

REGIONAL DEVELOPMENT PLAN FAISALABAD

Environment Sector



The Urban Unit

Urban Master Planning & Management Services (Pvt) Ltd.



Environment Sector

Faisalabad Regional Development Plan



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Setting the Context

Rapid urbanization, population expansion in urban centers and massive economic activities are among certain challenges that Punjab province is facing. To tackle these issues and improve Punjab’s population’s livability, development and planning at the regional level have been brought to attention.

There is a multifaceted way to express the terminology “**Region**” depending upon the scale of analysis. It could be any land that has common natural and artificial features. It could also be any basic administrative unit that either encompasses an area, division, or district

for local government. More distinctively, it could be any administrative or politically/economically/spatially defined area that may cover different states/countries or could be at a national/sub-national/local scale and has a role in a certain level of development.¹

Punjab Spatial Strategy 2047 outlines division as a good region for achieving larger development goals in harmony with districts and cities as well as for assessing the comparative advantages at a macro scale. **The strategy identifies division as a ‘region’ which forms the economic units based on a regional vision and development plans that not only enhance competitiveness and productivity of the region but also enable efficient resource allocation and more economic returns.** In an international context, China has successfully achieved its economic transition from an agrarian economy to an industrialized economy by focusing on regional developments and integrated planning frameworks.

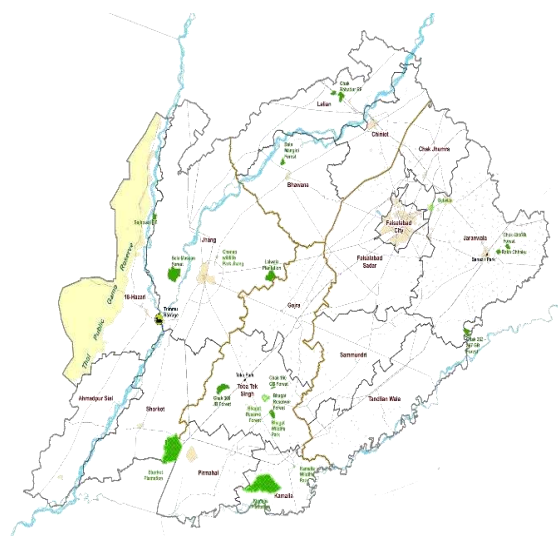


Figure 1: Divisions of Punjab Province

Faisalabad Division (Region), an Industrial hub and third most populous division of Punjab has a high potential for economic growth and providing higher opportunities for investments. However, this region is also facing various natural and anthropogenic hazards which include abrupt variations in temperature, dust storms as well as industrialization, urbanization, deforestation and depletion of water resources. This situation thus, demands a number of interventions with a range of amenity green structures and improved environmental quality in order to develop a proportion between grey and green areas of the region. Therefore, a regional development plan of the environment sector is being prepared for the spatial, economic and environmentally sustainable development in the region. It also helps in managing the challenges, disparities and competition for

development resources between cities in a region as well as keep the goods and resources available to them as per their needs.

¹ Schmitt-Egner, P. 2010. The Concept of 'Region': Theoretical and Methodological Notes on its Reconstruction. *Journal of European Integration*. 24(3): 179-200.

Faisalabad Regional Profile

Geographically, the Faisalabad Region lies from 31°14'60.00" North latitudes and 72°47'59.99" East longitudes covering a total area of about 17,917km².² According to Pakistan Population and Housing Census 2017, the Region has a population of about 14.185 million.³ The average elevation of the Faisalabad Region is about 176m (577 feet) above sea level.⁴ Faisalabad District is bounded by Chiniot in the North, by Sheikhpura District in the Northeast, by Shaiwal District in the East, by Sahiwal and Toba Tek Singh Districts in the South and by Jhang District in the West.⁵ The region comprised of flat, fertile plains and its soil is generally comprised of alluvial deposits with calcareous characteristics.⁶

There is a substantial urban-rural population size differences within the Faisalabad Region. According to 2017, Census of Pakistan, the annual growth rate of Faisalabad Region is 1.92. Moreover, the divisional level analysis shows that the ratio of Urban and Rural population is 36.87% and 63.13% respectively for Faisalabad Region. The detailed demographic profile of Faisalabad Region is given below:

Table 1: Demographic Profile of Faisalabad Region^{7,8}

Faisalabad Region					
Sr. #	Particulars	Faisalabad District	Chiniot District	Jhang District	T.T. Singh District
1.	Location	31°25'05.10"N 73°04'39.27"E	31.6268° N, 72.8043° E	31.1929° N, 72.2364° E	31.0685° N, 72.6151° E
2.	Area (km²)	5,857	2,643	6,166	3,252
3.	Population (2017)	7,882,444	1,368,659	2,742,633	2,191,495
4.	Population Density (per Sq. Km)	1345.82	517.84	444.80	673.89
5.	Urban Proportion	47.79	30.85	21.82	20.17
6.	No. of Tehsils	06 (Chak Jhumra, Faisalabad City, Faisalabad Sadar, Jaranwala, Samundri and Tandlianwala)	03 (Chiniot, Bhawana and Laliyan)	04 (Ahmed pur Sial, Chiniot, Jhang and Shorkot)	04 (Gojra, Kamalia, Pir Mahal and T.T. Singh)

² EIA Report – 500kV Faisalabad West Grid Station and Associated Transmission Project. 2016.

³ Pakistan Population and Housing Census, 2017.

⁴ https://faisalabaddivision.punjab.gov.pk/division_profile

⁵ <https://pcgip.urbanunit.gov.pk/docs/DLIs/DLIS/FPUSPReport.pdf>

⁶ <https://faisalabad.punjab.gov.pk/geography>

⁷ <https://www.pbs.gov.pk/sites/default/files/population/2017/tables/punjab/Table01p.pdf>

⁸ DISTRICT_WISE_CENSUS_RESULTS_CENSUS_2017.pdf

7.	Average Household Size	6.42	6.21	6.35	6.42
8.	Literacy Rate	60%	70%	65%	68%
9.	Health Facilities (DHQs, THQs, RHUs, BHUs, etc.)	312	54	70	80

By 2033, it is likely that the population of Faisalabad Region will grow by 17.3%. District-wise population projection is provided in the below table;

Table 2: Projected Population⁹

Districts	Growth Rate (1998-2017)	2017	2023	2028	2033
Faisalabad Region	1.92	14,185,231	15,899,845	17,485,980	19,230,344
Faisalabad District	1.98	1,368,659	8,866,474	9,779,710	10,787,008
Chiniot District	1.85	2,742,633	1,527,782	1,674,429	1,835,151
Jhang District	2.03	2,191,495	3,094,105	3,421,168	3,782,804
T.T. Singh District	1.59	7,882,444	2,409,052	2,606,760	2,820,693

As the population grows over the next decade, of the Faisalabad region may become even greater. Thus, demanding a regional-level development plan where development efforts are focused on the creation of a system of cities that fosters intercity networking, creates more jobs and increase productivity as well.

2.1. Climate Profile of Faisalabad Region

Faisalabad has a semi-arid climate, with very hot-humid summers and dry, cold winters. Summers usually starts in June and ends in September and in June. In June, the average high and low temperatures are 46 °C (114 °F) and 30 °C (86 °F), respectively. The winters usually start from October till the middle of March and the recorded average low temperature in winter is 12.5 °C.¹⁰ Faisalabad receives an average annual rainfall is only about 100 millimeters (4.0 inches) ¹¹ of which roughly half of the annual rainfall occurs in July and August during the monsoon season. In the Faisalabad Division, July has the highest relative humidity (66 %) due to heavy precipitation while May has the lowest relative humidity (20 %).¹²

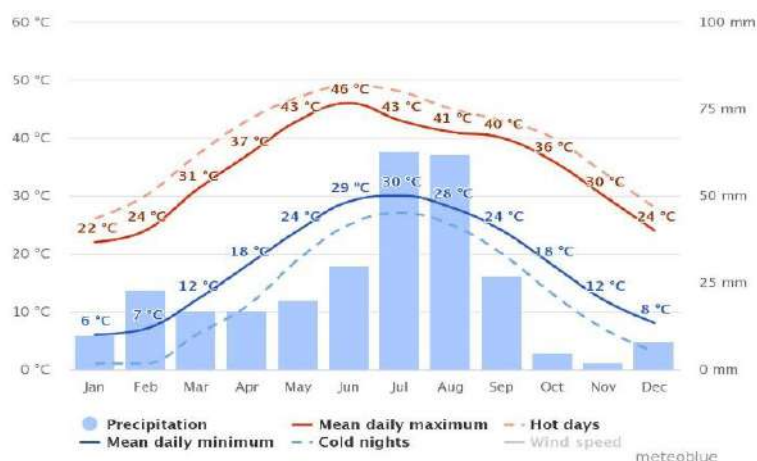


Figure 2: Average Annual Temperature and Precipitation of Faisalabad, 1993-2022

⁹ Based on the Statistical Analysis done by the Urban Unit

¹⁰ "Climate: Faisalabad - Climate graph, Temperature graph, Climate table"

¹¹ <https://faisalabad.punjab.gov.pk/climate>

¹² Weather Atlas Faisalabad weather

As per the **Global Climate Risk Index 2021**, Pakistan ranked in the top ten countries that suffered the most from extreme weather events¹³. Punjab's urban areas are particularly vulnerable to climate change. Some of them are heat stress (Urban Heat Island, or UHI), extreme precipitation, landslides, inland flooding, drought, and a lack of water. As shown in Table 3, the Climate Change Profile of Pakistan ranks districts of Faisalabad according to the climate risks and hazards classification.¹⁴

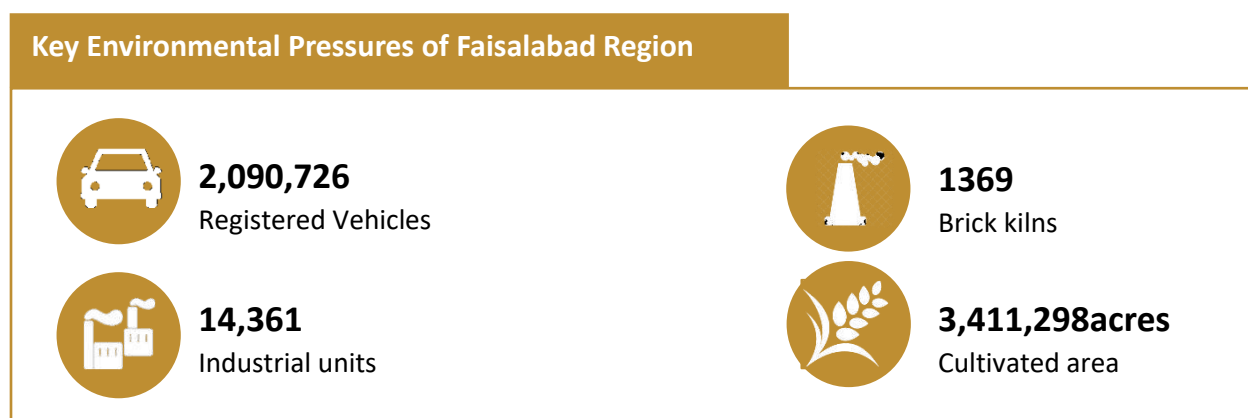
Table 3: Climate Change Risks and Vulnerability ranking of Faisalabad

Rank	Districts	Flood Risk	Landslide Risk	Earthquake Risk	Cyclone Risk	Drought Risk
70	Faisalabad	3	1	4	2	4
71	Toba Tek Singh	3	1	4	2	4
75	Jhang	5	1	3	2	3
93	Chiniot	3	1	3	2	3
Scoring key						
Very High		High	Medium	Low	Very Low	
5		4	3	2	1	

According to the climate risks ranking, Jhang is considered to be at a high risk of flood with the fact that the Chenab River flows to the west of the district adjacent to Jhang city. While the risk of earthquakes and droughts seems to be high in the area of Faisalabad and Toba Tek Singh districts. Additionally, wind and dust storms are common in the Faisalabad division. Sand and dust clouds are carried away by the strong wind throughout the year.

2.2. Environmental Quality

Faisalabad division is considered a major economic hub of Punjab. Despite its major contribution to the country's annual GDP through both industrial development and agricultural production, these economic activities also affect the health and well-being of the local resident by deteriorating their air quality and environment due to high levels of pollution.



¹³ <https://www.germanwatch.org/en/cr>

¹⁴ Chaudhry, Q. 2017. *Climate Change Profile of Pakistan*. Asian Development Bank, Philippines. doi.org/10.22617/TCS178761

2.2.1. Air Quality

The air pollution in different districts of the Faisalabad Division is mostly caused by heavy traffic, industries, and traffic congestion. There are **14,361 industrial units** in the division, of which most of them (more than 90 percent) are present in the Faisalabad district. Faisalabad is famous as a textile hub with more than 7,700 textile miles clustered in the region.

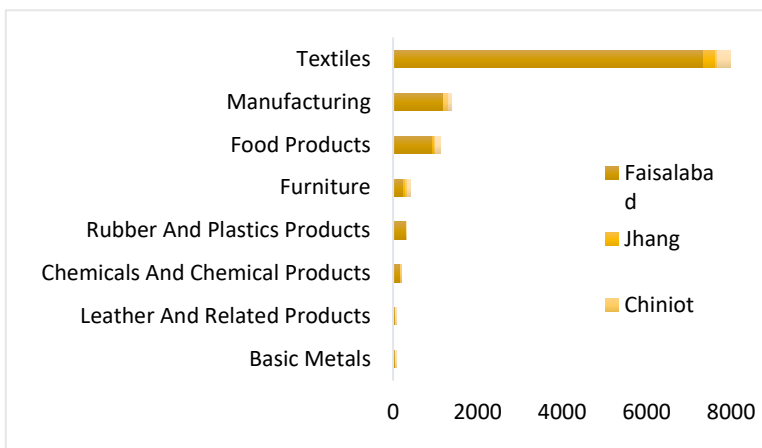


Figure 3: Major Industries in Faisalabad Region

There are **1,369 brick kilns** in Faisalabad division. These brick kilns emit carbon and soot particles as a primary source of pollution. PDMA did a commendable job by providing interest-free loans to brick kiln owners for the conversion of conventional brick kilns into ZigZag technique. The ZigZag technique is not only 30 percent fuel efficient but also reduces 70 percent of air emissions and is effective in properly baking the bricks by preventing heat loss.

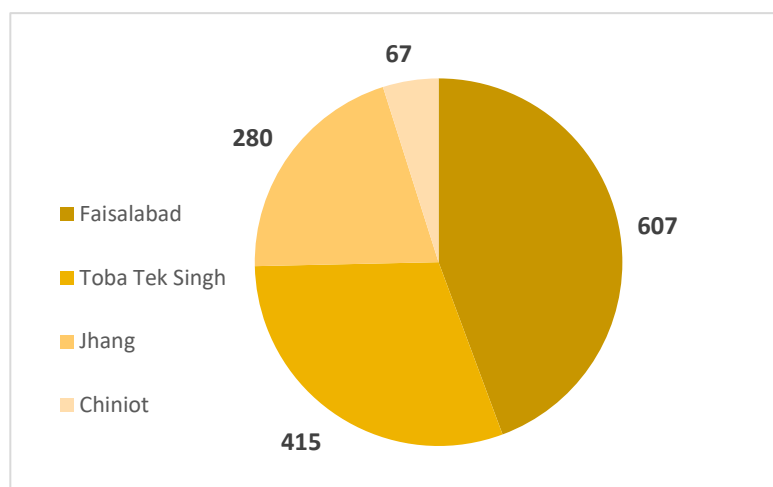


Figure 4: Number of Brick kilns in Faisalabad Division

The environment team monitored particulate matters (PM_{2.5} and PM₁₀) in the field with the help of portable air quality monitoring instruments at more than 200 points in Faisalabad Division. The monitoring results showed that the concentrations of PM_{2.5} were recorded above the Punjab Environmental Quality Standards of 35 µg/m³ at most of the sampling sites. This is mainly due to unpaved roads, traffic congestion, emissions from industries & brick kilns, and stubble burning in fields.

Similarly, the monitoring done in the field showed that the concentrations of PM₁₀ are recorded higher than the permissible limit of PEQS i.e., 150µg/m³ mostly at the west and north western areas of the division (i.e., Jhang and Chiniot) due to fugitive dust from unsealed roads, kms long que of sugarcane tractor trolleys on Chiniot – Jhang road, construction activities, agriculture waste and solid waste burning, and wind-blown dust particles on the roads. The effect of these pollutants is localized and temporarily affects the air quality in the immediate vicinity of the roads.

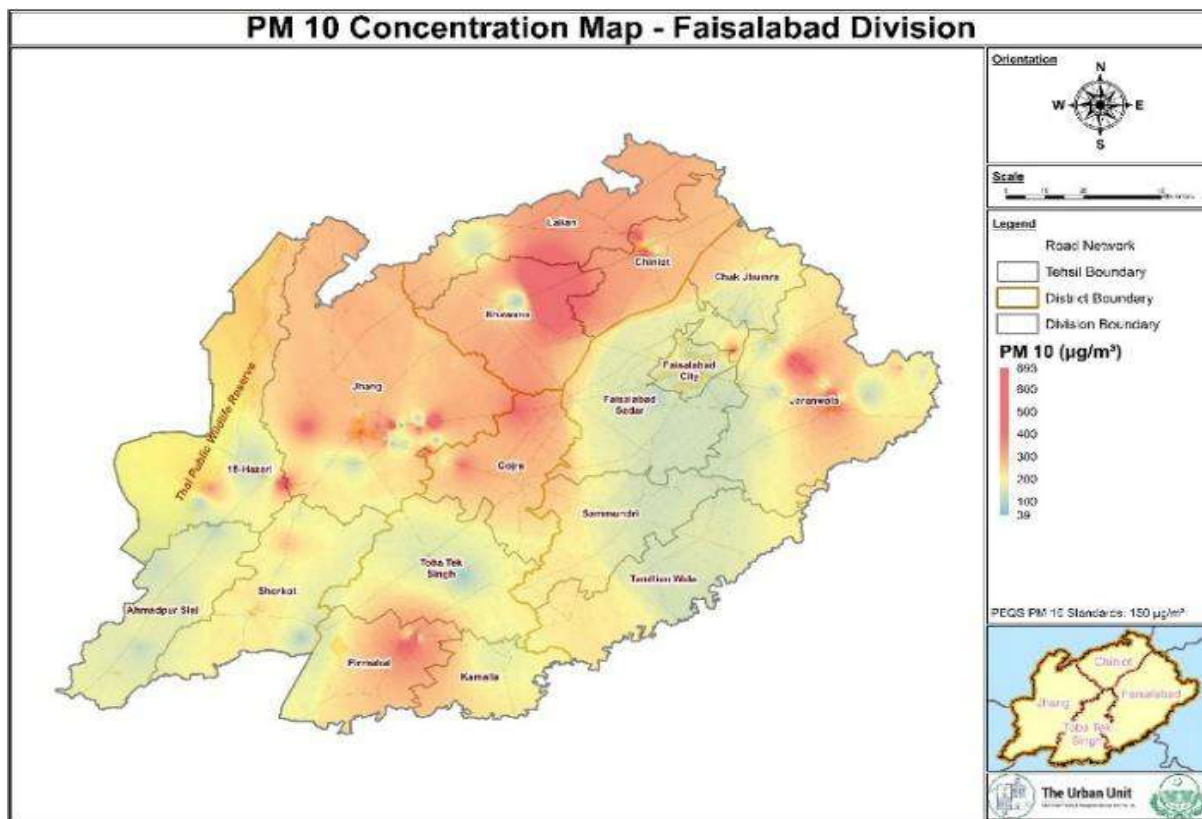
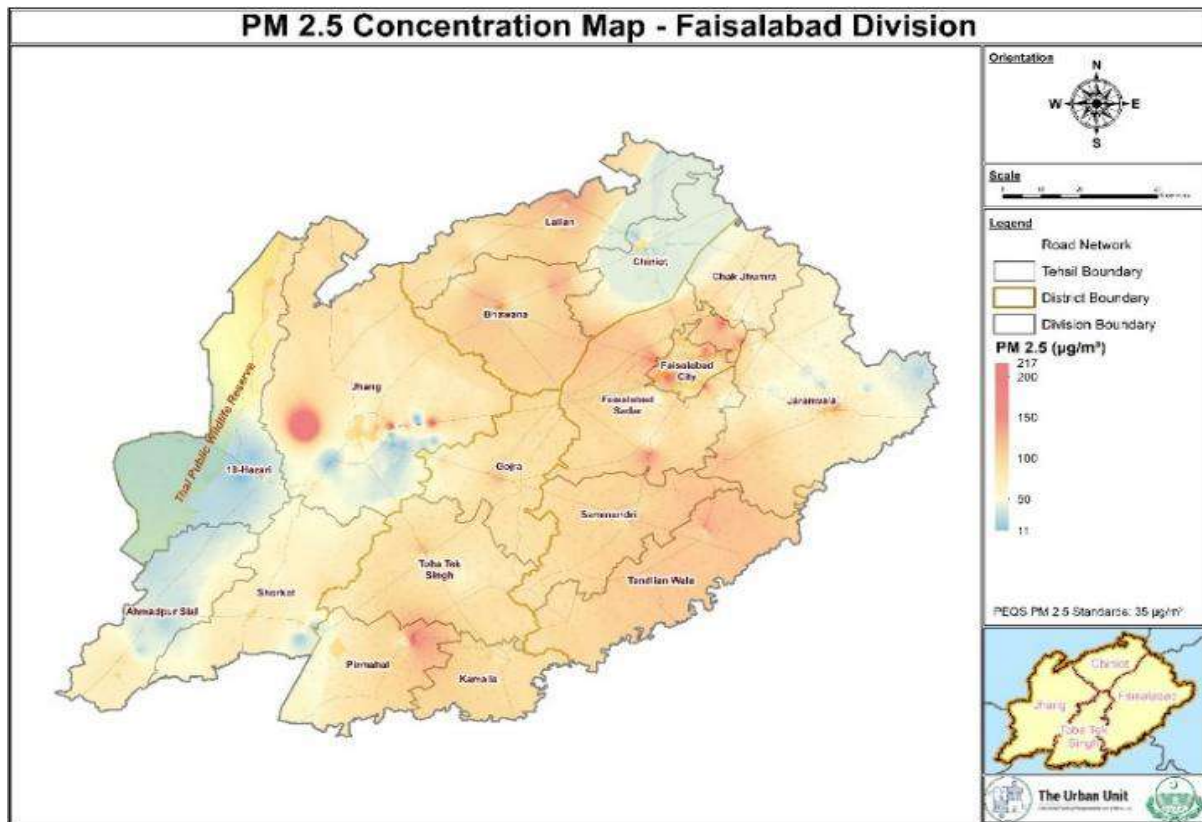
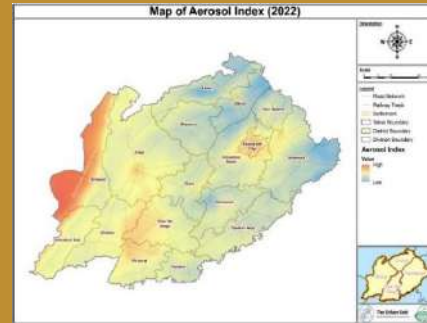


Figure 5: PM_{2.5} and PM₁₀ Concentration of Faisalabad Division

To compliment air quality monitoring in the field, the research team at the Urban Unit uses remote sensing and satellite data to evaluate the pollution concentrations of Aerosol Index, Sulphur Dioxide and Nitrogen Dioxide in the region. The results of these analyses are spatially represented below.

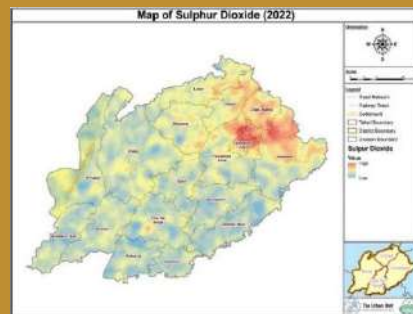
Aerosol Index (AI)

The concentration of AI was high at the western side which is mainly due to the presence of particulate matter arising from the Thal Desert.



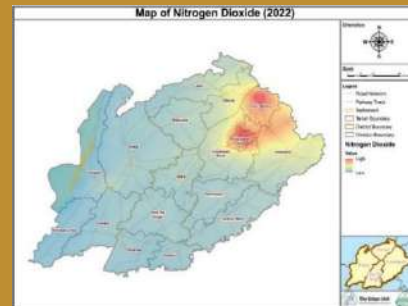
Sulphur Dioxide (SO₂)

The concentration of SO₂ was high around the city of Faisalabad due to the presence of a large number of industrial units in FIEDMC and Marble & Crushing Units in the city.



Nitrogen Dioxide (NO₂)

The concentration of NO₂ was high around the city of Faisalabad mainly due to vehicular and industrial emissions along the Highways.



Carbon Monoxide (CO)

CO was found to be high in the North East of district Faisalabad due to fumes from the burning of fuel in cars or trucks, fireplaces, or furnaces.

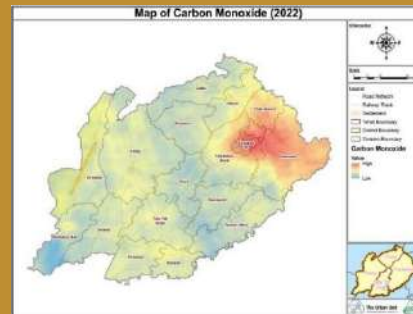


Figure 6: Concentration of AI, SO₂, NO₂ and CO in Faisalabad Region

2.2.2. Noise Quality

Noise Quality was also monitored at 200 points in the field using portable equipment. The results showed that noise concentrations were higher than the recommended permissible limit of 65 dB in the cities near commercial areas or near busy road. Overall, the noise pollution at most of the points were under control and well within the limits of Punjab Environmental Quality Standards (PEQS).

2.2.3. Water Quality

Water quality data of the Faisalabad division was assessed using past surveys of UNICEF (2013) and Punjab Saaf Pani (2015). The survey results showed that out of 3600 samples of the Faisalabad division, 43 percent of groundwater quality samples have TDS of more than 1000 ppm.

The concentration is even higher in the Faisalabad District with 46% of 1500 groundwater samples followed Toba Tek Singh District with 37% of 1300 samples, Jhang District with 12% of 600 samples and Chiniot District with 10% of 250 samples were above the prescribed limits of Punjab Environmental Quality Standards (PEQs) <1000.

2.2.4. Waste Water Assessment

Wastewater of Faisalabad is discharged through two major drains i.e., Paharang drain and Madhuana drains and other domestic drains into Chenab River and Ravi River. More than 70 percent of industrial wastewater discharges through Madhuana drain that ends up in River Ravi. Madhuana drain joins Samundri drain and converts into Main Samundri drain. It carries effluents from industrial and residential areas of Samundri and Faisalabad city and discharges into Ravi River at Mamoon Kanjan, within Faisalabad district. The drain adds about 55 tons/day¹⁵ of organic load into Ravi River. The level of BOD and COD of wastewater in Samundri drain also exceeds the WHO guidelines and NEQS permissible limits.

Chokera Waste Water Treatment Plant having capacity of 20 MGD is one of the few WWTP in Punjab that is treating both domestic and industrial waste through anaerobic and facultative ponds. IN 2014 National Institute for Biotechnology and Genetic Engineering (NIBGE) installed Floating Treatment Wetlands (FTWs) in one of the Wastewater Stabilization Ponds (WSPs) at Chokera over the area of 10,000 ft² in the pond.

¹⁵Nasir, A., Nasir, M. S., Shauket, I., Anwar, S., & Ayub, I. (2016). Impact of Samanduri drain on water resources of Faisalabad. *Advances in Environmental Biology*, 10(1), 155-160

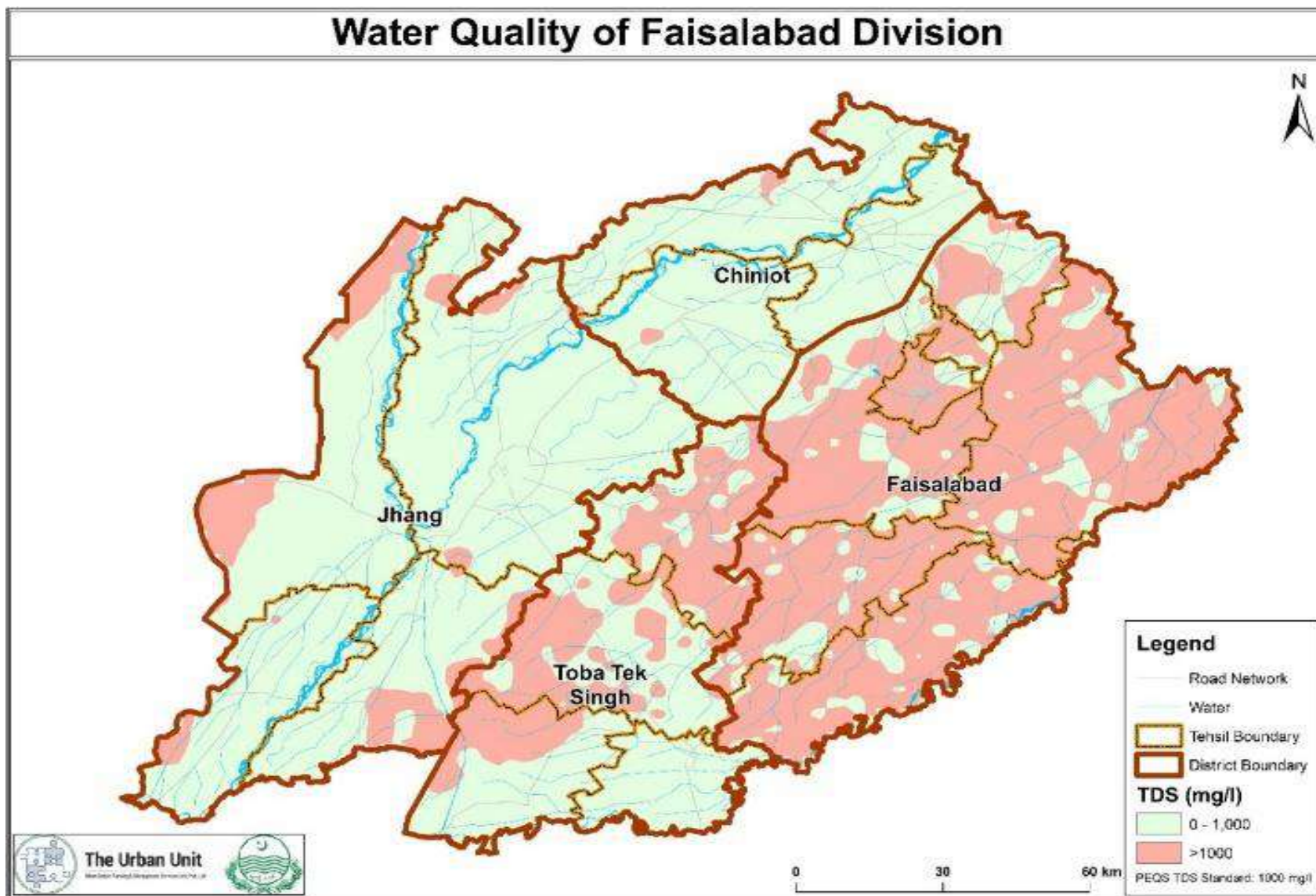


Figure 8: Water Quality of Faisalabad Region

2.2.5. Green Spaces

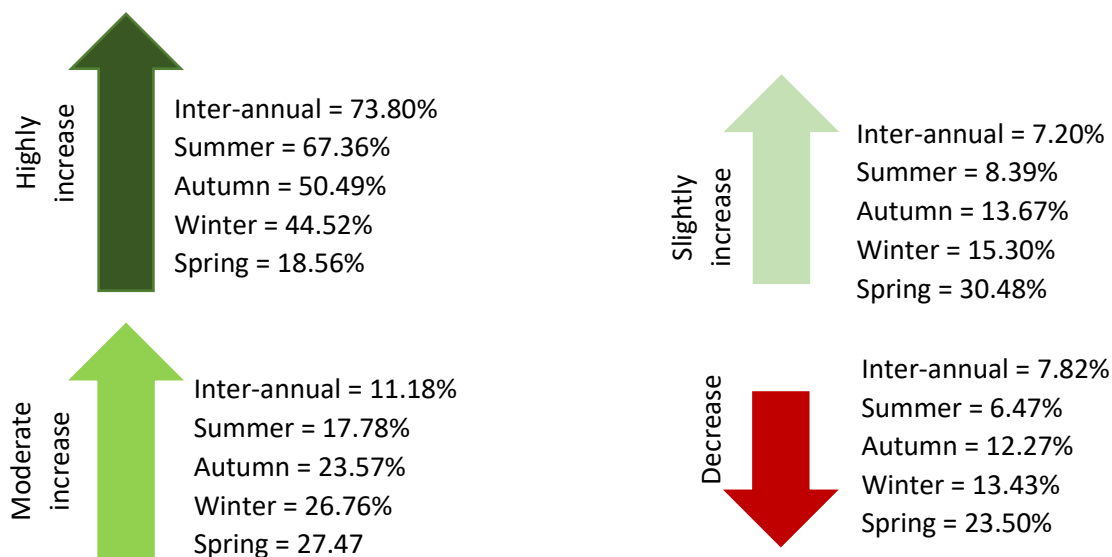
Spatial patterns of vegetation dynamics of the Faisalabad division were derived through the Normalized Difference Vegetation Index (NDVI). NDVI is considered the most common indicator in monitoring vegetation dynamics over large-scale areas and thus, it has been used to monitor vegetation greenness. The NDVI dataset for the Faisalabad division was acquired from Moderate Resolution Imaging Spectroradiometer MOD13A1(500 m) used in this study. The inter-annual and seasonal pixel-wise NDVI trends were calculated. The seasons were primarily categorized as Spring (March–April), Summer (May–September), Autumn (October–November) and Winter (December – February).

Vegetation trends in the Faisalabad region showed diversified substantial significant greening trends during inter-annual and seasonal level because of climatic influence. Spatially, percentage areas in highly increasing trend found highest in inter-annual (73.80 %) followed by Summer (67.36%), Autumn (50.49%), Winter (44.52 %) and Spring (18.56%).

In contrary to highest increasing trend, moderate increasing trend found highest in by Spring (27.47%), followed by Winter (26.76 %), Autumn (23.57%), Summer (17.78%) and interannual (11.18%).

Similarly, slightly increasing trend found highest in Spring (30.48%), followed by Winter (15.30%), Autumn (13.67%), Summer (8.39%) and interannual (7.20%).

Moreover, browning trend also found highest in Spring (23.50%), Winter (13.43%), Autumn (12.27%), interannual (7.82%) and Summer (6.47 %) respectively Figure 10.



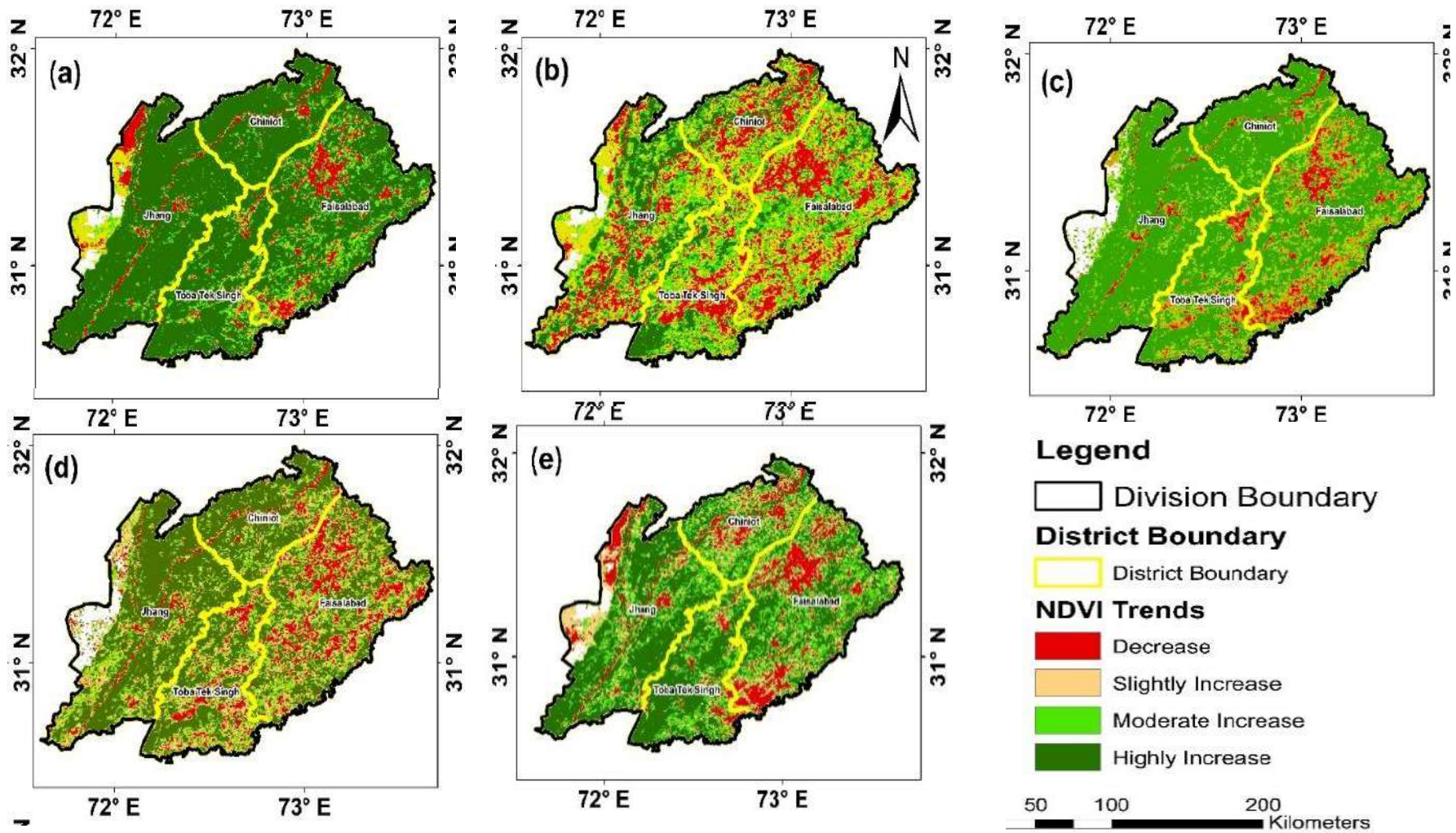








Figure 9: Spatial temporal trends of NDVI of Faisalabad division during 2001 – 2022; (a) Inter-annual, (b) Spring (c) Summer, (d) Autumn, (e) Winte

2.3. Key Environmental Issues and Challenges

 <p>Air Pollution (Industries, Heavy duty vehicles, brick kilns)</p>	 <p>Water & Wastewater Pollution Industrial discharge</p>	 <p>Forest Encroachment and Tree cutting</p>
 <p>Biomass Burning</p>	 <p>Open dumping of waste, lack of dumping sites</p>	 <p>Limited Parks and Green Spaces in Urban areas</p>

2.4. Biodiversity Conservation Areas

Faisalabad has notable forest and wildlife areas under different categories of forest and protected areas act of Punjab. Forests are determined both by the presence of trees and the absence of other leading Land use areas. The Forest is a broader terminology used for the conservation, protection and production of natural resources e.g., Forest cover in National Parks to conserve habitats, natural reserves and other protected areas.

Forest is referred to as land with a tree cover occupying **>0.5 hectares** (FAO, 2018)



The Urban Unit team visited more than 12 environmentally sensitive and high conservation value areas during the field visit of Faisalabad Division. Detailed assessments of these visits were conducted which provides a basis to understand the basic challenges of biodiversity in the region. Details of forest lands in each district, key field observations and assessment of these sites are presented in the subsequent sections.

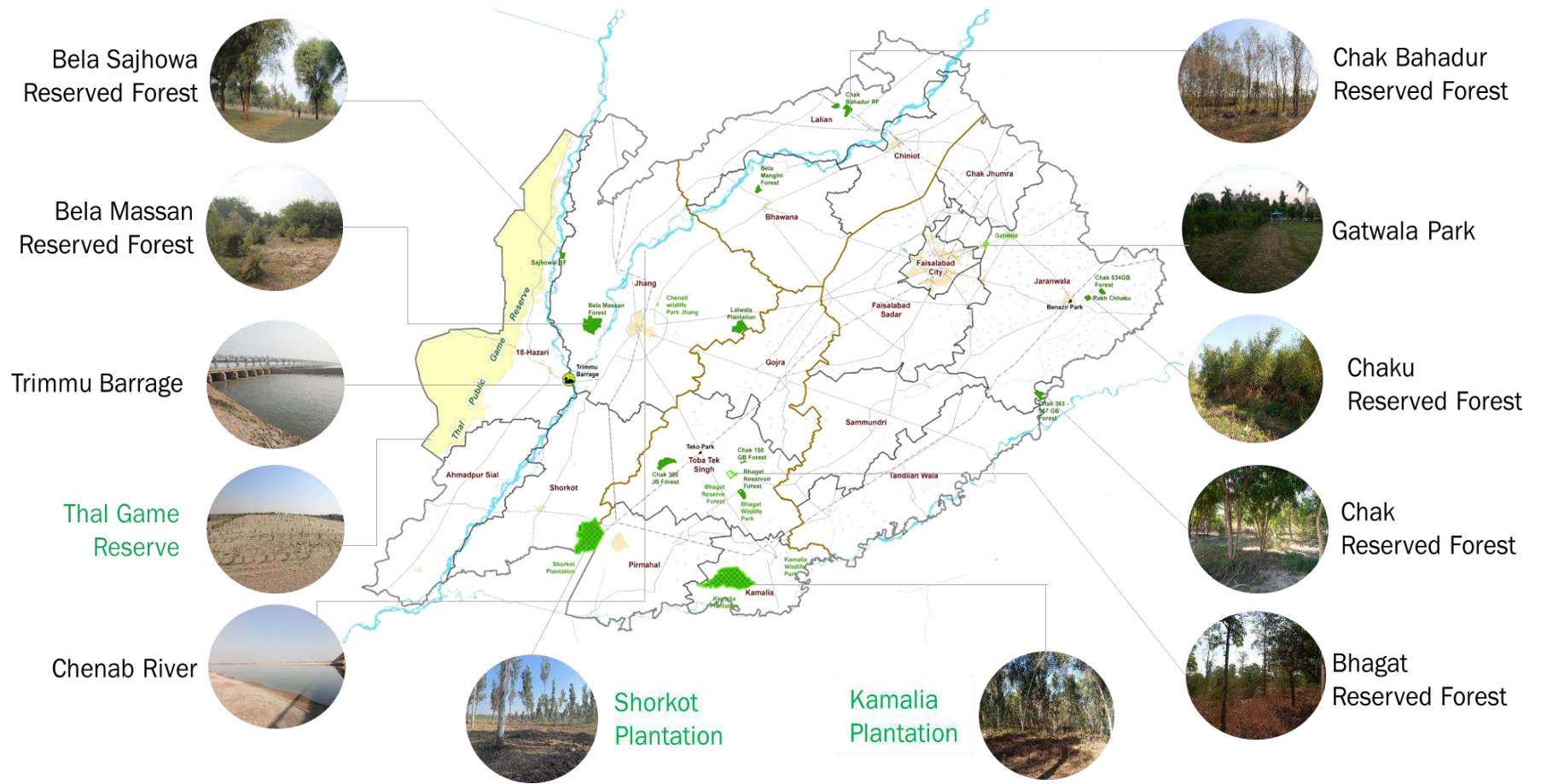


Figure 10: Conservation Sites in Faisalabad Region

2.4.1. Forest Lands at Faisalabad District

In the Faisalabad district, following are the forest lands notified under different categories;

Sr. #	Name	Gross Area	Planted	Plantable Blank
1.	Gatwala	131	131	0
2.	Rakh Chakku	940	322	102
3.	Chak 648-GB	390	227	151
4.	Chak 363-GB & 367-GB (Khuppi)	901	282	558
5.	Chak 250-RB	536	0	536
6.	Chak 155-RB	461	0	461
Net Gross Area		3,359	962	1,808

Key Field Observations and Assessments

The key findings about the forest land of district Faisalabad are as follows:

- Agricultural practice was observed on forest land.
- Forest land encroachment by local residents is common.
- Planted area is very limited and along the periphery.
- Monoculture plantations and open spaces are reducing biodiversity in the region.



Figure 11: (a) Agricultural Practiced (b) Agricultural Crops (c) Peripheral Plantation

2.4.2. Forest Lands at Toba Tek Singh District

Toba Tek Singh occupied comparatively more area under forest land which supports the environmental values of the region. The area statement of the region is as follows:

Sr. #	Name	Gross Area	Planted	Plantable Blank
1.	Kamalia Plantation	10,866	7,537	1,390
2.	Chak 300-GB	1,491	0	1,371
3.	Chak 150-GB	76	0	66
4.	Chak 160-GB	186	103	50
5.	Chak 359-GB & 361-GB	618	196	324
6.	Chak 324-JB	351	104	219
Net Gross Area		13,588	7,940	3,420

Key Field Observations and Assessments

The forest land of Toba Tek Singh is fertile and has a variety of flora that support a diversity of birds and animals but some of the important key finding based on habitat assessment and diversity analysis are as follows:

- Mostly exotic species (*Eucalyptus camaldulensis*) is practiced to plant forest land which reduces the biodiversity of Kamalia plantation.
- Few compartments are planted with indigenous plantations which support the local biodiversity of the region.
- Increase in invasive alien species i.e. *Prosopis juliflora* is common, which also effecting the local biodiversity of the region.
- Forest land encroachment is commonly practiced by the local resident on Chak 300-GB forest land.



Figure 12: (a) Mix Plantation Bhagat (b) Exotic Species Plantation Kamalia (c) Indigenous Plantation

The Quadratic Species richness analysis was performed at the Bhaghat Plantation and Kamalia Plantation. The analysis showed that the exotic species were mostly planted at the Kamalia plantation which had a negative impact on the local diversity of fauna and flora. While on the other hand, Bhaghat Plantation forest where indigenous species are commonly planted showed a positive impact on the local biodiversity and have a variety of flora with thirteen different species which are maintaining a habitat for animal diversity.

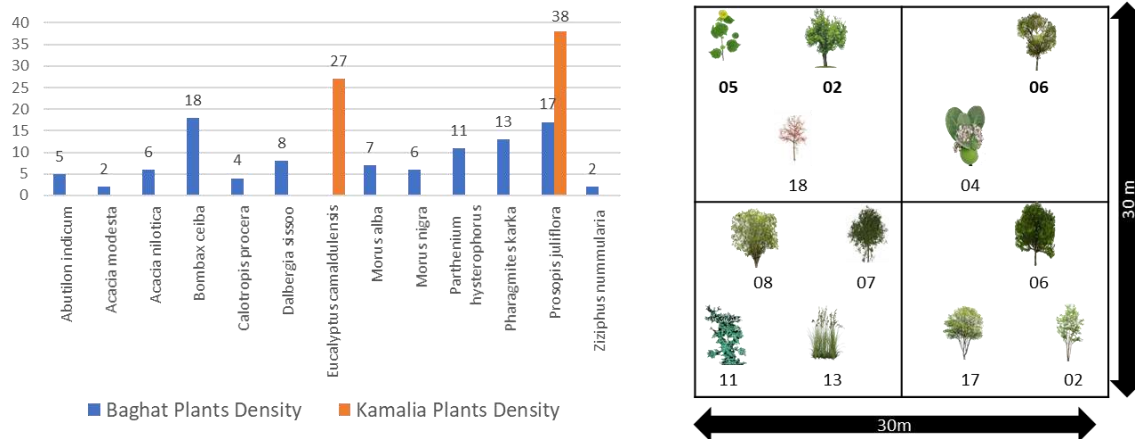


Figure 13: Species alpha diversity Analysis of Two Forest Plantation

2.4.3. Forest Lands at Chiniot District

The forest land of Chiniot district is comparatively limited which is 0.4% of the total land area of Chiniot, where less than 0.1% of the total land is planted. Statistical data of forest lands at Chiniot district is as follows:

Sr. #	Name	Gross Area	Planted	Plantable Blank
1.	Chak Sarkar Chiniot & Mathram	1,006	0	0
2.	Chak Bahadar	1,141	261	601
3.	Chak 150-GB	484	320	80
Net Gross Area		2,631	581	681

Key Field Observations and Assessments

- The planted area of Chiniot district is fragmented which negatively affects the biodiversity of the region.
- Monocultural plantation trend of Eucalyptus camaldulensis (Sufaida) is common.
- Major area of forest lands at Chiniot district is blank.



Figure 14: (a). Blank Area (b) Plantable Blank Area (c) Monocultural Eucalyptus Plantation

2.4.4. Forest Lands at Jhang District

Jhang is the land where different habitats are providing shelter to a variety of wildlife, these habitats are desert habitat, aquatic habitat and forest habitat. Some of the diversified forest land are as follows:

Sr. #	Name	Gross Area	Planted	Plantable Blank
1.	Chak Jalal Din	702	225	275
2.	Chak 170-JB	2,015	913	782
3.	Chak 700-JB & 703-JB	51	5	41
4.	Chak Said Bahram	2,101	400	1,628
5.	Chak Maddressa	933	213	686
6.	Bela Sajhowal	359	347	12
7.	Shorkot Plantation	9,841	6,640	3,000
Net Gross Area		16,002	8,743	6,424

Key Field Observations and Assessments

- Bela’s forest plantation with a variety of plants is a habitat of many animal species like jackals, porcupines, wild hares, wild boar and a diversity of avifauna.
- Grazing, forest fire and cutting of trees are common which destroy the natural habitat
- Most of the forest land planted area was introduced by an exotic species i.e. Sufaida which affected the moisture of soil and reduced the diversity of the area.



Figure 15: (a) Kikar Plantation Massan forest (b) Bela Sajhowal (c) Eucalyptus Plantation Shorkot

2.5. Wildlife Protected Areas

Faisalabad division has a unique variety of biodiversity and providing a number of ecosystem services. Details are as follows:

2.5.1. Chaku Plantation Game Reserve Faisalabad

In the Faisalabad district, a game Reserve covering an area of about 940 acres was established under the wildlife act 1974 of the Government of Punjab. A wide range of birds and other wildlife species like grey francolin, greater coucal, porcupine and herpetofauna visited and stayed at this place predominantly.






2.5.2. Kamalia & Bhagat Plantation Game Reserve Toba Tek Singh

Bhagat and Kamalia plantations were both notified under the wildlife protected act as Wildlife Sanctuaries to conserve and protect the wildlife species of Toba Tek Singh, however, the status of both plantations were later reversed to Game Reserve. The major faunal diversity of the region includes porcupines, wild hares, wild boars, jackals, grey francolin, jungle prinia, Jungle babbler, greater coucal and reptilian species.

2.5.3. Thal & Shorkot Plantation Game Reserve

In District Jhang, Shorkot Forest Plantation and Thal Game Reserve spreads over an area of 9,841 and 255,663 acres respectively, that were notified under Game Reserve category of Punjab Wildlife Act 2020. These areas are notified to conserve and protect the wildlife of Jhang district. Some of the important animal species includes Houbara bustard, shikra, Indian roller, jackals, desert hare and common lizards.

2.6. Major Threats to Conservation Sites

 <p>Change in Land Agricultural practice on forest land – Faisalabad Mix cropping in Bhagat Reservoir – T.T. Singh</p>	 <p>Invasive Species Increase in invasive alien species i.e., <i>Prosopis juliflora</i>– T.T. Singh</p>	 <p>Forest Land Encroachment Forest land Encroachment– Faisalabad</p>
 <p>Limited plantation / Open spaces Limited Planted area, reducing plant diversity– Faisalabad Chak Bahadar Reserved Forest - Chiniot</p>	<p>Monoculture Plantation Sufaida (<i>Eucalyptus camaldulensis</i>) plantation; reduce moisture of land Chak Mangeni Reserved Forest, Chiniot Kamalia, T.T. Singh (very few planted with Thali & Kikar) Shorkot (80% sufaida), Jhang</p>	

Legal Landscape

The constitution of Pakistan has substantially altered the allocation of legislative powers between the National and Provincial Assemblies, resulting in more Provincial autonomy. Powers have been assigned to provincial Environmental Protection Agencies/Departments (EPAs/EPDs) Some of the key national/provincial regulations that are considered related to the Regional Development Plan of Faisalabad is enlisted below whereas details are attached in Annexure – A.

National Framework	Provincial Framework
<ul style="list-style-type: none"> ▪ Pakistan Climate Change Act, 2017 	<ul style="list-style-type: none"> ▪ Punjab Environment Protection Act, 2017
<ul style="list-style-type: none"> ▪ Forest Act, 1927 	<ul style="list-style-type: none"> ▪ Policy on Controlling Smog, 2017
<ul style="list-style-type: none"> ▪ Pakistan Environmental Protection Act, 1997 	<ul style="list-style-type: none"> ▪ Punjab Environmental Protection (Delegation of Powers for Environmental Approvals) Rules, 2017
<ul style="list-style-type: none"> ▪ National Climate Change Policy, 2012 	<ul style="list-style-type: none"> ▪ Punjab Hospital Waste Management Rules, 2014
<ul style="list-style-type: none"> ▪ Framework for Implementation of Climate Change Policy, 2013 	<ul style="list-style-type: none"> ▪ Punjab Environmental Protection Motor Vehicle Rules, 2013
<ul style="list-style-type: none"> ▪ National Sustainable Development Strategy, 2012 	<ul style="list-style-type: none"> ▪ Punjab Environmental Protection Administrative Penalty Rules, 2013
<ul style="list-style-type: none"> ▪ National Disaster Risk Reduction Policy, 2013 	<ul style="list-style-type: none"> ▪ Regulation of Disclosure of Environmental Information and Citizen Engagement, 2020
<ul style="list-style-type: none"> ▪ National Forest Policy, 2015 	<ul style="list-style-type: none"> ▪ Environmental Sampling Rules, 2001
<ul style="list-style-type: none"> ▪ National Rangeland Policy, 2010 	<ul style="list-style-type: none"> ▪ Pollution Charge Rules, 2001
<ul style="list-style-type: none"> ▪ Review of IEE / EIA Regulations, 2000 	<ul style="list-style-type: none"> ▪ Environmental Tribunal Rules, 2012
<ul style="list-style-type: none"> ▪ National Conservation Strategy, 1992 ▪ Biodiversity Action Plan for Pakistan, 2000 ▪ Guidelines for sensitive and critical areas, 1997 	<ul style="list-style-type: none"> ▪ Punjab Environmental Quality Standards (municipal and liquid effluents, drinking water, motor vehicles, ambient air, noise, treatment of liquid and disposal of biomedical waste and Industrial gaseous emission), 2016. ▪ Punjab Forest Policy, 2019

Vision, Objectives and Goals

4.1. VISION

A vibrant and internationally competitive region with sustainable development in conducive environment whilst protecting and improving biodiversity where ecological resources are proficiently managed and conserved, cleaner environment, climate resilience and recreational facilities may be important indicators of the region's macro-level socio-economics. ””

4.2. GOALS

To protect, conserve and retain the ecological values as well as sustainable development of the region for current and future generations, predominantly as a derivation of glory, inspiration, education, recreation and enhance the local community's livelihood.

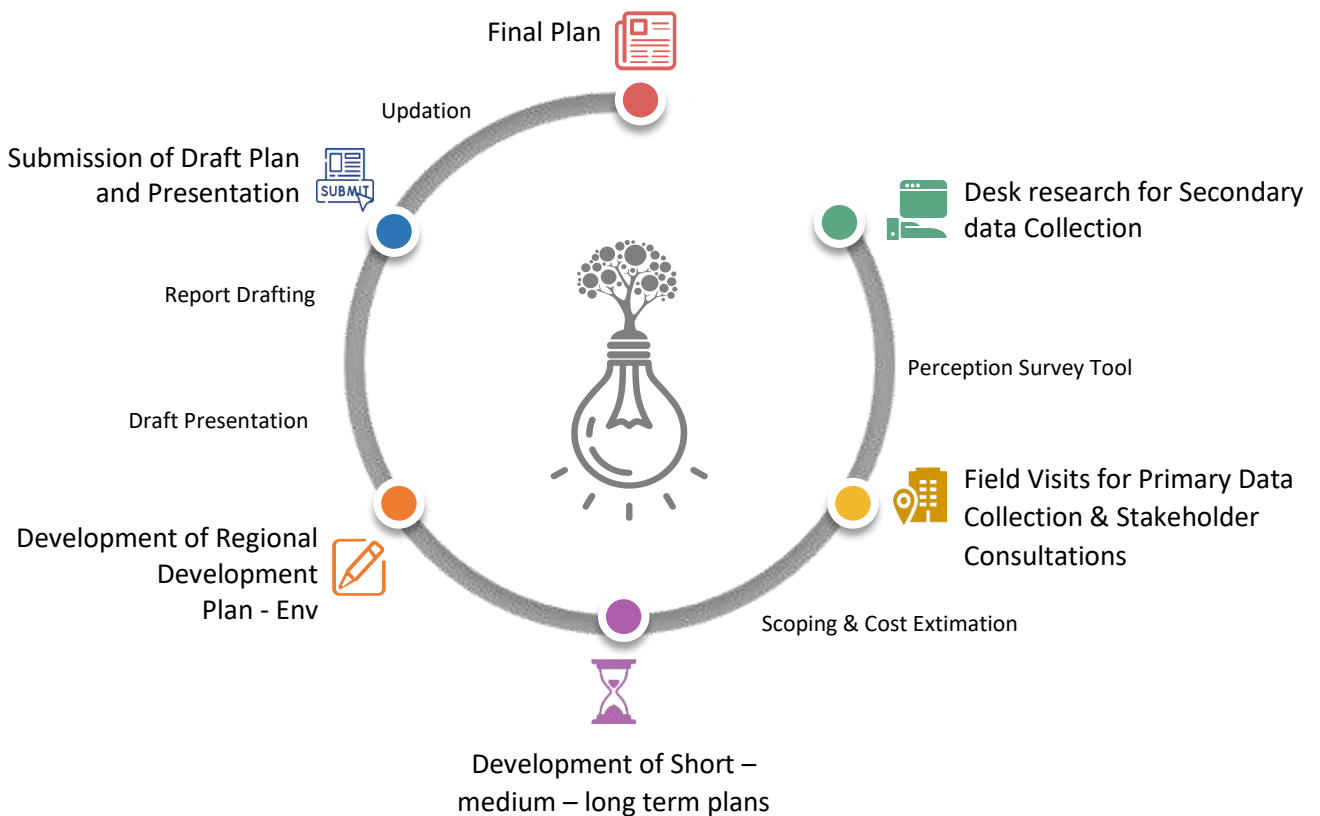
4.3. OBJECTIVES

This plan helps to prioritize development projects at the regional level based on current conditions and future growth needs. Specific objectives of the plan are as follows:

- To identify potential projects & programs that can contribute to the economic growth, environment protection, conservation, employment opportunities and exploit competitive benefits of region.
- Improve the overall state of environment in Faisalabad Region.
- Project Prioritization and capacity needs for improve livability and competitiveness.
- Such a plan will fulfill a longstanding demand of local officials to have a document that can provide them a strategic vision for the development of the region and have a voice in the overall planning process in the province.

Methodology

Faisalabad Regional Development Plan for the Environment sector was developed to prioritize the most resilient and sustainable solutions for the mitigation of the baseline environmental issues. The plan focuses on adopting a combined approach of data collection from field visits and literature while involving all regional and provincial stakeholders (government organizations and local community) and using modern remote sensing technology for impacts assessment on the ground scale. It provides a framework of interventions for environmental improvement, divided into short, medium, and long-term plans spanning from three to ten years. The methodology adopted for the purpose of this plan is given below:



5.1. Field Visits

The Team of experts consisting of environmental scientists, environmental engineers, biodiversity professionals, and archaeological experts from the Environment and Social Safeguards Division visited the Faisalabad Division for primary data collection. Field Visits were conducted in three phases;

Inception Visit:

The inception visit consisted of stakeholder consultation meetings with the Commissioner of Faisalabad Division, and Deputy Commissioners of Faisalabad, Jhang, and Chiniot Districts. It was conducted by the senior officials of the Environment Team between November 7 – November 9, 2022.

Rapid Assessment Survey:

Rapid Assessment Survey was conducted between November 22 – 25, 2022 by a team of experts from the Environment & Social Safeguards Team. It mainly consisted of meetings with key stakeholders and rapid assessment surveys of the major urban centers in Faisalabad, Jhang, Chiniot, and Toba Tek Singh. The institutional hierarchies, inter-linkage of departments, key concerns of the stakeholders, and technical and capacity-building issues were identified during this survey. In addition, air quality and noise were monitored, key sources of air and water pollution were identified, and current conditions of the cultural and archaeological sites and green spaces were assessed in major urban centers.

Detailed Assessment Survey:

The detailed assessment survey was conducted by the Environment & Social Safeguards Team between December 9 – 16, 2022. This survey mainly focused on field surveys in all 17 tehsils of the Faisalabad, Jhang, Toba Tek Singh, and Chiniot Districts. The baseline environmental, biodiversity, and archaeological conditions were assessed, key areas of interventions for environmental improvement were identified, and the perception of local residents relevant to the quality of the environment and green spaces was recorded.

5.2. Stakeholder Consultation

A total of 15 Consultation Meetings with key government officials in the Faisalabad Division were conducted by the Environment & Social Safeguards team. During these meetings, the key concerns of relevant departments and suggestions for environmental improvements were recorded. In addition, institutional capacities were examined. All key stakeholders provided complete support in the development of a practical and attainable regional development plan.



District Office, Faisalabad



PMD, Faisalabad



Deputy Director Env, Fsd



COs of MC, Chiniot



AD-EPA, T.T. Singh



PHA, Faisalabad



FIDMEC Industrial Estate



DFO, Jhang



MC Office - Jhang



Lyallpur Museum Office



DFO, Faisalabad



Revenue office, Faisalabad



Director Department of
Agriculture & Env Sci. GCUF



Assistant Deputy Commissioner-
Revenue, Faisalabad

Figure 16: Stakeholder's Consultations

5.3. Community Consultation

In accordance with the sustainability framework for environmental improvement, the concerns of the general public were also recorded through consultation. The community shared their main environmental concerns, changes in the environmental quality over the years, sources of air and water pollution, and causes of the negative environmental impacts of different kinds of development. All of these issues have been considered during the development of this regional plan in order to ensure the benefit of the community.



Figure 17: Community Consultation

Regional Development Plans

6.1. Framework

Punjab is the most vibrant as well as the populous province of the Pakistan. However, from past few decades the province is facing challenges not from the economic front but also from the ecological side. The Government of Punjab is well cognizant to the myriad problems that the province is facing. Therefore, in order to tackle these challenges Government of Punjab has taken series of initiatives and drafted various regulation/policies/strategies that address such issues (viz., rapid urbanization, unreliable service provision, low municipal service recovery, high environmental pollution and so forth) and create a regionally equitable economy across the province. As in the province, the public spending is distributed on the basis of administrative jurisdiction i.e., division (region), districts and tehsils, it is desired to consider spatial and socio-economic dimensions for improved service delivery and environmentally sustainable development at a macro scale

Keeping in view of all the facts such as present challenges, risks, gaps, needs and priorities for future economic development, a Framework for Environment Sector of Regional Development Plan of Faisalabad Region is designed. Each component of this framework is passed through a lens of existing infrastructure, governance and population factor. Comparative advantage is gained by using credible mapping resource and Geographic Information Systems (GIS) for spatial representation of relevant data along with current state of environmental conditions. Consultation is another keystone of the RDP drafting process which is done through meetings, data collection forms, field visits, planning exercises and feedback sessions. Finally, the framework is drafted which enlisting the priority projects at district level which are consolidated as one broader plan/project digest of Sargodha Region.

6.2. Project Digest/ Investment Plan

Based on the framework of regional development plan, desk review/secondary information, on-ground survey, perception and expectation survey, consultations with local community and meetings with local authorities, a Project digest is developed for Faisalabad Region, which can also call as Investment Plan. These projects are divided based on their urgency / priority for a ten-year span and divided in to short, medium and long term.

The total cost of the environmental sector project digest for Faisalabad Region is Rs. **5395** million.

6.3. Proposed Projects

The proposed projects for the improvement of environmental values and biodiversity conservation of Faisalabad division are as follows:

A. Short – Term Plan (Up To 3 Years) Estimated

Sr. No.	Proposed Projects	Government Entity	Estimated Cost (PKR million)
1.	Installation of Air Quality Monitoring System (2 BAM & 50 Low cost equip)	EPD	38
2.	Forest Plantation (Faisalabad – 900 Acres)	FWF	274
3.	Green and air urban Corridor in Samundri City (24.2 km)	MC	15
4.	Improvement of 40 semi developed parks of Faisalabad as part of Sustainable Parks Initiative (on an average area of 7 - 10 kanal)	PHA	800
5.	Improvement of Parks and placement of missing facilities: <ul style="list-style-type: none"> - 4 parks in Chiniot, - 2 Parks in Toba Tek Singh - 6 Parks in Jhang 	MC	240
6.	Railway Track beautification & Plantation (Toba Tek Singh, Chiniot, Jhang – 10.5 km)	Irrigation & FWF	11
7.	Plantation along water bodies (Jhang Branch Canal, Faisalabad Nullah and Chiniot Nullah) 50 km	EPD	38
Total			1,378

B. Medium – Term Plan (Up To 05 Years) Estimated

Sr. No.	Proposed Projects	Government Entity	Estimated Cost (PKR million)
1.	Installation of Air Quality Monitoring System (2 BAM & 100 Low cost Equip)	EPD	42.5
2.	Forest Plantation (Chiniot and Toba Tek Singh - 1300 Acres)	FWF	395
3.	Improvement of 40 semi-developed Parks of Faisalabad as part of Sustainable Parks Initiative.	PHA	800
4.	Nature-based solutions: Treatment and Plantation (Jaranwala/Sangla interception Drain and Sumandari Drain) (3 Floating Bed)	Irrigation	21.8

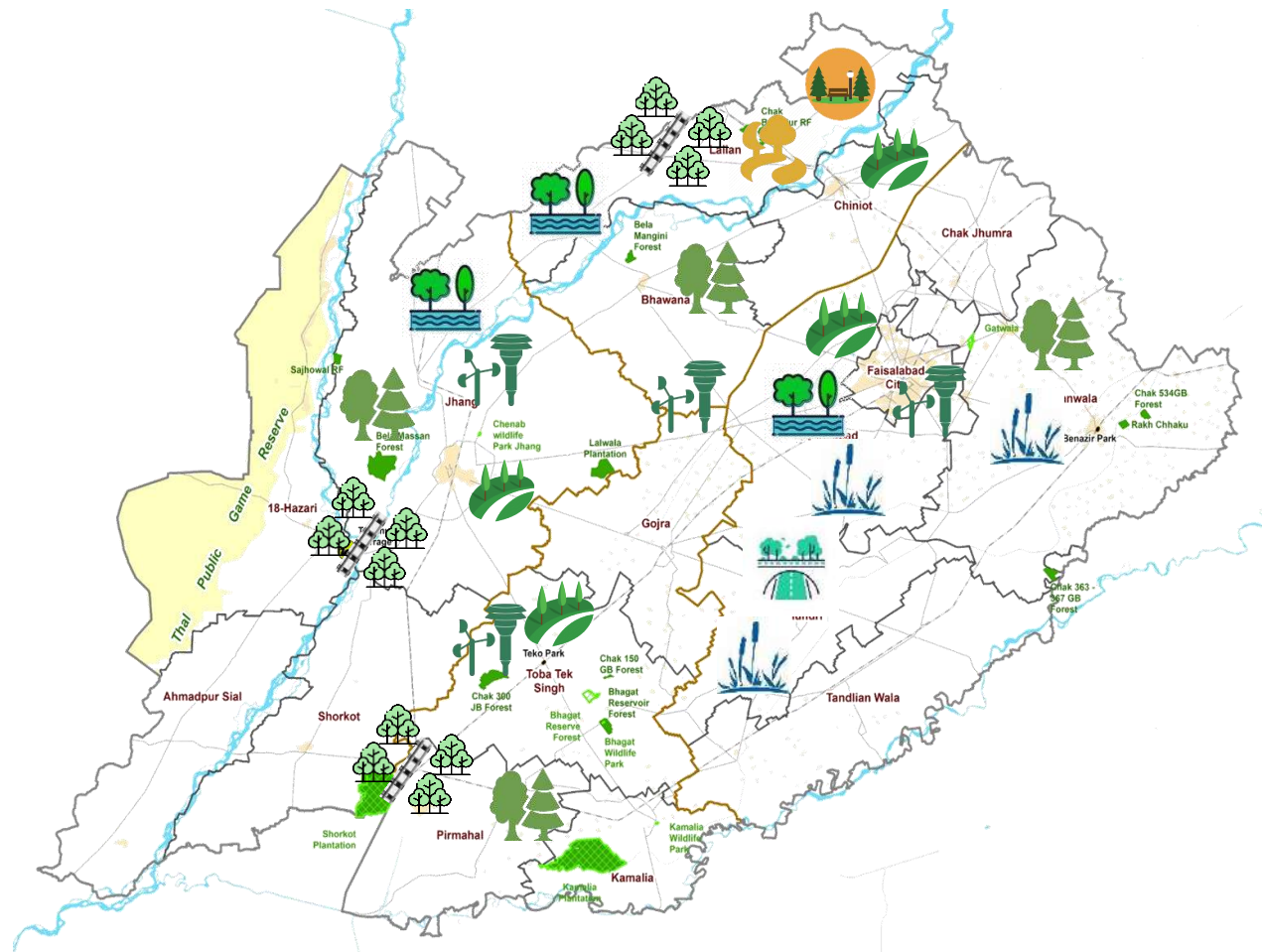
5.	Railway Track beautification & Plantation (Toba Tek Singh, Chiniot, Jhang – 10.5 km)	Railway & FWF	162
Total			1421.3

C. Long – Term Plan (Up To 10 Years) Estimated

Sr. No.	Proposed Projects	Government Entity	Estimated Cost (PKR million)
1.	Establishment of Forest Park near Lalian City (150 Acres)	FWF	221
2.	Forest Plantation (Jhang – 2500 Acres)	FWF	760
3.	Development of 64 semi-developed Parks of Faisalabad as part of Sustainable Parks Initiative.	PHA	1,408
4.	Nature-based solutions: Treatment and Plantation (Waste water Pond at Kurianwala road, Rasoolpur Village) (3 Floating Bed)	Irrigation & EPD	21.8
5.	Chenab River Habitat Sanctuary	MC	185
Total			2595.8

D. Proposed Interventions Map

-  Chenab River Habitat Sanctuary
-  Green and Air Corridor
-  Ambient Air Quality Equipment
-  Afforestation (Forest Plantation)
-  Park Improvement
-  Waste Water Treatment
-  Railway Track Beautification
-  Plantation along canal
-  Proposed Forest Park



6.3.1. PROJECT 1: Chenab River Habitat Sanctuary

The Chenab River Habitat Sanctuary will be a habitat of ichthyofaunal diversity and species of birds including waterfowls. The sanctuary will also vital to migratory birds and other wildlife of the region to enhanced the biodiversity richness. This flourishing urban sanctuary ecosystem will be influenced habitat conservation resulting in fresh water diversity that creates a dynamic and sustainably rich environment with high biodiversity. In addition to conservation and protection of this rare natural resource, the Sanctuary's goal also includes promoting environmental values and enhancing Sanctuary habitat.

Sanctuary will also help to promote the understanding toward physical environment, biological environment and interacting relation between human and wild resources. It also helps to promote research opportunities and the recreational values of the region.

This river sanctuary will serve as a flood protection site, with terraces of agriculture that protects the nearby Chiniot city from the flood. The sanctuary will also provide a recreation spot for the resident of Chiniot city and the nearby community, with amenities that includes walking tracks, cycling track, picnic spots, natural scenic spots etc.

Conceptual Design

The Habitat sanctuary design based on two major components of landscape design i.e. softscape and hardscape. The softscape of the region plan based on indigenous species of Faisalabad region and compartment with distinguished components.

- **Arboretum:** A proportion of sanctuary donated to tree varieties.
- **Fruticetum:** A proportion of sanctuary donated for the growth of shrubs and bushes.
- **Orchidarium:** An area of sanctuary donated to flowering plants.
- **Fish Hatchery:** A wetland within sanctuary for fish hatchery.
- **Green House:** Area for the establishment of seasonal and non-seasonal plant nursery and growth.



Figure 18: (a) Arboretum (b) Orchidarium (c) Green House



Figure 19: Conceptual design for Chenab River Habitat Sanctuary

Rough Estimate Cost

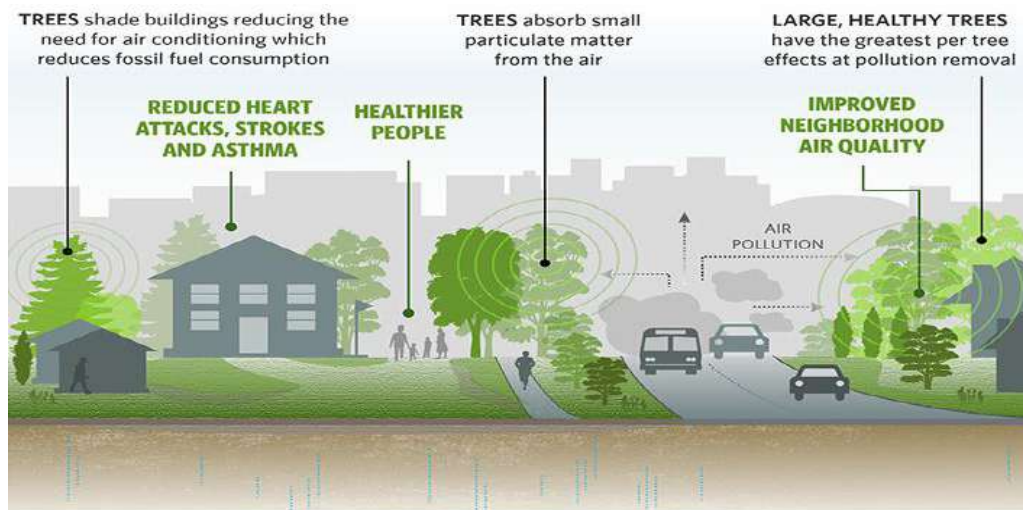
Table 4: Rough Cost Estimation for Chenab River Habitat Sanctuary

Sr. No	Description	Millions
1	Construction of Walking Trail	16.33
2	Construction of Bird Hide	2.33
3	Construction of Green House	23.86
4	Construction of Information Center/ Cafeteria	28.59
5	Construction of Toilet Block (Women and Men)	1.56
6	Construction of Parking Area	24.72
7	Construction of Fish Hatchery	13.58
8	Construction of Boardwalk	12.90
9	Construction of Natural Soil	11.35
10	Construction of Green Area	35.03
11	Plantation (Arboretum, Fruticetum, Orchidarium & Scatter Plantation)	1.82
	Sub- Total Amount	172.07
	Add Contingencies Cost (2.5%)	4.30
	Add PST (5%)	8.60
	Grand Total Amount with Contingencies and PST	185.0

6.3.2. PROJECT 2: Green and Air Urban Corridors

In order to improve the environmental values of cities, recent studies have emphasized the expansion of urban green spaces and link of these green spaces with the ecological corridors. They are frequently developed

along region of abandoned transportation infrastructure such as railway lines, roads, canal and nullah to create networks of green spaces. In addition to cooling cities



and enhancing air quality by creating cool air paths, green corridors are especially advantageous for urban biodiversity. Green corridor also helps to enhanced the aesthetic beauty of the urban areas and provide the recreational opportunities for locals.

Scope of The Project

To develop a Green Corridor with a larger collection of trees and other vegetation along Streets, Water features, in Parks, and Open spaces to provide a green solution to Urban Heat Island. Connecting green spaces as corridors can create a wind-induced cooling effect by reducing the local ambient temperature, enhancing the cooling effect.

Proposed Areas

Samundri City (Including Primary roads, secondary roads, canal, nullah and railway track).

Conceptual Design

- The green corridor should be a connected network of green cover and green spaces to achieved the basic aim of the project.
- The plantation along water channel should be planned and based on stratification to enhanced the beauty of the region.
- Number of rows based on the availability of spaces along the planting area.
- The placement of vegetation around developments and the maintenance of larger, interconnected green spaces throughout regions should be done to promote air quality improvement.

Conceptual Design of Green Corridor - Samundri City



Figure 20: Conceptual design for Green Urban Corridor

Rough Estimate Cost

Table 5: Rough Cost Estimation for Green and Air Urban Corridor

MRS Ref. #	Item No.	Description	Unit	Rate (PKR)	As Per Qty		
					Qty	Amount (PKR)	Millions (PKR)
N.s	1	Providing and planting of trees including the cost of pitting, fertilizer, watering completes in all respect for 24.2 km project	No's	375.00	36,848.00	13,818,000.0	13.82
					Total Amount	13,818,000.0	13.82
					Add 2% Contingency Charges	276,360.0	0.28
					Add 5% PST	690,900.0	0.69
					Total Amount Rs.	14,785,260.0	14.79

6.3.3. PROJECT 3: Installation of Air Quality Equipment

Faisalabad is one of the main industrial hubs and the third-largest city in Pakistan. The situation of environmental pollution in Faisalabad is aggravating, day by day due to industrial expansion, rapidly increasing urbanization, and an increasing number of vehicles are factors responsible for environmental pollution generally in terms of air quality. Air quality monitoring is an important factor in enabling effective monitoring decision-making on-air quality issues. One of the biggest challenges in air quality management is proper access to air quality data. The Pakistani government has started to respond to this air pollution challenge. The proposed project is to establish an air quality monitoring system in major hotspots of Pollutant concentration in the Faisalabad Division.

Scope of Project

The project aims to record air pollutant concentrations (PM_{2.5}, PM₁₀) in each district of the Faisalabad Division.

Proposed Areas

- Faisalabad District
- Jhang
- Chiniot
- Toba Tek Singh

Activities

- Installation of air quality monitoring equipment (US-EPA Approved BAM 1025) and low-cost sensors in hotspot areas of Faisalabad Division.



**Low Cost air
quality equipment**

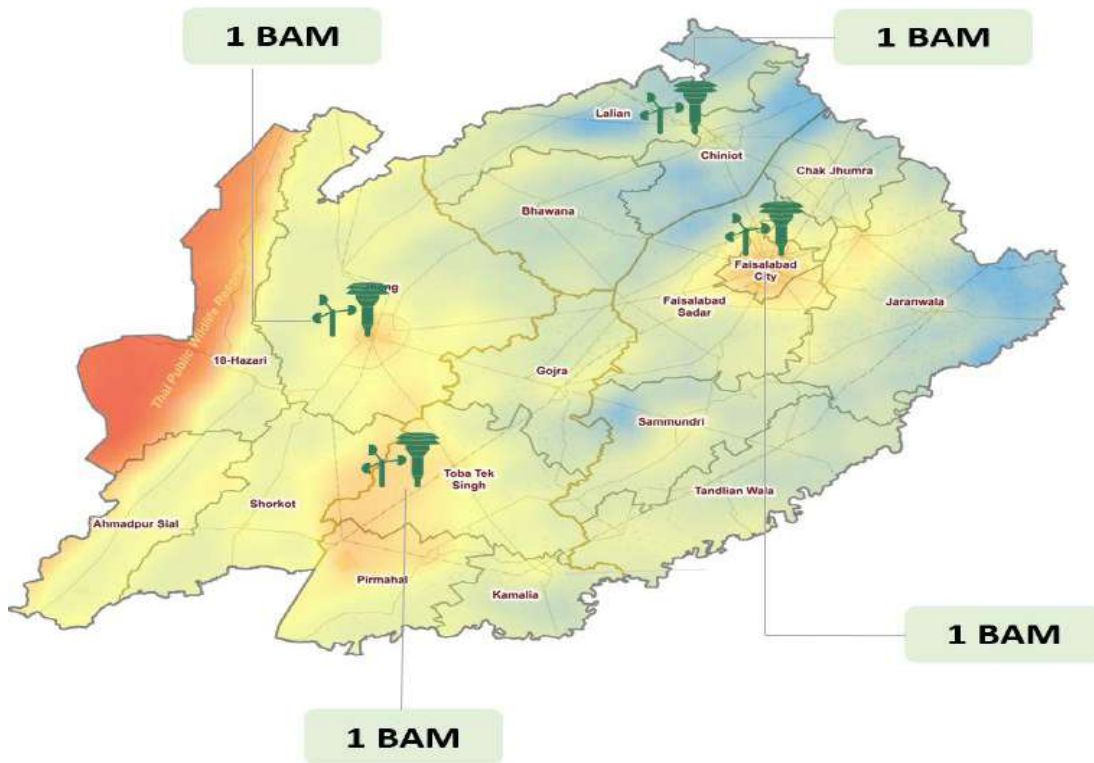


Figure 21: Proposed Locations for Air Quality Monitoring equipment

Rough Estimate Cost

Table 6: Rough Cost Estimation for Air Quality Monitoring equipment

Sr. No.	Reference	Description	Unit	Amount (M. Rs)
1.	BAM 1020	Installation of Air Quality Monitoring System	4	68.00
2.		Low-Cost air quality equipment (Certified)	150	12.75
Total Amount				80.75

6.3.4. PROJECT 4: Greening of Industries

More than 14,000 large and medium size industries with almost 7,700 Textile Units in Faisalabad Division. A comprehensive approach is required for pollution prevention management in the textile sector of Faisalabad. Greening of Industries is a pathway for protecting communities, vital ecosystems, and the global climate from escalating environmental risks and emerging scarcities of natural resources.

The greening of industries can be operationalized by mainstreaming and scaling up the practices for pollution reduction by installing effluent treatment plants, and installation of emission reduction technologies. This will help to increase the supply of appropriate, affordable and reliable environmental goods and services.

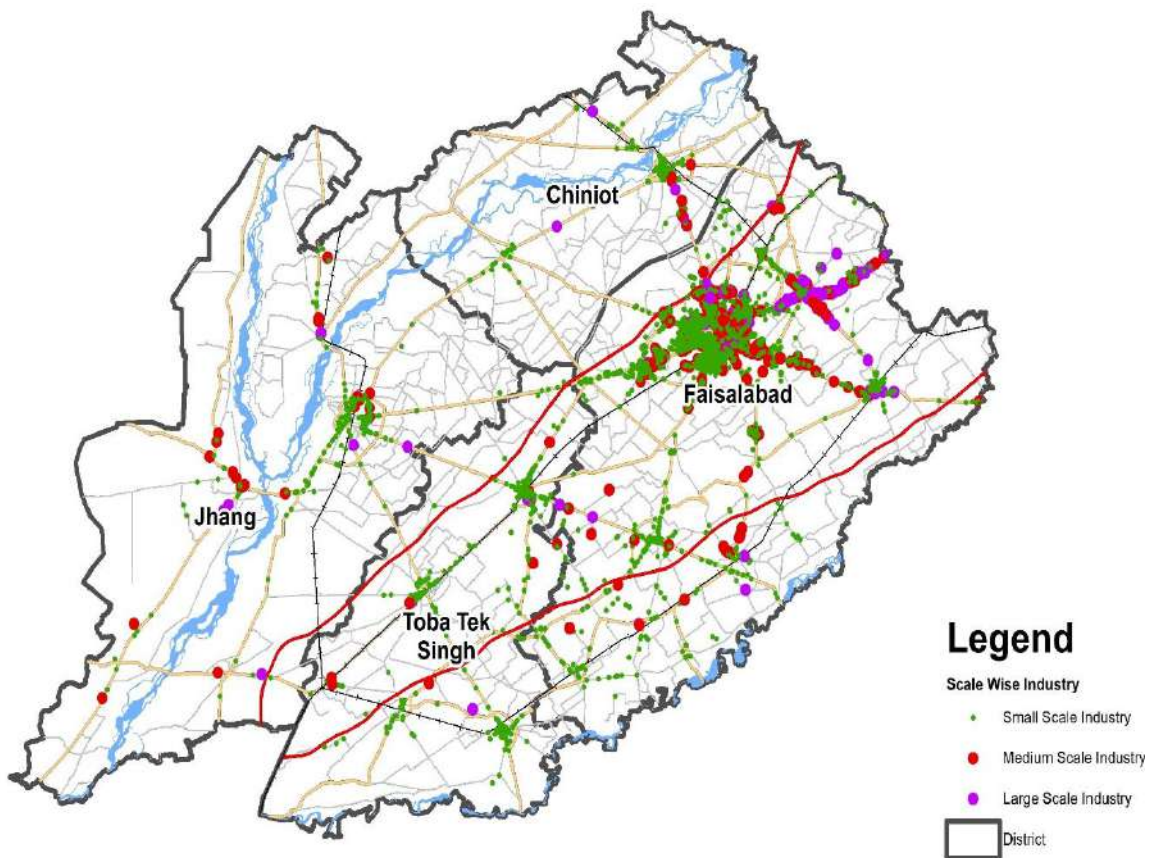


Figure 22: Industrial Unit of Faisalabad Region

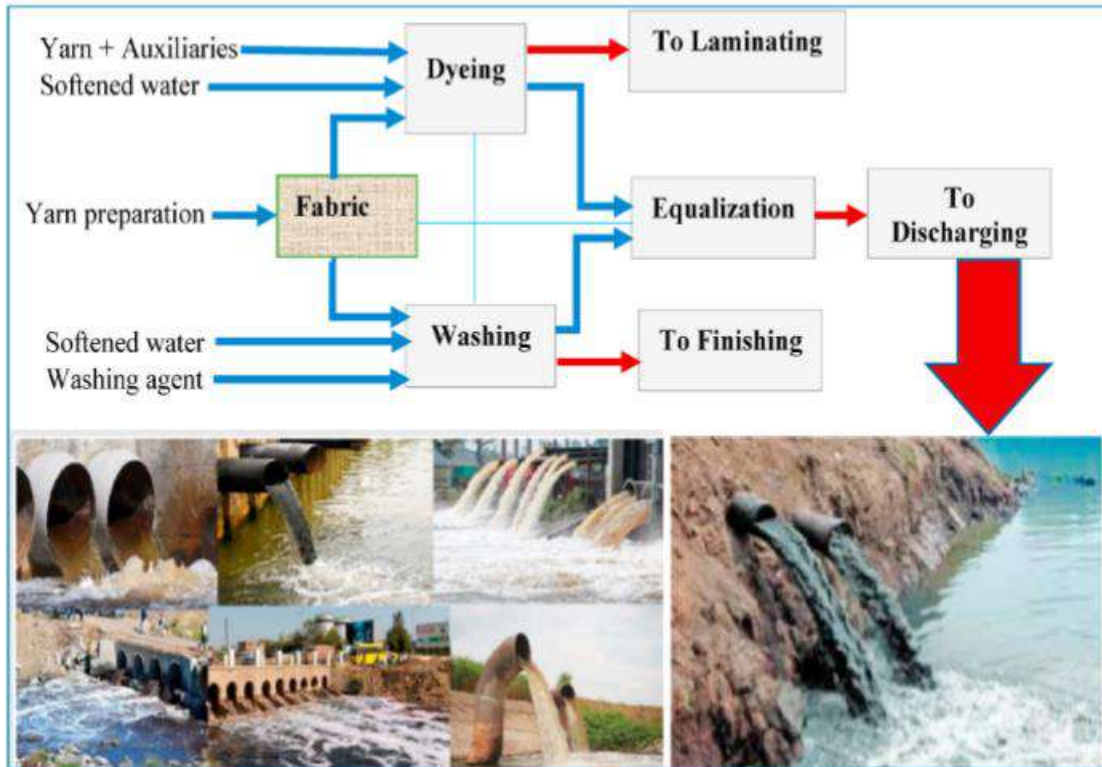


Figure 23: Wastewater Discharge from Textile Industries

Scope of Project

- Textile Units in Faisalabad Division

Conceptual Design

Textile Wastewater treatment plant

Textile wastewater treatment processes include the following steps:

- Primary treatment (Screening, Homogenization, Neutralization Coagulation, and Flocculation)
- Secondary treatment (Aerobic and anaerobic treatment, aerated lagoons, activated sludge process, trickling filtration)
- Tertiary treatment (removal of residual organic color compounds by adsorption and removal of dissolved solids by membrane filtration)
- Sludge destruction

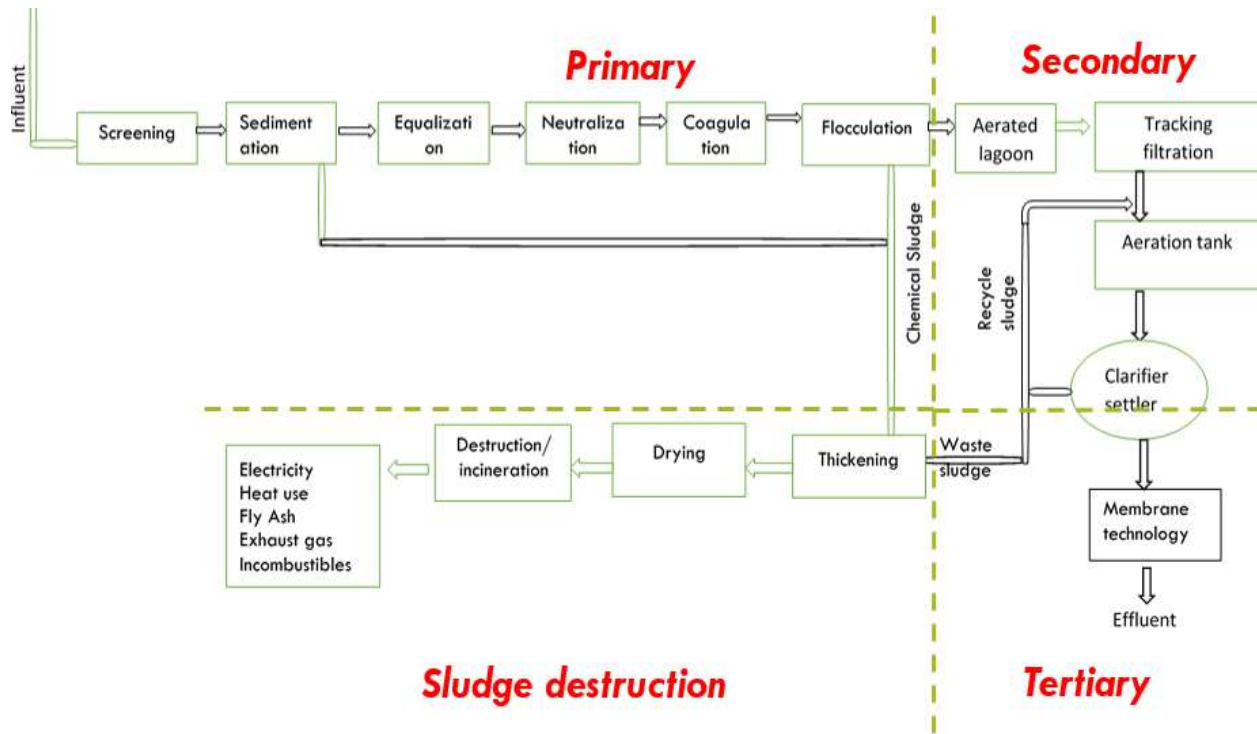


Figure 24: Wastewater Treatment Processes for Textile Industries

Cyclones

Cyclone dust collectors can be used as pre-separators to reduce the dust load reaching the final filter, or as protective devices to remove large hot particles from the gas or air stream to prevent damage to the filter material.

Wet Scrubbers

Wet scrubbers can be used to remove harmful materials from industrial emissions, known as flue gases before they are released into the environment.



Figure 25: Air Pollution Control Technologies for Textile industries

6.3.5. PROJECT 5: Forest Plantation

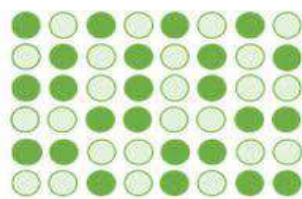
Local residents' livelihoods and quality of life are significantly impacted by the plant diversity and forests in and around their areas, which offer a variety of products and environmental services. Forest plantation plays an important role to prevent desertification, conserving & protecting biodiversity and preventing settlements from natural hazards i.e. floods and sandstorm. In addition to enhancing landscape beautification values, forests and trees offer recreational and educational opportunities and serve as wildlife habitat.

Proposed Sites

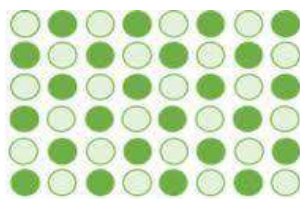
Locality	District	Area (Acres)	No. of Plants
Chak 363-GB & Chak 367-GB	Faisalabad	500	375,000
Chak 648-GB	Faisalabad	150	112,500
Chak 250-RB & Chak 155-RB	Faisalabad	250	187,500
Kamalia Plantation	Toba Tek Singh	300	225,000
Chak 300-GB	Toba Tek Singh	400	300,000
Chak 150-GB	Toba Tek Singh	50	37,500
Chak 359-GB & Chak 361-GB	Toba Tek Singh	250	187,500
Chak Bahadar	Chiniot	300	225,000
Shorkot Plantation	Jhang	1,200	900,000
Chak 170-JB	Jhang	200	150,000
Chak Said Bahram	Jhang	800	600,000
Chak Maddressa	Jhang	300	225,000

Conceptual Design

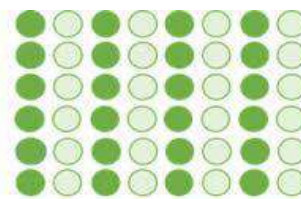
- The plantation design should be based on mixed plantation or polyculture design to attract and conserve the wild diversity of the region.
- The plantation spacing follows 10 x 8 (Lines vs tree spacing) for the well-maintained growth of the plants.
- Indigenous plant species that are native to the Faisalabad division are selected for planation:
 - *Acacia modesta* (Phulai)
 - *Acacia nilotica* (Kikar)
 - *Dalbergia sissoo* (Shisham)
 - *Morus alba* (Shehtoot)
 - *Morus nigra* (Toot)
 - *Ziziphus nummularia* (Beri)
- The tree plantation will be followed by gradual thinning for better growth of plants and removal of weeds e.g., *Prosipis juliflora*.



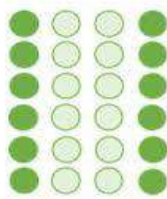
Mixed Plantation



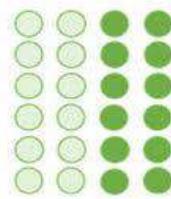
Inter-plantation



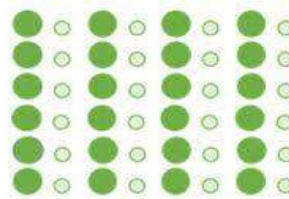
Inter Row Plantation



Row-Strip Plantation



Strip Inter-plantation



Relay Inter-plantation



Figure 26: Forest Plantation Conceptual Design

Rough Estimate Cost

Table 7: Rough Cost Estimation for Forest Plantation

Description	Unit	Rate (PKR)	As Per Qty	
			Qty	Millions (PKR)
Faisalabad District				
Tree Plantation (including the cost of pitting, fertilizer and watering) for 900 acres	No's	375	684,000	256.5
Toba Tek Singh District				
Tree Plantation (including the cost of pitting, fertilizer and watering) for 1,000 acres	No's	375	760,000	285
Chiniot District				
Tree Plantation (including the cost of pitting, fertilizer and watering) for 300 acres project	No's	375	228,000	85.5
Jhang District				
Tree Plantation (including the cost of pitting, fertilizer and watering) for 2,500 acres project	No's	375	1,900,000	712.5
			Total Cost	1,339.5
			Add 5% PST	66.98
			Total Amount Rs.	1,406.5

6.3.6. PROJECT 6: Improvement of Semi developed Parks of Faisalabad

Urban parks are a significant component of urban amenity green spaces. These are significant key tools for measuring the sustainability of cities. Green spaces in the cities facilitate sustainable urban planning. Unplanned urban growth with limited green spaces / open public spaces are not even decreases the sustainability of the area but also negatively impacts the citizen's health and well-being.

The provision of urban green spaces is one of the major priorities in the livable city. The total number of green spaces in a city is one of the important indicators of a sustainable urban ecosystem and quality of urban life. According to WHO, standard 9 sq. m of Green Space is the minimum benchmark per person (UN-Habitat 2013). For planners and city managers, this benchmark is an important guideline for city managers and planners regarding planning and remedial measures.

As per the data collected from PHA Faisalabad, the Faisalabad city has a total of 344 parks. Jhang, Chiniot and Toba Tek Singh have an average 6-8 parks are under their Municipal Committees.

Scope of the Project

Provision of following facilities in the parks:

- Children’s Play Area
- Gazebo
- Walking Track & Pathways
- Drinking Water faucets Fountains
- Rest areas/washrooms
- Parking area
- Cafeteria
- Benches

Proposed Areas:

- Rehabilitation and improvement of Fatima Park, Hafiz Umer Park, Noorpur Park, Ladies parks, Grounds of People’s Colony
- Extension and improvement of Nawaz Sharif Park, Jhang, and Tariq Park, Shorkot
- Rehabilitation and improvement of Park, Chiniot
- Rehabilitation and improvement of Railway Park, Tehsil Kamalia Park, Toba Tek Singh

Rough Cost Estimates

Table 8: Rough Cost Estimation for 01acre Park

Sr. No	Description	Amount in PKR	Millions
1	Construction of Main Gates	1,031,484.89	1.03
2	Construction of Horticulture Works	5,721,656.19	5.72
3	Construction of Bins, Wood Bench-01, Water Cooler, Round Swing, Swings and See-Saw	2,760,288.00	2.76
4	Construction of Toilet Block (Women and Men)	1,561,045.19	1.56
5	Construction of Jogging Track, Path Way and Parking	3,689,200.80	3.69
6	Construction of Gurad Room	364,500.00	0.36
7	Construction of Under Ground Water Tank	475,868.46	0.48
8	Construction of Sign Board	425,000.00	0.43
9	Construction of Electrification	3,033,100.00	3.03
10	Construction of Canteen	1,735,250.00	1.74
	Sub- Total Amount	20,797,393.54	20.80
	Add Contingencies Cost (2.5%)	415,947.87	0.42
	Add PST (5%)	1,039,869.68	1.04
	Grand Total Amount with Contingencies and PST	22,253,211.08	22.253

Conceptual Design

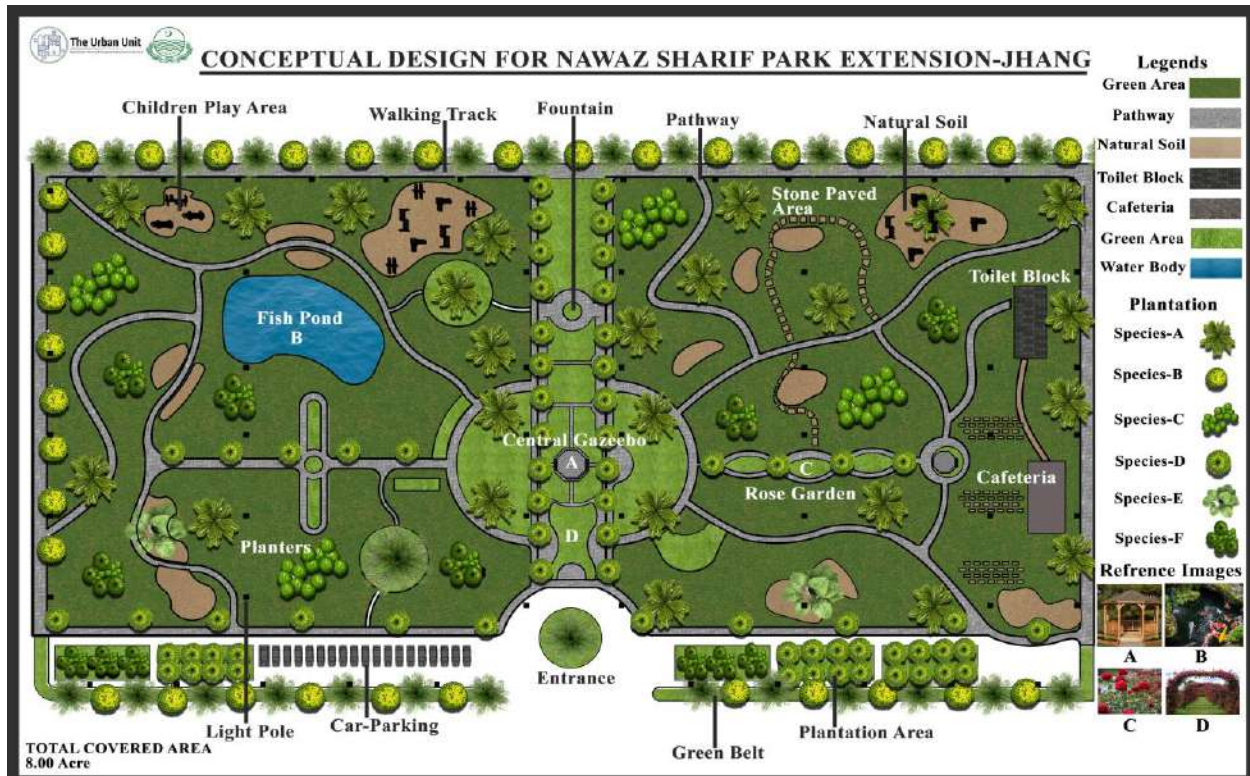


Figure 27: Conceptual design for Parks (Nawaz Sharif Park & Ladies Park)

6.3.7. PROJECT 7: Nature-Based Solution; Treatment & Plantation through Construction of Wetland

The use of plants to purify water supplies makes it both helpful to surrounding employees and communities and environmentally benign. By using plants, bacteria, or other related microbial organisms to absorb toxins from water, it is feasible to purify water and wastewater. The creation of a low-cost bio-remediation technology was made possible by the natural process of phytoremediation, which takes place in an ecosystem through the involvement of organic or inorganic constituent cycles. This process allows for the remediation to be carried out by retention, removal, or degradation. The constructed wetland is the most commonly used type of phytoremediation for wastewater treatment.

Conceptual Design

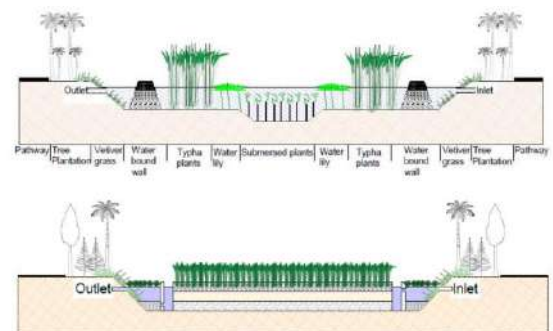
- Reed bed and planting bed prepared for water purification
- Introduction of eco-friendly aquatic plant species having the ability of phytoremediation to treat the water.
- The selective proposed plant species for water resource filtration are as follows:
 - *Phragmites karka* (Common Reed)
 - *Typha latifolia* (Cattail)
 - *Potamogeton perfoliatus* (Redhead Grass)
 - *Pistia stratiotes* (Water Lettuce)
 - *Nelumbo nucifera* (Indian Lotus)
 - *Lemna minor* (Duckweed)



Floating Bed Wetland



Rejuvenation of wastewater ponds



Constructed Wetland

Figure 28. Constructed Wetland and Floating Bed Design

Rough Estimate Cost

Table 9: Rough Cost Estimation for Construction of Wetland

MRS Ref#	Description	Unit	Rate (PKR)*	As Per Qty	
				Qty	Amount (PKR million) *
	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	%0Cft	9,958.10	192,000.00	1.9
	Earthwork excavation in open cutting 5.01 ft. (1.5 m) to 10.0 ft. (3.0 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 100 ft. (30 m) lead:- i) ordinary	%0Cft	10,891.30	230,400.00	2.5

6/6'	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 / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a) (i)&(ii) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- (3) Type C (nominal mix 1: 2: 4)	Cft	587.00	4,320.00	2.5
6/5(i)	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	0.58
7/4-i)	Pacca brick work in foundation and plinth in:- Cement, sand mortar:-			-	-
	Ratio 1:3	%Cft	34,848.25	2,475.00	0.86
6/11-c	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	28,903.85	10,800.00	3.12
14/8'	Brick lining 9"x4½"x3" (225x113x75 mm) in 1:6 cement, sand mortar:-				-
	a) in bed	%Cft	37,060.90	5,250.00	1.95
	b) on slope	%Cft	38,938.60	618.75	0.24

23/43	Providing, laying, cutting, jointing, testing and disinfecting High Density Polyethylene Pipe (HDPE-100) working pressure pipe, Beta/Dadex/Popular/ILorequivalent including the cost of specials, in trenches, as approved & directed by the engineer in charge, complete in all respects				-
	c) PN-10 (SDR-17) (1000 mm)	P.Rft	28,792.10	280.00	8.06
Total Amount					21.8

6.3.8. PROJECT 8: Railway Track Plantation

Planting trees along railway tracks offer several significant advantages. Some of these include: lowering air pollution and enhancing air quality. They can also aid in water conservation and the reduction of soil erosion. Socially trees can enhance the railway track's aesthetic view, making it more beautiful to locals and travellers, and can also serve as a noise barrier. Trees can also provide support by stabilizing the soil near a railway track, reducing the likelihood that it would erode or shift.

Conceptual Design

- Ornamental Plantation to improve the aesthetic sense of the area.
- Indigenous plantation to improve environmental values and urban biodiversity.
- Grassy lawn to stabilize the nearby soil along railway track.
- Provision of Benches for local and traveller.
- Provision of Light Poles to enhance the aesthetic values.

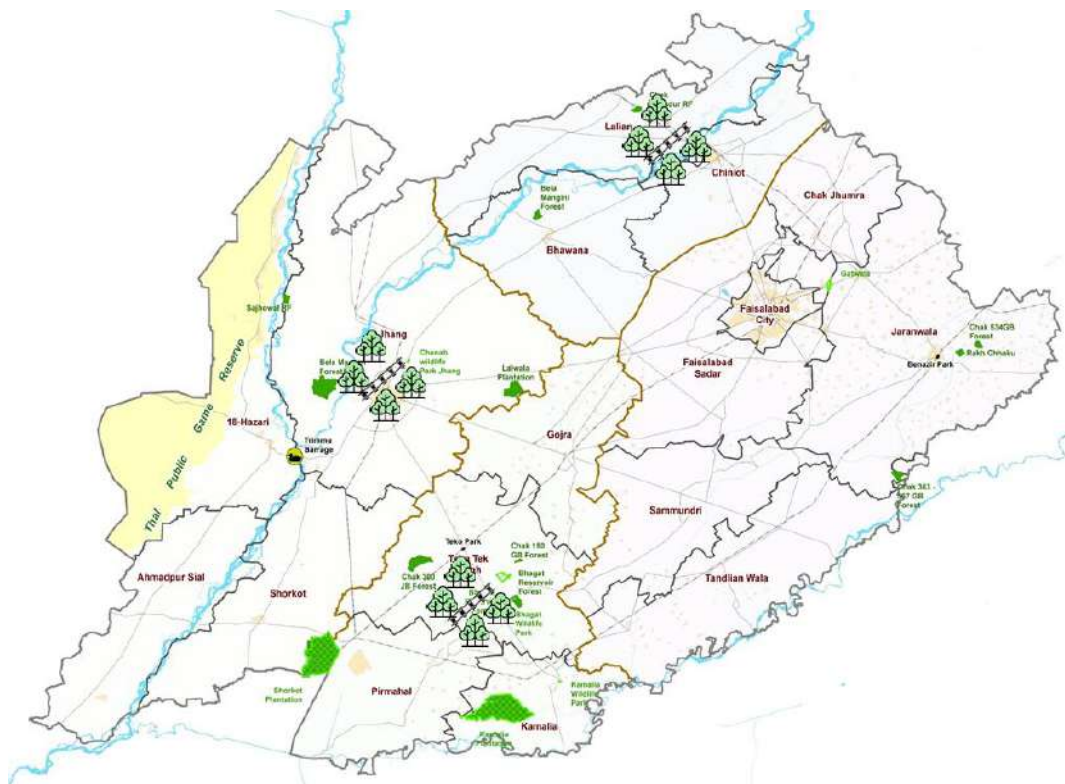


Figure 29. Proposed Location for Railway Plantation

Quantification

Description	No. of Plants
Total numbers of trees to be planted on Projected area (10.5 km)	17,325
Total number of Benches at 300 feet distance	115
Total number of Light polls at 150 feet distance	230

Rough Estimate Cost

Table 10: Rough Cost Estimation for Railway Plantation

Sr. No	Description	Millions (PKR)
1	Construction of pathway	75.43
3	Construction of stone	33.47
4	Construction of green area and plantation	32.61
5	Outdoor furniture benches & light pole	10.25
	Sub- Total Amount	151.76
	Add 2% Contingency Charges	3.04
	Add 5% PST	7.59
	Total Amount Rs	162.38

6.3.9. PROJECT 9: Water Channel Plantation

Every district of Punjab has an extensive canal irrigation system to catch up water requirements. In order to protect canal embankments from soil erosion, and to reduce water evapotranspiration, tree plantation can play a significant role. These trees will also help in improving the habitat of native fauna and also attract waterfowl. Canal Plantation comes under social forestry and helps to increase the Aquatic diversity. The suitable plant species for water channel plantation includes:

- *Acacia nilotica* (Kikar)
- *Acacia modesta* (Phulai)
- *Dalbergia sissoo* (Shesham)
- *Morus alba* (Shehtoot)
- *Mangifera indica* (Amm)
- *Ficus benghalensis* (Bhor)
- *Ziziphus nummularia* (Ber)

Proposed Sites

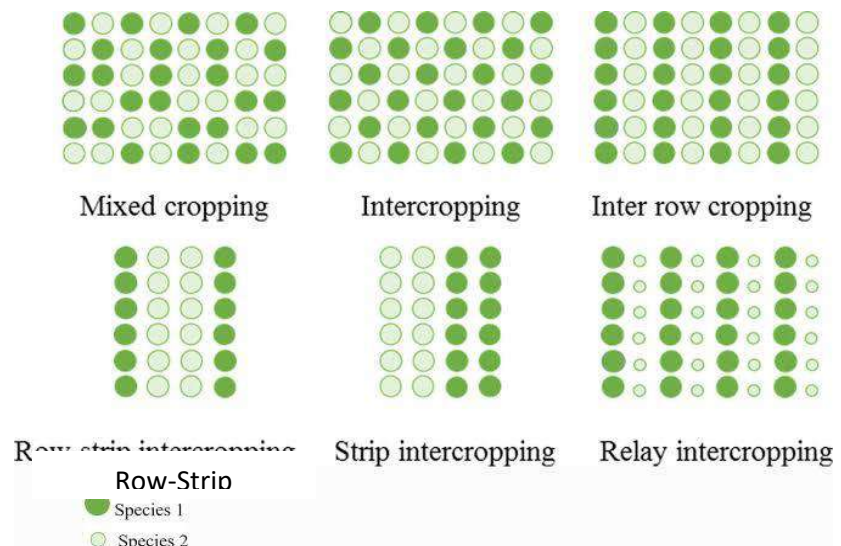
- Jhang Branch 30 km
- Faisalabad Nullah 10 km
- Chiniot Nullah 10km



Figure 30. Existing Condition along Water Channels

Conceptual Design

The plantation design should be based on mixed plantation of indigenous species that helps to maintain the diversity composition of flora and fauna.



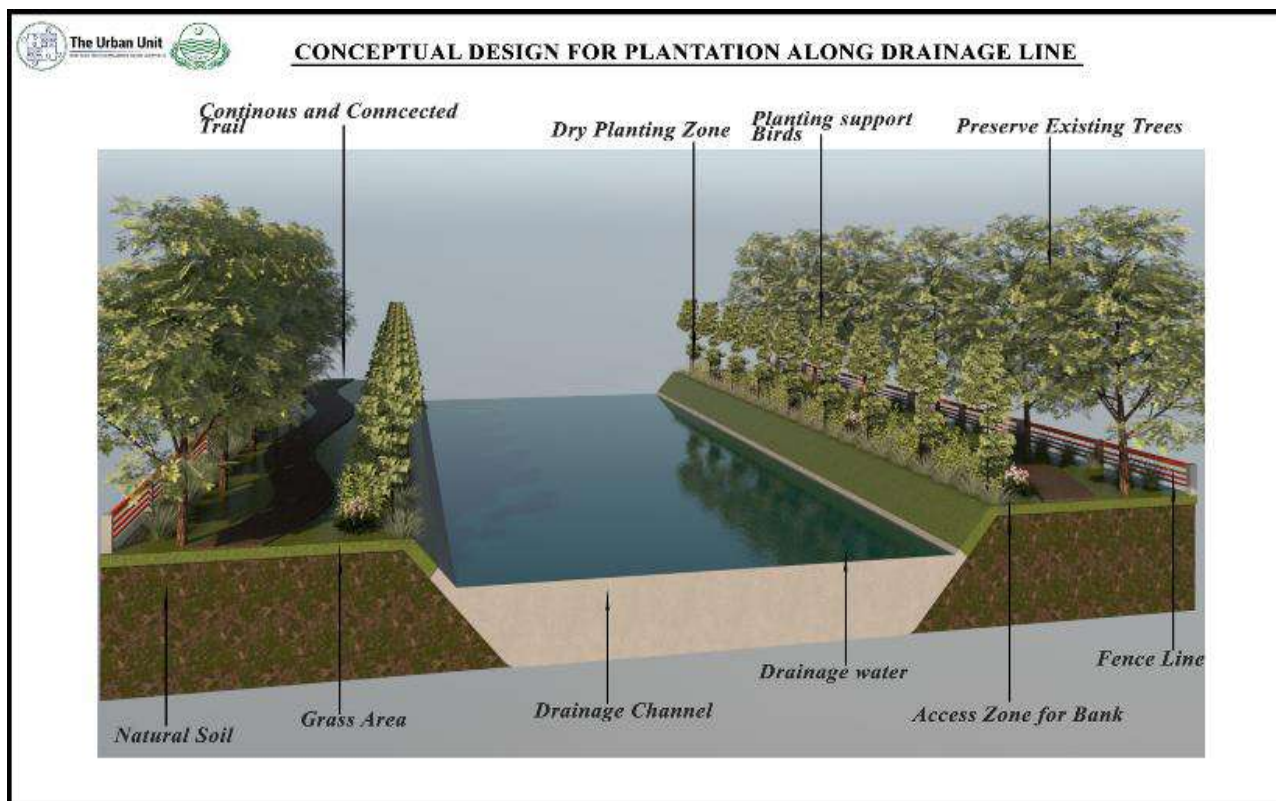


Figure 31. Proposed Design and Layout of Plantation

Rough Estimate Cost

Table 11: Rough Cost Estimation for Water Channel Plantation

Rough Estimate Cost (50 km)		
Sr. No.	Description	Millions (PKR)
1.	Construction of green area	261.09
2.	Construction of walking trail	37.14
3.	Construction of benches & dustbins	9.48
4.	Construction of natural soil	1.45
5.	Construction of front elevation wall 72 rft	2.17
	Sub- Total Amount Rs	311.34
	Add 2% Contingencies	6.23
	Add 5% PST	15.57
	G-Total Amount Rs	333.13

6.3.10. PROJECT 10: Establishment of Forest Park

Forest Park is a very magnificent and diversified concept that enhances climatic and ecosystem value. A healthy forest park helps to improve the air and water quality in the nearby areas and also protects from the catastrophic impacts of climate change. The Forest Park ecology provides habitat for native species, supports wildlife, and keeps the area cool. Forest Parks are providing variety of benefits including shade, reduced polluting factors like Green House Gas emissions and improve oxygen production. In addition to environmental values, it enhances the recreational opportunities, improve mental and physical health of locals. The forest park also increases the faunal and floral diversity of the area and also increase the research opportunities for biological and environmental researcher.

Proposed Site

- Chak Sarkar Forest Land 150 Acres



Figure 32. Existing Conditions of Proposed land for Forest Park

Conceptual Design

- The park with the provision of softscape including arboretum, Grassy lawns, Lakes, Rose garden, scattered plantation and butterfly house.
- The Plantation of park includes indigenous, ornamental, medicinal, flowering and fruiting plants to attract faunal diversity especially avifaunal of the region.



Figure 33: (a) Proposed Arboretum (b) Proposed Forest Trail (c) Gatawala Forest Park

- The hardscaping component of park includes forest trail, animal enclosures, swing area, admin office, parking area, toilet block, jogging track and cycling track to enhance recreational and public use opportunities.

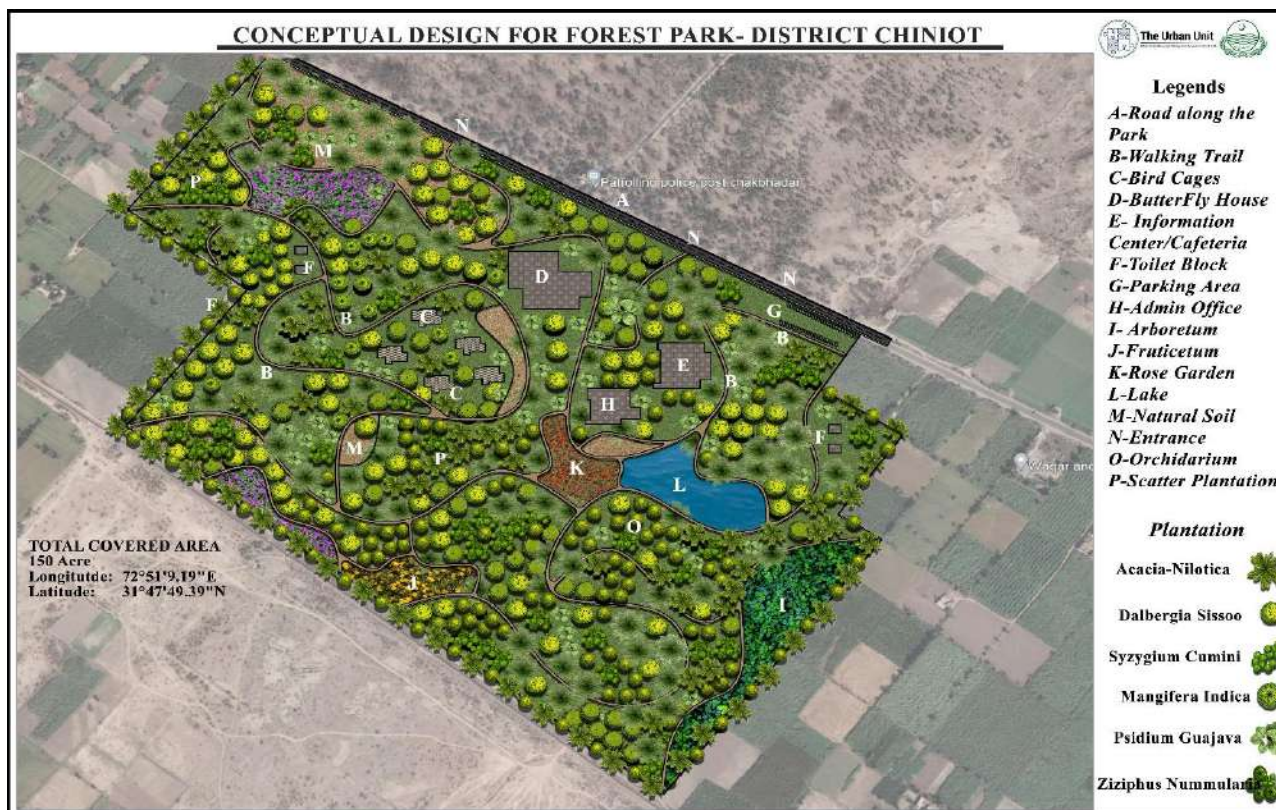


Figure 34: Proposed Layout Design of Forest Park

Rough Estimate Cost

Table 12: Rough Cost Estimation for Forest Park

Sr. No	Description	Amount in PKR	Millions
1	Construction of Walking Trail	20,846,889.43	20.85
2	Construction of Brid Cages	357,500.00	0.36
3	Construction of Butter Fly House	15,440,000.00	15.44
4	Construction of Information Center/ Cafeteria	28,589,180.00	28.59
5	Construction of Toilet Block (Women and Men)	1,561,045.19	1.56
6	Construction of Parking Area	24,723,861.14	24.72
7	Construction of Admin Office	18,589,180.00	18.59
8	Construction of Rose Garden	7,829,663.17	7.83
9	Construction of Lake	54,301,134.78	54.30
10	Construction of Natural Soil	30,417,893.13	30.42
11	Plantation (Arboretum, Fruticetum, Orchidarium & Scatter Plantation)	2,701,687.50	2.70

	Sub- Total Amount	205,358,034.35	205.36
	Add Contingencies Cost (2.5%)	5,133,950.86	5.13
	Add PST (5%)	10,267,901.72	10.27
	Grand Total Amount with Contingencies and PST	220,759,886.92	221



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