensors and machinery for remote operation and monitoring.

Figure 15: Mechanical gates for controlling water at a canal in Bhagat Sub-Division, T. T. S.

SCADA enabled Telemetry system would greatly benefit in monitoring and control of canal systems in Faisalabad. Moreover, graphical and pictorial representations of data can be generated in minimal time and with minimal effort. The output can be configured to appear on specified portals or dashboards, increasing the effectiveness for operational and maintenance capabilities of these institutions. Integration of GIS and SCADA-based resources offer another advantage as they can be calibrated to transmit data to a centralized control unit, for a real-time analysis of different features of the system.

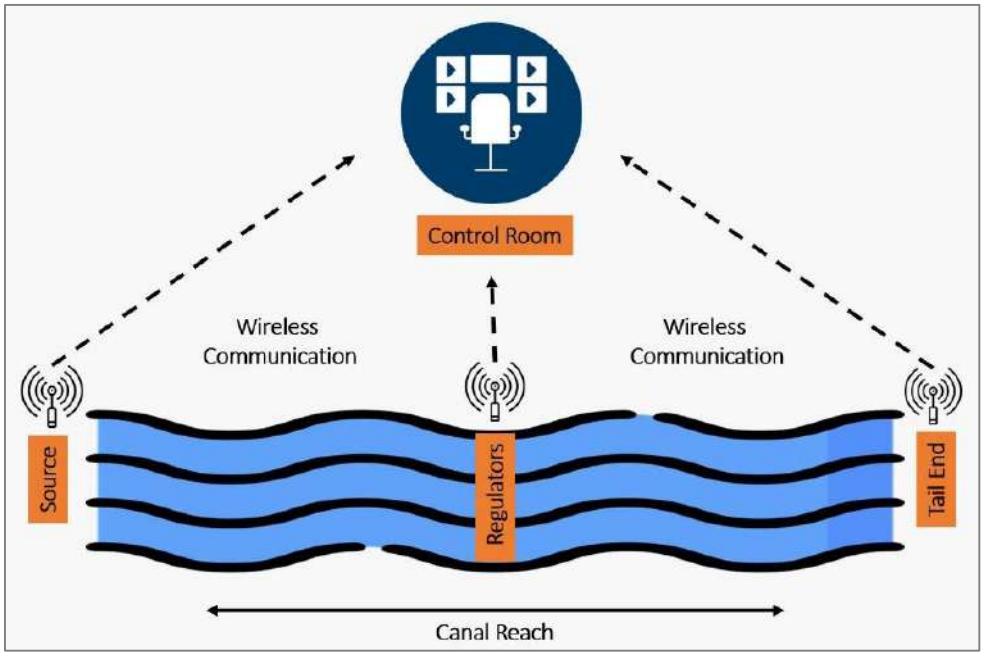


Figure 16: Concept drawing of a SCADA enabled Telemetry System

4.3.1.3. Proposed Plan for Telemetry System

In this regional plan 100 regulators are proposed to by shifted on telemetry system as a pilot project. In short-term plan 20 % of above mentioned 100 regulators are proposed to be linked with Telemetry system for effective monitoring and management of water in canals, 30 % in medium term plan and 50 % in long term plan. Field sensors will be installed at regulators, which will be further connected to communication system. These communication systems will transmit data to Master control room which will be established at irrigation office by using communication network like GSM. These instruments will be powered by dedicated solar system with battery backup to operate on 24-hour basis.

4.3.1.4. Cost of Telemetry Projects and Interventions

Sr.	Schemes	Rough Cost
1	Provision of telemetry system at 100 Regulators with Water Gauge Reading Along Channel in Faisalabad	336.27 Million PKR
Total Cost (M) PKR		**336.27 Million PKR**

4.3.1.5. Output of the Telemetry System

The general output of a telemetry system would be evident as effective and real-time monitoring of canal staging and accurate measurement of hydraulic properties. Some of the outputs that the system aims to achieve are as below.

- Ability to monitor canal inflows, storage and outflows at different points
- Provide timely early warning and monitoring during the flood seasons
- Eliminate the human errors during the manual reading
- Create a transparent and accessible system for water transactions for all stakeholders
- Help attain the target of smart irrigation system as per international best practices

4.4. Further Recommendations

Some further recommendations are proposed for effective uplifting and capacity enhancement of irrigation stakeholders.

4.4.1. Capacity Building & Training of Irrigation Department

Capacity building and appropriate training of staff and field personnel of irrigation department are proposed for enhancement of their knowledge and technical expertise. Following are some of the proposed recommendations for achieving this milestone.

- Trainings of office staff in Contract Management Knowledge Area
- Trainings of office staff in Litigation Knowledge Area
- Training of field staff on field work equipment: (e.g. auto level / total station / current meter / theodolite)
- Enlisting & inclusion of new & irrigation relevant training courses at Lahore irrigation Academy
- R&D on new irrigation techniques at Irrigation Academy Lahore
- Provision of new books related to best irrigation practices
- Enhancing computer literacy in department
- Adopting of new means of water application in fields

5. Project Digest

Projects have been proposed and bifurcated over the planning period of the project (2023 – 2033) to limit the financial strain and streamlined execution of the projects.

5.1. Proposed Projects & Interventions for Short Term

Table 13: Proposed Projects & Interventions for Short Term

SR #	DESCRIPTION OF ITEM	COST	MILLIONS
Proposed Interventions & Estimated Cost of Rehabilitation of Irrigation System			
1	Repairing of Head Regulators and Cross Regulators	97,423,257	97
2	Complete Repairing of Office Building of Irrigation Department of Jhang	4,500,000	5
3	Reconstruction of Damaged Canal Fall	55,614,600	56
4	Rehabilitation of Cross drainage channel	23,630,000	24
Proposed Interventions & Estimated Cost of Nature Based Solution for Drainage System			
5	Floating Beds on running channel	13,500,000	14
Proposed Interventions & Estimated Cost of System Improvement through Telemetry			
6	Provision of telemetry system at 20 Regulators with Water Gauge Reading Along Channel in Faisalabad	67,254,146	67
	a) Sub Total Amount of Short Term Intervention	**261,922,003**	**262**

5.2. Proposed Projects & Interventions for Medium Term

Table 14: Proposed Projects and Interventions for Medium Term

SR #	DESCRIPTION OF ITEM	COST	MILLIONS
Proposed Interventions & Estimated Cost of Rehabilitation of Irrigation System			
1	Complete Rehabilitation of District Jhang Rest House	31,731,526	32
2	Repairing of Head Regulators and Cross Regulators	148,083,351	148
3	Rehabilitation of Cross drainage channel	64,750,000	65
Proposed Interventions & Estimated Cost of Nature Based Solution for Drainage System			
4	Land Acquisition and Resettlement	384,000,000	384
Proposed Interventions & Estimated Cost of System Improvement through Telemetry			

5	Provision of telemetry system at 35 Regulators with Water Gauge Reading Along Channel in Faisalabad	117,694,756	118
	b) Sub Total Amount of Medium Term Intervention	**746,259,633**	**746**

5.3. Proposed Projects & Interventions for Long Term

Table 15: Proposed projects & Interventions for Long Term

SR #	DESCRIPTION OF ITEM	COST	MILLIONS
Proposed Interventions & Estimated Cost of Rehabilitation of Irrigation System			
1	Repairing of Head Regulators and Cross Regulators	194,846,514	195
2	Rehabilitation of Cross drainage channel	102,850,000	103
Proposed Interventions & Estimated Cost of Nature Based Solution for Drainage System			
3	Constructed Wetlands	42,579,263	43
Proposed Interventions & Estimated Cost of System Improvement through Telemetry			
4	Provision of telemetry system at 45 Regulators with Water Gauge Reading Along Channel in Faisalabad	151,321,829	151
	C) Sub Total Amount of Long Term Intervention	**491,597,607**	**492**

The Total Cost of this Rough Cost Estimate has been worked out amounting to **1,500 Million** including 2% Contingencies & 5% PST.

COSTING

Faisalabad Regional Development Plan
IRRIGATION SECTOR

6. Rough Cost Estimate

6.1. Costing for Rehabilitation of Canal Falls

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD				
FAISALABAD REGIONAL DEVELOPMENT PLAN				
SUMMARY OF ROUGH COST ESTIMATE CANAL FALL (CHINIOT)				
Sr.	Description	Amount in PKR	Amount in Millions	Remarks
1	Construction of Canal Fall at Chiniot	51,976,262	51.98	
	Sub- Total Amount	**51,976,262**	**51.98**	
	Add 2% Contingency Charges	1,039,525.23	1.04	
	Add 5% PST	2,598,813.08	2.60	
	Total Amount R.s	**55,614,599.86**	**55.61**	

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023) DISTRICT CHINIOT						
CANAL FALL						
MRS Ref#	Item No.	Description	Unit	Rate(PKR)	As Per Qty.	
					Qty.	Amount (PKR)*
3/21(a-ii)	1	Excavation in foundation of building, bridges and other structures, including dag belling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead up to one chain (30 m c) Lift above 15 ft (4.5 m): ii) Ordinary soil	%0Cft	11,535.10	192,000.00	2,214,739.20
6/8 b	2	Providing and casting in situ bored reinforced concrete piles using Ordinary port land cement / Sulphate resisting cement or as may be required including screening, washing of aggregates, mixing of constituents using batching plant, Transportation by Transit Mixer, pouring in the required proportion to achieve a nominal cylindrical strength in the field as per ACI - 214, with the specified consistency. i/c the cost of labor, boring, equipment / machinery, plate form (except the cost of steel reinforcement, its labor for bending and laying in position and boat platform etc. which will be paidse parately) excluding the cost of admixture as approved and directed by the Engineer In charge.				
		(b) 4000 PSI (iv) 0.61 m / 24 inch	Per Rft	2,595.65	2,200.00	5,710,430.00
6/5(i)	3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone	%Cft	38,880.60	1,500.00	583,209.00

		aggregate): (f) Ratio 1: 2: 4				
6/6 a-II-3	4	Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:-				-
		Slab of rafts / strip foundation, base slab Type B (nominal mix 1: 1½: 3)	Per Cft	641.50	28,800.00	18,475,200.00
7/4-i)	5	Pacca brick work in foundation and plinth in: Cement, sand mortar:-			-	-
		Ratio 1:3	%Cft	34,848.25	500.00	174,241.25
6/12-c	6	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labor charges for binding of steel reinforcement (also includes removal of rust from bars):-				
		Deformed bars (Grade-60)	%Kg	31,982.30	77,500.00	24,786,282.50
		Railing Protection				
25-10	7	Fabrication of heavy steel work, with angle, tees, flat iron round iron and sheet iron for making trusses, girders, tanks, etc., including cutting, drilling, refitting, handling, assembling and fixing, but excluding erection in position.	%Kg	4,397.85	550.00	24,188.18
25-11	8	Erection and fitting in position iron trusses, staging of water tanks, etc.	%Kg	1,449.35	550.00	7,971.43
		Total Amount				**51,976,261.55**

6.2. Costing for Rehabilitation of Head Regulators

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD				
FAISALABAD REGIONAL DEVELOPMENT PLAN				
SUMMARY OF ROUGH COST ESTIMATE CANNAL HEAD REGULATOR				
Sr.	**Description**	**Amount in PKR**	**Amount in Millions**	**Remarks**
1	Construction of Canal Head Regulator (No's of 226)	411,544,975	411.54	
	Sub- Total Amount	**411,544,975**	**411.54**	
	Add 2% Contingency Charges	8,230,899.49	8.23	
	Add 5% PST	20,577,249	20.58	
	G-Total Amount R.s	**440,353,123**	**440.353**	

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD
FAISALABAD REGIONAL DEVELOPMENT PLAN
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023)DISTRICT FAISALABAD

Canal Head Regulator						
MRS Ref#	Item No.	Description	Unit	Rate(PKR)	As Per Qty	
					Qty	Amount (PKR)*
6/5(i)	1	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): (f) Ratio 1: 2: 4	%Cft	38,880.60	1,500.00	583,209.00
6/6 a-II-3	2	Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc. and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects::				-
		Slab of rafts / strip foundation, base slab Type B (nominal mix 1: 1½: 3)	Per Cft	641.50	750.00	481,125.00
7/4-i)	3	Pacca brick work in foundation and plinth in: Cement, sand mortar:-			-	-
		Ratio 1:3	%Cft	34,848.25	375.00	130,680.94
6/12-c	4	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labor charges for binding of steel reinforcement (also includes removal of rust from bars):-				
		Deformed bars (Grade-60)	%Kg	31,982.30	1,875.00	599,668.13
25-10	5	Fabrication of heavy steel work, with angle, tees, flat iron round iron and sheet iron for making trusses, girders, tanks, etc., including cutting, drilling, riveting, handling, assembling and fixing, but excluding erection in position.	%Kg	4,397.85	450.00	19,790.33
		Erection and fitting in position iron trusses, staging of water tanks, etc.	%Kg	1,449.35	450.00	6,522.08
		Total Amount				1,820,995.46
		226 X G-Total Amount				411,544,974.53

6.3. Costing for Rehabilitation of Aqueducts

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD				
FAISALABAD REGIONAL DEVELOPMENT PLAN				
SUMMARY OF ROUGH COST ESTIMATE CROSS DRAINAGE (FAISALABAD)				
Sr.	Description	Amount in PKR	Amount in Millions	Remarks
1	Construction of Cross Drainage at Faisalabad	178,572,243	179	
	Sub- Total Amount	178,572,243	179	

	Add 2% Contingency Charges	3,571,445	4	
	Add 5% PST	8,928,612	9	
	Total Amount R.s	**191,072,300**	**191**	

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023)DISTRICT FAISALABAD						
Cross Drainage work						
Mrs Ref#	Item No.	Descriptio n	Unit	Rate(PKR) *	As Per Qty	
					Qty	Amount (PKR)*
6/6 a-II-3	1	Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- :				-
		Slab of rafts / strip foundation, base slab Type B (nominal mix 1: 1½: 3)	Per Cft	641.50	1,697.50	1,088,946.25
6/12-c	2	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-				
		Deformed bars (Grade-60)	%Kg	31,982.30	4,243.75	1,357,248.86
		Total Amount				**2,446,195.11**
		73x G-Total Amount				**178,572,243**

6.4. Costing for Rehabilitation of Rest House

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD				
FAISALABAD REGIONAL DEVELOPMENT PLAN				
SUMMARY OF ROUGH COST ESTIMATE BANGLA NAUL WALA REST HOUSE (JHANG)				
Sr.	Description	Amount in PKR	Amount in Millions	Remarks
1	Construction of Rest House at Naul Wala House Jhang	29,655,632	29.66	
	Sub- Total Amount	**29,655,632**	**29.66**	
	Add 2% Contingency Charges	593,112.64	0.59	
	Add 5% PST	1,482,781.60	1.48	
	Total Amount R.s	**31,731,526.22**	**31.73**	

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD			
FAISALABAD REGIONAL DEVELOPMENT PLAN			
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023) JHANG			
BANGLA NAUL WALA REST HOUSE			

MRS Ref#	Item No.	Description	Unit	Rate(PKR)*	As Per Qty	
					Qty	Amount (PKR)*
3/21(a-ii)	1	Excavation in foundation of building, bridges and other structures, including dabbling, dressing, refilling around structure with excavated earth, watering and ramming lead Up to one chain (30 m) and lift up to 5 ft. (1.5 m)	%0Cft	11,658.25	3,937.50	45,904.36
6/5(i)	2	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): (nominal mix 1: 4: 8)	%Cft	29,723.50	2,062.50	613,047.19
6/6 a-II-3	3	Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc. and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- :				-
		Slab of rafts / strip foundation, base slab Type C (nominal mix 1: 2: 4)	Per Cft	583.25	1,893.75	1,104,529.69
7/4-i)	4	Pacca brick work in foundation and plinth in: Cement, sand mortar:-			-	-
		Ratio 1:5	%Cft	29,928.60	375.00	112,232.25
7/5-i)	5	Pacca brick work in ground floor:-			-	
		Ratio 1:5	%Cft	32,331.00	5,250.00	1,697,377.50
6/12-c	6	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labor charges for binding of steel reinforcement (also includes removal of rust from bars):-				
		Deformed bars (Grade-60)	%Kg	31,982.30	4,734.38	1,514,162.02
6/36(b)	7	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bitumen coating: b) with 2 coats of bitumen: ii) 2" thick (50 mm)	%Sft	10,839.80	675.00	73,168.65
6/37 (a-III)	8	Providing and laying damp proof course with cement sand plaster and bitumen coating: iii) Ratio 1:2 b) ¾ " thick (20 mm)	%Sft	7,284.10	400.00	29,136.40
11/9-b	9	Cement plaster 1:4 up to 20' (6.00 m) height: c) ¾" (20 mm) thick	%Sft	4,856.75	8,775.00	426,179.81
10/3	10	Providing, laying, watering and ramming brick ballast 1½" to 2"(40 mm to 50 mm) gauge mixed with 25% sand, for floor foundation, complete in all respects.	%Cft	10,166.50	1,650.00	167,747.25
		First class deodar wood wrought joinery in doors and windows etc. paneled, or paneled or				

12/7	12	glazed, or fully glazed, fixed in position, including chowkat, holdfast, hinges, tower bolts, chocks, robber stop, cleats/ G.I, clamps, handles and chord with hooks etc. complete (excluding sliding bolts or lock): a) 2" thick (50mm)	Per Sft	2,587.40	308.00	796,919.20

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023) JHANG						
BANGLA NAUL WALA REST HOUSE					As Per Qty	
MRS Ref#	Item No.	Description	Unit	Rate(PKR)*	Qty	Amount (PKR)*
11/22+23	12	Distempering: a) New surface: iii) three coats	%Sft	1,743.30	1,607.50	28,023.59
13/7	13	French polishing complete: doors a)on new work	%Sft	5,701.45	616.00	35,120.93
9/12 & 26/37	16	First class Single layer of brick tiles 9"x4½"x1½" (225x113x40 mm) laid over 4"(100 mm) earth and 1" (25 mm) mud plaster without Bhoosa, grouted with cement sand 1:3 on top of RCC roof slab, provided with two coats of 34 lbs. per %Sft. or 1.72 Kg/Sq.m bitumen coating sand blinded with 0.2mm thick polythene sheet. complete in all respects as per drawings and specification, including curing, etc.	%Sft	11,111.65	3,000.00	333,349.50
		Roof Drainage				
9/17	19	Plain galvanized iron sheets 22 SWG rain water down pipe including clamp and fixing in position.:				
		a) 4" dia	Rft	420.85	42.00	17,675.70
9/21	20	Rain water down pipe cast iron head fixed in place, including cost of clamp holdfast and painting.				
		a) 4" dia	Each	985.15	6.00	5,910.90
N.s	21	Provide and lay rain water troughs on roof using cement concreter 1:2:4 and finished with 1/2" thick 1:3 in grey cement sand plaster with waterproof agent as per Specifications, whole system leak-free:				
		a) 1'-6" x 1'-6"	No	1,300.00	6.00	7,800.00
		Tile Work				
10/25.	22	Providing and laying super b quality Ceramic tiles dadoo f Master brand of specified size, Glossy/Matt/Textures skirting /dadoo f approved Color b and Shade with adhesive bond over 1/2"thick (1:2) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding	Sft	310.10	14,200.00	4,403,420.00

		complete in all respects as approved and directed by the Engineer in charge. i) 12"x18"/12"x24"/10"x24" /8"x24"/12"x36"				
10/23.	23	Providing and laying floor of mosaic marble chips tiles 1"(25 mm) thick of approved quality and shade, laid in white cement and pigment, over ¾"(20 mm) thick bedding of cement sand mortar 1:2, including finishing and polishing, complete.	%Sft	25,247.15	660.00	16,663,119.00

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023) JHANG						
BANGLA NAUL WALA REST HOUSE					As Per Qty	
MRS Ref#	Item No.	Description	Unit	Rate(PKR)	Qty	Amount (PKR)*
10/45.	24	Providing and laying flooring with China Verona Marble having uniform texture(Spotless) of required size and specified thickness, with ad hesivebondover3/4" thick bed ding of (1:2) cement sand mortar i/c the cost of matching sealer, cutting, grinding and chemical polishing complete in all respect as approved and directed by the Engineer in charge ii) 3/4" thick (12"x24"/12"x36")	Sft	440.25	175.00	77,043.75
23/47-b	25	Providing, laying, testing and commissioning of POLYP ROPYLENER AND OMCOPOLYMER(PPRC) waters Up ply pipe (Dadex/Popular/Beta or equivalent) with specified pressure rating PN(PRESSURENOMINAL)and conformingtoDIN8077- 8078codei/c cost of solvent specials, making jharries complete in all respect as approved and directed by Engineer in charge. (Internal/External Diameters mentioned). b) PN-20 pipe				-
		(i)(1/2") 20 mm	P.Rft	49	450.00	21,937.50
		ii)(3/4") 25 mm	P.Rft	67	600.00	40,290.00
		(iii)(1") 32 mm	P.Rft	108	350.00	37,677.50
Ch:-19/31	29	Providing and fixing gun metal peet/gate valve (screwed):-				-
		a) 30mm dia	Each	5,732	8.00	45,859.20
Ch:-19/7-i	30	Providing and fitting glazed earthen ware wash hand basin 56x40 cm (22"x16") including bracket set, waste pipe and waste coupling, etc.				-
		white, with pedestal	Each	6,161	4.00	24,642.00
N.s		Providing and fitting English commode	Each	6,870.00	4.00	27,480.00
N.s		Providing and fitting Indian commode	Each	1,275.00	-	-

Ch:-19/35-ii		Providing and fitting "P" trap:-				
		ii) 10 cm (4") glazed.	Each	323	4.00	1,293.00
Ch:-19/12-i		Providing and fitting glazed earthen ware low down flushing cistern 13.63 liters (3 gallons) capacity, including bracket set, copper connection, etc.				
		i) white	Each	4,742	4.00	18,966.60
19/19	34	Providing and fixing, chromium plated towel rail: i) 60 cm (24") long, and 2 cm (¾") dia.	Each	741	4.00	2,964.80
19/23	35	Providing and fixing Bathroom Accessories (7-piece set) Master brand - One Cosmetic Shelf, One Towel rod with bracket, one soap dish, one double hook, one towel ring, brush holder, toilet paper holder & looking glass i/c the cost of hardware etc. complete in all respect as approved and directed by the Engineer in charge.				-
		i) Plastic soap dish	Each	1,200	8.00	9,600.00
		ii)Plastic toilet paper holder	Each	900	4.00	3,600.00
		iii)Plastic tower rail	Each	1,400	4.00	5,600.00
		iv)Plastic shelf 60x13 cm (24:x5") with bracket and railing	Each	900	4.00	3,600.00
		v) Plastic Brush holder	Each	900	6.00	5,400.00

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023) JHANG						
BANGLA NAUL WALA REST HOUSE					As Per Qty	
MRS Ref#	Item No.	Description	Unit	Rate(PKR)	Qty	Amount (PKR)*
		vi) Looking glass with plastic frame	Each	1,700	6.00	10,200.00
		vii) Towel ring	Each	600	10.00	6,000.00
Ch:-19/35	31	Providing and fitting 10cm (4") gully trap, including cement concrete, cost of PVC grating 15 x 15 cm (6"x 6") and masonry chamber 30x30cm (12"x12")	No.	790	12.00	9,482.40
N.s	32	Provide, cut, fix, join and test uPVC pipe for soil and waste conforming to ISO 3633:1991 (wall thickness=3.2mm) including uPVC fittings with solvent cement jointing "Dadex" make or approved equal, including clamping to walls or under floor, cutting through walls and providing sleeves through concrete for pipelines and pipe fittings including testing of the following				-

		diameter.				
		a) 50mm dia	Rft	350	325.00	113,750.00
		b) 75 mm outside diameter	Rft	425	275.00	116,875.00
Ch:-19/34	33	Provide and fix uPVC Floor Trap "Dadex" make or approved equivalent including grating, and cover, as approved.				-
		a) 50mm dia	No.	670	6.00	4,021.20
		b) 75mm dia	No.	790	6.00	4,741.20
N.s	34	Provide and fix uPVC Floor Clean out "Dadex": make or approved equal including testing complete in all respect as per drawings.				-
		a) 75mm dia	No.	650	6.00	3,900.00
N.s	35	Provide and fix install 500-gallon capacity roof water tank "Dura: or "Sun International Co. Pvt. Ltd., or approved equal including all arrangement accessories connections complete in all respects and as per approved by the Engineer.	No.	8,000	4.00	32,000.00
Ch:-21/1	36	Providing and laying R.C.C pipe, molded with cement concrete 1:1½:3 with spigot or collar joint etc., including cost of Reinforcement, confirming to B.S.S 5911, Part 1981, class "L" including lowering in trenches to correct alignment and grade, jointing, cutting of pipes where necessary finishing and testing complete. (9" dia pipe)	Rft	554	320.00	177,232.00
N.s	37	Construction of square masonry manhole (2'x2') including cover and frame = (Up to 6 ft. depth)	No.	7,500	10.00	75,000.00
		Internal Electrification				-
Ch:-24/3	38	S/E of PVC pipe for wiring recessed in walls i/c inspection boxes hooks cutting repairing surface etc. 20 mm	P.Rft	75.25	1,500.00	112,875.00
		25 mm	P.Rft	90.2	1,200.00	108,240.00
		32 mm	P.Rft	97.7	850.00	83,045.00
Ch:-24/11	39	Supplying and erection of single core cable PVC insulated etc.				-
		3/0.029"	P.Rft	27.1	4,500.00	121,950.00
		7/0.029"	P.Rft	43.3	2,550.00	110,415.00

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023) JHANG						
BANGLA NAUL WALA REST HOUSE					As Per Qty	
MRS Ref#	Item No.	Description	Unit	Rate(PKR)*	Qty	Amount (PKR)*

Ch:24/14	40	Supply and erection of M.S. sheet box of 16 SWG, 10 cm (4") deep, with 4.75 mm thick (3/16") Bakelite sheet top, for recessed wiring, including making holes for regulators, switches, plugs, etc.				-
		(10"x10")	Each	296	20.00	5,920.00
Ch:-24/27	41	S/F of bottom holder Bracket large size.	Each	136.1	25.00	3,402.50
Ch:-24/30	42	S/E of switches 5 Amp piano type	Each	75.1	125.00	9,387.50
N.s	43	S/E of celling Rose bracket.	Each	250	6.00	1,500.00
Ch:-24/36	44	S/E of 3 pin switch and plug combine 5 Amp	Each	126.95	135.00	17,138.25
Ch:-24/36	45	Supply and erection of 3 pin, 10/15 Amp. Wall socket. Recessed type.	Each	167.75	135.00	22,646.25
N.s	46	S/E of roof hook i/c M.S. box 7"x4"	Each	250	6.00	1,500.00
Ch:-24/26	47	S/E of wall type / pole type bracket with double cover water tight reflector.	Each	1,052.70	12.00	12,632.40
N.s	50	S/E Down lighter 1x 12W LED Light (Smart Lights) as approved by the Electrical Engineer.	Each	600	60.00	36,000.00
N.s	52	S/E of Main Panel Board as shown in the Drawings. Incoming 30 Amp Double Pole 1 No Voltmeter 1 No Amp Meter **Outgoing** 8 Nos. 10 Amp Single Pole Bus Bars 1 No Phase, 1 No Neutral, & 1 No. Earth Thimbles	Each	55000	1.00	55,000.00
		G-Total Amount				**29,655,631.99**

6.5. Costing for Constructed Wetlands

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD				
FAISALABAD REGIONAL DEVELOPMENT PLAN				
SUMMARY OF ROUGH COST ESTIMATE WETLANDS (FAISALABAD)				
Sr.	**Description**	**Amount in PKR**	**Amount in Millions**	**Remarks**
1	Construction of Constructed Wetlands at Faisalabad	39,793,704	39.79	
	Sub- Total Amount	**39,793,704**	**39.79**	
	Add 2% Contingency Charges	795,874.08	0.80	
	Add 5% PST	1,989,685.19	1.99	
	Total Amount R.s	**42,579,263.10**	**42.58**	

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD						
FAISALABAD REGIONAL DEVELOPMENT PLAN						
MRS, 1ST BI-ANNUAL-2023 (01.01.2023 to 30.06.2023)DISTRICT FAISALABAD						
Constructed Wetlands						
MR Ref #	**Item N.**	**Description**	**Unit**	**Rate(PKR)**	**As Per Qty**	
					Qty	**Amount (PKR)***

3/42	1	Earthwork excavation in open cutting upto 5'-0" (1.5 m) depth for storm water channels, drains, sullage drains in open areas, roads, streets, lanes, including under pinning of walls and shoring to protect existing works, shuttering and timbering the trenches, dressed to designed level and dimensions, trimming, removal of surface water from trenches, back filling and surplus excavated material disposed of and dressed within 50 ft. (15 m) lead:- i) ordinary	%0 Cft	9,958.10	255,000.00	2,539,315.50
	2	Earthwork excavation in open cutting 5.01 ft. (1.5 m) to10.0 ft. (3.0 mm) depth for storm water channels, drains, sullage drains in open areas, roads, streets, lanes, including under pinning of walls and shoring to protect existing works, shuttering and timbering the trenches, dressed to designed level and dimensions, trimming, removal of surface water from trenches, back filling and surplus excavated material disposed of and dressed within 100 ft. (30 m) lead:- i) ordinary	%0 Cft	10,891.30	306,000.00	3,332,737.80
6/6'	3	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting,curing, rendering and finishing exposed surface, complete(but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):- (a)(iii) Reinforced cement concrete in slab of rafts / stripfoundation, base slab of column and retaining walls; etc andfooting beams, other structural members other than those mentioned in6(a) (i)&(ii) above not requiring form work (i.e. horizontalshuttering) complete in all respects:- (3) Type C (nominal mix 1: 2: 4)	Cft	587.00	8,370.00	4,913,190.00
6/5(i)	4	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): (f) Ratio 1: 2: 4	%Cft	38,880.60	1,560.00	606,537.36
7/4-i)	5	Pacca brick work in foundation and plinth in:- Cement, sand mortar:-			-	-
		Ratio 1:3	%Cft	34,848.25	2,775.00	967,038.94
6/12-c	6	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-				
		Deformed bars (Grade-60)	%Kg	31,982.30	20,925.00	6,692,296.28
14/8'	7	Brick lining 9"x4½"x3" (225x113x75 mm) in 1:6 cement, sand mortar:-				-
		a) in bed	%Cft	37,060.90	6,375.00	2,362,632.38
		b) on slope	%Cft	38,938.60	618.75	240,932.59
23/43	8	Providing,laying,cutting,jointing,testinganddisinfectingHighDensityPolyethylenePipe(HDPE-100)workingpresurepipe,Beta/Dadex/Popular/IILorequivalentincludingthecostofspecials,intrenches,asapproved & directed by the engineer incharge, complete in all respects				-

		c) PN-10 (SDR-17) (1000 mm)	P.R ft	28,792.10	630.00	18,139,023.00
		Total Amount				**39,793,703**

6.6. Costing for Telemetry System

THE URBAN UNIT (URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT PVT.LTD					
FAISALABAD REGIONAL DEVELOPMENT PLAN					
SUMMARY OF ROUGH COST ESTIMATE SYSTEM IMPROVEMENT-TELEMETRY					
Sr No.	**Component Description**	**No of Units**	**Unit Cost**	**Total Cost**	**Remarks**
1	Data Logger	100	2,912,650	291,265,000	
2	Range Finder (non-contact ultrasonic range finder (water level sensor)				
3	GSM/GPRS Telemetry data transmission modems/ SIM cards				
4	Rechargeable Battery 12 V				
5	Solar Panel 100 W				
6	Charging Regulator 12 V				
7	Pressure Transducer				
8	Control system + Motor				
9	Water Quality meter				
10	Allied Cables, Mountings, Surge Suppressors				
11	**Master Control Room**	1	23,006,712	23,006,712	
	Sub Total Amount R.s			**314,271,712**	
	Add 2% contingencies			6,285,434.24	
	Add PST 5%			15,713,585.60	
	G-Total Amount R.s			**336,270,731.84**	

The Urban Unit

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