ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Construction of Storm Water Drainage System in Bonpora-Padshahi Bagh in Srinagar City

Abstract: "Bonpora-Padshahibagh area lacks essential storm water drainage system as it gets submerged more frequently during episodes of precipitation and remains waterlogged for the prolonged period which reflects negative impact on Society, Health and Environment at large".

Jhelum Tawi Flood Recovery Project- The World Bank Financed Project

Environmental Impact Assessment Report

October 2019

Project ID: P154990

CONSTRUCTION OF STORM WATER DRAINAGE SYSTEM IN BONPORA PADSHAHI BAGH AREAS OF SRINAGAR- JAMMU & KASHMIR

(Jhelum Tawi Flood Recovery- World Bank Supported Project)

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Acronyms & Abbreviations

AAQ	:	Ambient Air Quality
ASI	:	Archaeological Survey of India
BIS	:	Bureau of Indian Standards
CPCB	:	Central Pollution Control Board
CPR	:	Common Property Resources
DPR	:	Detailed Project Report
DO	:	Dissolved Oxygen
EA	:	Environmental Assessment
EIA	:	Environmental impact Assessment
EMP	:	Environmental Management Plan
EMoP	:	Environmental Monitoring Plan
ERA	:	Economic Reconstruction Agency
GC	:	General Conditions
GoI	:	Government of India
ILO	:	International Labour Organization
IS	:	Indian Standard
J&K	:	Jammu and Kashmir
JTFRP	:	Jhelum Tawi Flood Recovery Project
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
NAAQS	:	National Ambient Air Quality Standards
NOC	:	No Objection Certificate
OP	:	Operational Policy
PAP	:	Project Affected Persons
PIU	:	Project Implementation unit
PIA	:	Project Influence Area
PMU	:	Project Management Unit
PPE	:	Personal Protective Equipment
PUC	:	Pollution Under Control
PWD	:	Public Works Department
RoW	:	Right of Way
JKSPCB	:	Jammu & Kashmir State Pollution Control Board
TAQAC	:	Technical Assistance and Quality Audit Consultants
WB	:	World Bank

EXECUTIVE SUMMARY

Project Introduction

Catastrophic deluge of September 2014 shows negative impact on economic aspects of the State and massive infrastructure damages in which capital city Srinagar was most affected and a trail of siltation in most of the water bodies as environmental degradation which is always synonymous with major floods. In connection to catastrophic flood, a mission of the World Bank visited the State during February 1-6, 2015 on request of Government of India to review and assess the damages in order to produce a rapid multi-sectorial assessment report of the damages and needs. The Rapid Damage and Needs Analysis (RDNA) estimates the total damages and loss caused by floods at about INR 211,975 million (US$ 3,550.45), most of it to housing, livelihoods, and roads and bridges, which combined represented more than 70% of the damages in terms of value.

One of the sub-project component aims at construction of Storm Water Drainage network in Bonpora-Padshahibagh area of district Srinagar. During September 2014 floods, Bonpora, Nowgam, Padshahibagh and, adjoining areas were completely inundated for number of days and was further aggravated as no drainage/ pumping station/s exists in the area. The area lacks essential storm water drainage system resulting into frequent waterlogging/ submergence of the area. The Bonpora area usually remain waterlogged throughout the year. The proposed subproject has a total length of SWD drainage network as 12 km. The proposed sub-project required of 995.00 m^2 of land for construction of pumping station as per design criteria. The land as per revenue records falls under the category of Shamilat Deh Land as per Revenue records provided by the SMC. However, there is no impact on livelihood.

Project Location

The proposed subproject *"Construction of Storm Water Drainage Scheme" is situated in Nowgam Bonpora-Padshahibagh Area of Srinagar City"* having a geo-coordinates of $34^0$02'11"N (Lat) $74^0$49'25"E (Long) at Nowgam [1]IPS and $74^0$49'46"E (Lat) $34^0$03'13"N (Long) at Padshahi Bagh [2]MPS. It is about 2km from the Srinagar Railway Station and 8 km from Srinagar Sheikh Alam International Airport. The subproject area is a built-up/ open field area and is very important interconnecting link road from bypass Nowgam via Padshahibagh and connects Lasjan, Jawahar Nagar, Rajbagh, Rambagh, Lal Chowk and rest of Srinagar. The final disposal point (outfall channel) is at Padshahibagh pumping station with already existing outfall channel into Padshahibagh nallah (at geo-coordinates of $34^0$02'14.5" N Lat $74^0$49'48.5" E Long). This small Padshahibagh nallah originates from the floodplains of Summerbugh Lasjan near River Jhelum and has an approx. length of 6 km.

[1] Intermediate Pumping Station
[2] Major Pumping Station

Screening and Environmental Assessment (EA)

Sub-projects under "Jhelum and Tawi Flood Recovery Project" commonly known as JTFRP have a prior requirement of screening which is based on three categories; viz., nature of the project, size of the project and location of the project that is sensitive area criteria. The objective of the Environment screening is to identify the potentially significant environmental issues of the sub-project at an early stage for detailed Environmental impacts. The EA for selected subproject includes establishing environmental baseline in the study area, identify the range of environmental impacts, specify the measures to avoid, minimize, and mitigate negative impacts and maximize positive impacts and integrate possible environmental enhancement measures. The proposed measures will be formulated in the form of an environmental management plan with necessary budget and institutional roles for effective implementation. The EMP developed shall form the part of construction contract document.

Policy and Legal Regulatory Instruments

National and State Laws

- EIA Notification, 14th Sept 2006 and Subsequent amendments
- Jammu and Kashmir Forest (Conservation) Act, 1997
- Jammu and Kashmir Wildlife (Protection) Act, 1978
- Air (Prevention and Control of Pollution) Act,1981
- Water Prevention and Control of Pollution) Act,1974
- Noise Pollution (Regulation and Control Act),2000
- Construction & Demolition Waste Management Rules, 2016
- e-waste (Management) Rules, 2015
- Public Liability and Insurance Act 1991
- Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 2019
- Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996/ Jammu and Kashmir Building and Other Construction Workers (Regulation of Employment and Condition of Services) Rules, 2006
- Jammu and Kashmir Electricity Act, 2010 and amendments
- Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules,2008 and amendments thereof
- Solid Waste Management Rules, 2016
- The Jammu and Kashmir Preservation of Specified Trees Act, 1969

World Bank Operational Policies

- OP/BP 4.01 Environmental Assessment
- OP/BP 4.36 Forests
- OP/BP 4.11 Physical Cultural Resources
- OP/BP 4.12 Involuntary Resettlement

Project Description

The proposed subproject "Construction of Storm Water Drainage Scheme" is situated in Nowgam Bonpora-Padshahibagh Area of Southern part of Srinagar City".

The area lacks an important drainage system resulting in frequent waterlogging/ submergence of the area *(refer Appendix-2 site photographs)*. In 2014 floods, the HFL of this area got raised by at least 3-5m of Bonpora-Padshahi Bagh area.

The main road and especially link roads in Nowgam Bonpora, Advent Colony, Padshahi bagh etc are in highly dilapidated condition due to the lack of essential drainage system in the area. As such locals are facing lot of inconvenience every day and same has been captured in photographs during screening/ assessment survey. During the floods of September 2014, the whole area was submerged with a water column of >20 feet which made the life of inhabitants miserable. Even short spell of rain causes excessive surface runoff and resulting in greater inconvenience in all walks of life, like school students, locals, etc.

The proposed Storm Water Drainage subproject has a total length of 12 km of SWD drainage network with 2 pumping stations (Fig 1-3 Index map/ IPS/MPS). The proposed sub-project involves acquisition of 995.00 m^2 of land for construction of one Intermediate Pumping station (IPS) and one Major Pumping Station (MPS). The land required for two pumping stations as per revenue records falls under the category of Shamilat Deh Land. However, there is no impact on livelihood as the drainage work will be carried out within the available RoW. The drainage work is carried out on daily basis by way of laying of concrete pipes and the filling to make the surface restoration is done for the entire stretch simultaneously. The sites for two pumping stations are open land and free from any encroachment.. The works shall include procurement of all materials and labour, construction, testing, commissioning and maintenance during the operation stage.

Scope of the Work

The scope of works for the proposed project will include but not limited to

- Clearing, Excavation, backfilling and reinstatement
- Concrete Works and Structures
- Storm Water Drainage Works
- Pumping Stations (MPS & IPS) , Building and miscellaneous works
- Road restoration works

Public Consultation

One of the important components of this study is dissemination of project information by way of “Consultation with stakeholders and general public”, which was conducted with local residents/ stakeholders in sub project Area and proposed site of pumping stations of Bonpora-Padshahi Bagh. Public consultation was conducted on 3 February, 2019 and 6 May 2019 for the areas in the proposed scheme. Community heads of the locality were consulted which helped in gathering of public in the resident houses involving both genders for the successful consultation meetings. The local residents of the Nowgam-Bonpora and Padshahibagh areas were consulted based on the procedural guidelines of reaching public required for the preliminary baseline characteristics of environmental and social screening *(refer Appendix-3 and 6*).

Public consultation was conducted at the project location and reconnaissance survey of the project was done and a meeting with the local people as part of study. During

consultation process of the proposed sub-project, people have expressed keen interest about the proposed sub-project and were aware about the upcoming project. People in general were very enthusiastic about the benefits of the subproject.

And some of the positive response with suggestions received from the local residents and stakeholders during consultation is abridged as, i) locals ensured full cooperation and support for the successful execution of the project; ii) local residents who are related to the construction industry may be engaged with the proposed drainage works in Bonpora-Padshahibagh; iii) temporary access routes/ ramps/ bridges shall be provided during construction/ excavation activity;

Assessment of Impacts

This Environmental Assessment report deliberates the retorts of EIA study carried out for the proposed Storm Water Drainage system in Bonpora-Padshahibagh area of Srinagar City in terms of the potential environmental impacts that may occur as a result of the implementation of project. The anticipated environment impacts identified during construction phase which comprise of transitory/ insignificant increase in air and noise pollution, soil erosion, slight change in water quality near the construction area and these impacts are temporary and site and time specific in nature . The major impacts of the project are expected to be during the construction phase leading to air and noise quality deterioration, occupational, health and safety impacts to the works and local communities, utility shifting, access to private properties, generation of construction debris through and excavation activities and disposal of excavated silt from the drains during operation phase respectively. The proposed storm water drainage in Bonpora- Padshahibagh area will have a significant positive impact and mainly to address the problem of water logging, flooding, water stagnation/ odour and water borne diseases which in turn would strengthen public health, enhancement of subproject area aesthetics and reduction in ground water contamination/ pollution.

The project mitigation measures has been developed for evading, reducing and regulating the adverse impacts on the environment impacts induced by the project proposed. The policy, legal and institutional framework under the ambit of which the EIA was undertaken, is also detailed out in environmental assessment report. The Environmental Management Plan (EMP) for the storm water drainage system in Bonpora-Padshahi bagh has been developed, which elaborates on the mitigation measures, means of implementation for the proposed measures, monitoring strategy and the budgets pertaining to implementation of the proposed mitigation measures.

1. INTRODUCTION

1.1. Project Background

In September 2014, Jammu & Kashmir experienced torrential monsoon rains in the region causing major flooding and landslides. The continuous spell of rains from September 2 to 6, 2014, caused Jhelum and Chenab Rivers as well as many other streams/tributaries to flow above the danger mark. The Jhelum River also breached its banks flooding many low-lying areas in Kashmir, including the capital. In many districts, the rainfall exceeded the normal by over 600%. The Indian Meteorological Department (IMD) records precipitation above 244.4 mm as extremely heavy rainfall, and J&K received 558mm of rain in the June- September period, as against the normal 477.4 mm. The district of Qazigund recorded over 550 mm of rainfall in 6 days as against a historic normal of 6.2 mm over the same period.

Due to the unprecedented heavy rainfall the catchment areas particularly the low lying areas were flooded for more than two weeks. Some areas in urban Srinagar stayed flooded for 28 days. Water levels were as high as 27 feet in many parts of Srinagar city. The areas from the main tributaries of river Jhelum vis-à-vis Brengi nallah, Vishav nallah, Lider nallah and Sandran nallah started overflowing due to the heavy rainfall causing water levels in Jhelum river to rise.

Based on the **Rapid Damage Needs Assessment (RDNA)** results, restoration works underway, and discussions with the GoJ&K, the project will focus on restoring critical infrastructure using international best practice on resilient infrastructure. Given the state's vulnerability to both floods and earthquakes, the infrastructure will be designed with upgraded resilient features, and will include contingency planning for future disaster events. Therefore, the project aims at both restoring essential services disrupted by the floods and improving the design standard and practices in the state to increase resilience.

1.2. Project Development Objective

The Project Development Objective (PDO) is to support the recovery and increase disaster resilience in targeted areas of the State, and increase the capacity of the State entities to respond promptly and effectively to an eligible crisis or emergency.

The project is comprised of the following seven components:

1. Reconstruction and strengthening of critical infrastructure (US$60 million)
2. Reconstruction of roads and bridges (US$80 million)
3. ***Restoration of urban flood management infrastructure (US$50 million)***
4. Strengthening and restoration of livelihoods (US$15 million)
5. Strengthening disaster risk management capacity (US$25 million)
6. Contingent Emergency Response (US$0 million)
7. Implementation Support (US$20 million)

1.3. Description of the Project

The objective of this component "Restoration of urban flood management infrastructure" of the Jhelum and Tawi Flood Recovery Project is to strengthen and reinforce existing weak and vulnerable flood control infrastructure. Investments will primarily include rehabilitation/renovation of around 56 storm water pumping stations in Srinagar city, and replacement of the power equipment, switch/ panel boards at elevated places, and related investments for improvement and increased resilience.

Under this component, one of the subproject identified is the proposed subproject "Construction of Storm Water Drainage Scheme", which is situated in Nowgam Bonpora-Padshahibagh Area of Srinagar City" having a geo-coordinates of 34º02'11"N (Lat) $74^0$49'25"E (Long) at Nowgam [3]IPS and $74^0$49'46"E (Lat) 34º03'13"N (Long) at Padshahi Bagh [4]MPS. It is about 2km from the Srinagar Railway Station and 8 km from Srinagar International Airport. The subproject area is a built-up area with open fields and is very important interconnecting link road from bypass Nowgam via Padshahibagh and connects Lasjan, Jawahar Nagar, Rajbagh, Rambagh, Lal Chowk and rest of Srinagar. The final disposal point (outfall channel) is at Padshahibagh pumping station with already existing outfall channel into Padshahibagh nallah (at geo-coordinates of 34º02'14.5" N Lat 74º49'48.5" E Long). This small Padshahibagh nallah originates from the floodplains of Summer bagh Lasjan near River Jhelum and has an approx. length of 6 km.

1.4. Need of the Project

The proposed construction of Storm Water Drainage System in Bonpora Padshahibagh Area has been formulated for the area which is a part of Srinagar City. Srinagar is the summer capital of the State of Jammu and Kashmir. The project area is situated in the Srinagar City near Srinagar railway station. The subproject area is a built-up area and is very important interconnecting link road from bypass Nowgam via Padshahibagh and connects Lasjan, Jawahar Nagar, Rajbagh, Rambagh, Lal Chowk and rest of Srinagar. The subproject area during the rainy seasons and winters remain waterlogged most time of the year due to low lying nature of the area.

A large number of tourists from all over the world visit Srinagar city throughout the year as one of the preferred tourist destination. It is also known for traditional Kashmiri handicrafts and dry fruits. The city has been Centre of the arts and learning. In 2014 floods, the HFL of this area got raised by at least 2-5m of Bonpora-Padshahibagh Area.

The proposed storm water drainage sub project in Srinagar City, comprised of Nowgam, Bonpora, Advent colony and Padshahibagh etc and does not have any drainage and disposal system and is facing surface over flow problem, causing urban flooding / water stagnation/ water logging in the area, creating nuisance and unhygienic condition for the public. Chances of epidemic are very high because water table is high and submergence is always there. Providing of good drainage network in the area is very important as short

[3] Intermediate Pumping Station
[4] Major Pumping Station

spells of precipitation finds its way to the existing compounds, houses, mixing of water with septic tanks which leads to the contamination of water supply and spread of water borne diseases. The inhabitants of the area are demanding construction of efficient drainage system and its disposal since very long. Number of public protests of the area was reported, demanding drainage system in the Bonpora Padshahibagh area. The Government of J&K approved the drainage scheme under Component 3 of JTFRP supported by the World Bank.

Since the importance of this project component "Restoration of urban flood management infrastructure" in Srinagar Municipal Areas is to (i) strengthen and reinforce the existing weak and vulnerable flood control infrastructure. Investment will primarily include rehabilitation/renovation of storm water pumping stations/drainages in Srinagar municipal area and related investments for improvement and increased resilience; and (ii) assessing urban flood management interventions in other project area.

1.5. Benefits of the Project

By constructing the storm water drainage scheme, whole area will be benefitted by many folds as discussed below;

- The sub project will focus on development of critical infrastructure of efficient Storm Water Drainage system using international best practices of resilient infrastructure.
- It is proposed to construct the Storm Water Drainage in Bonpora- Padshahibagh Area of Srinagar City which was badly affected with 2014 floods and usually remain water logged most of the time. The pumping stations (MPS/IPS) of the storm water drainage system will be constructed by taking the pumping machine floor level 1 m above HFL as recorded in 2014. Therefore, the SWD system with high pumping machine floor level design parameters which will be 1 meter higher than the 2014 HFL and are not likely to be affected during floods and heavy rains.
- By constructing SWD and pumping station with pump floor designed 1 meter higher than HFL of 2014, will ensure pumping of storm water during heavy rains. Therefore it will minimize the possibility of flooding by reducing the water logging conditions.
- Efficient storm water drainage system with SCADA in place will be operated remotely during flooding conditions to evacuate storm water rapidly and restoring area flood management system efficiently.
- Submersible pumps will be installed at pumping stations, which will continuously pump storm water during flooding conditions.
- Through rapid pumping of storm water by pump stations, environmental conditions of the area will be improved by avoiding water logging and stagnation especially during rainy seasons thereby leading to better quality of life and better aesthetics.
- The subproject will improve human health by way of controlling water-logging conditions and preventing breeding of mosquitoes and other water-related vector diseases in the sub project vicinity.

- Area flood management system will be ultimately improved and beneficial to the local communities by saving their houses, vicinity and livelihoods, which gets affected due to frequent flooding and water logging of the area and inner roads of colonies during rainy season.
- The sub project will strongly benefit vulnerable groups and women community, school going kids who are the most suffering section of the society due to water logging and floods in the area.
- The sub project will have a positive long- term impact on city storm water management, the state's economy, living standards and quality of life of local population.

1.6. Need of Environmental Assessment (EA)

The EA for the subproject includes establishing the environmental baseline conditions in the study area, identify the range of anticipated environmental impacts during design, pre-construction, operation and maintenance stages of the project, specify the measures to avoid, minimize, and mitigate negative impacts and maximize positive impacts and integrate possible environmental enhancement measures.

The proposed mitigation measures will be formulated in the form of an environmental management plan with necessary budget and institutional roles for effective implementation of EMP for the "Construction of Storm Water Drainage System in Bonpora-Padshahibagh area in Srinagar City under Jhelum and Tawi Flood Recovery Project (JTFRP) and integration of the same in to project implementation agreements, including construction contract documents.

1.7. Scope and TOR of Environmental Assessment study

The environmental assessment for storm water drainage in Bonpora-Padshahibagh area includes screening and scoping, identification and evaluation of anticipated environmental impacts; and environmental management plan to mitigation of likely impacts of the proposed subproject as required. Environmental monitoring and reporting of implemented mitigation measures will also part of environmental assessment.

1.8. Environmental Screening and Scoping

Environmental screening exercise of the proposed subproject project was undertaken to facilitate inputs on environmental, social and economic considerations for current and future prospects. Further, this report also provides scoping inputs in determining the major environmental issues and defines the scope of work for conducting environmental assessment. As per the findings and recommendations of the Environmental Screening report, Environmental Assessment has been carried out for the subproject. The scoping exercise defines geographical boundaries for the subproject for impact assessment as well as defining the project influence area to assess the impacts due to project activities.

1.9. Environmental Assessment (EA)

The EA for selected subproject includes establishing environmental baseline in the study area, identify the anticipated environmental impacts, specify the measures to avoid, minimize, and mitigate negative impacts and maximize positive impacts and integrate necessary mitigation measures, environmental management plan and enhancement measures as required. The proposed measures will be formulated in the form of an environmental management plan with necessary budget provisions and institutional roles for effective implementation during various stages of the project. The EMP developed shall form the part of construction contract document.

1.10 Environmental Management Plan

An Environmental Management Plan designed for the implementation of the subproject shall consists of overall framework which will be a guidance document providing environmental planning and design criteria for the current subprojects, generic environmental management measures, institutional mechanism for implementation, capacity building and training process, and resource material to function adequately to mainstream the environmental management and implementation of environmental management and monitoring plan.

1.11. Structure of Environmental Assessment Report

The structure of EA report has been categorized in the following Chapters:

Executive Summary

1. Introduction
2. Approach & Methodology.
3. Project Description
4. Policy, Legal and Administrative Framework
5. Environmental Baseline Conditions
6. Impact Assessment & Mitigation Measures
7. Analysis of Alternatives
8. Public Consultation
9. Environmental Management Plan

Annexures
Figures
Tables
Boxes
Abbreviations and Acronyms

2. APPROACH & METHODOLOGY

2.1. Reconnaissance Survey

The reconnaissance survey was conducted in February & May 2019 in project domain area of Bonpora-Padshahibagh, Padshahibagh Nallah which is a receiving water body for the proposed storm water drainage network by the consultant's Environmental Expert before the inception of the screening exercise and environmental assessment study. The site visit and the initial assessment have become the key elements of the schedule of preparation as a part of the screening report. In addition to field investigations and observations, consultations/ field visits were held jointly with the stakeholders and project proponents and available environmental documentation was assembled for review

2.2. Project Impact and Project Influence Area

In perspective of the environmental assessment study of a storm water drainage subproject, it is important to define the area for environmental impacts are being considered. The project will support infrastructure and the proposed construction of Storm Water Drainage network Bonpora-Padshahibagh Area are confined within the existing roads of the area. The subproject also includes restoration of existing roads.

The project impact area has been considered within the periphery of Bonpora & Padshahibagh area where drainage network will be laid and project influence area has been considered as 1 km radius from the proposed drainage line/ pumping stations of the Storm Water Drainage.

2.3. Screening methodology

The screening exercise was done through reconnaissance survey, Public consultation meetings were arranged with the community and conducted in large gathering at Bonpora & Padshahibagh areas and in-house meeting with locals and officials and community. Field survey and data collection were carried out as per the screening checklist provided in ESMF of the project. The information has been gathered through primary as well as secondary sources, with the support of PIU team members. The objective behind the environmental screening was to delineate affected environmental features and issue like water logging/ submergence, plantations / trees, sensitive receptors-schools/ religious places and residential area, human settlements, water, natural resources etc. in the project area, in order to define impacts and to minimize the adverse environmental impacts by suggesting best engineering solutions/options at optimal costs.

The positive actions are not only to avoid adverse impacts, but to capitalize on opportunities to correct environmental degradation or improve environmental conditions were determined.

2.4. Detailed Baseline Environmental Surveys

A comprehensive survey was conducted for the purpose of environmental impact and screening studies. For this purpose, a data sheet was devised to collect quantitative and qualitative social and environmental data together with local subproject specific consultations. This will be the basis for further investigations for future studies. Information collection, literature survey and analysis of data published and other recorded data e.g. on wildlife, forest flora, climate, pollution along with socio-economic, demographic, land-use pattern, land ownership details etc. pertaining to the subproject were also studied and reviewed. National and state guidelines were also reviewed prior to carry out baseline studies. Detailed survey has been carried out by the environmental and social experts who are responsible for the documentation of the environmental and social investigations and issues, to evaluate the existing environmental and social setting and conditions of the proposed project area. Potential significant impacts were identified on the basis of analytical review of project activities, baseline data, land use, environmental factors, socio-economic conditions and review of assessment of potential impacts identified in previous similar kind of projects. A participatory process was adopted while performing social screening of the sub- project. The information has been gathered through primary as well as secondary sources of information, with the support of PMU and PIU team members.

2.5. Collection of Data

Keeping in line with the sub project activities, literature surveys were carried out referring publication & using internet and useful information about the project impact and influence area was collected. This includes both published and unpublished environmental data. Literature searches were undertaken and relevant agencies were contacted and appraised of the proposed sub project. The following data were collected for the storm water drainage during environmental screening study: `

- Geo reference maps.
- Socio-economic data from the Planning Department and Census records.
- Geological data from Geological Survey of India.
- Meteorological data from India Meteorology Department, Govt. of India.
- District Profile from District Statistics Department.
- Forestry and Wildlife Data from Forest Department.
- Flora and fauna from various sources, including the State Forests Department and Wildlife Department.

Readily available data was reviewed with the initial reconnaissance investigations, and the need for primary data collection in some instances was determined.

2.6. Environmental Monitoring Data

Water quality monitoring data of Jhelum flood spill was collected by the PIU. As one of the bridge project of J&K ERA under ADB funding at (Mehjoor nagar, Padshahibagh) have a number of sampling sites near the present sub project site of Bonpora-Padshahibagh. Environmental monitoring laboratory of ERA was utilized for the above monitoring following the standard monitoring, sampling and lab protocol. All the water samples were examined as per the procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA).

Similarly, Air Quality monitoring and assessment of noise levels were used from the same authentic source.

2.7. Assessment of Alternatives

Analysis of alternatives is an analytical comparison of the operational effectiveness, costs and environmental and social risks of proposed development options. This helps to analyze the options critically in relation to its impacts on all physical, social and biological environments. The 'no action option' is to be considered among various options available. The process will ultimately help to determine which option is comparatively better than the other various options. For this project, alternative analysis has been made for three considerations, *i.e.* strategic, planning and technology consideration.

2.8. Stake holder consultation and participation

Stakeholder's view and perception were assessed through informal and formal public consultation meetings. The different stakeholder's *viz.* government officials, local people (both male & female) were contacted and consulted during the course of the study. Stakeholders were informed about the subproject components and likely environmental impacts before seeking their views. In each consultation, all efforts were made to have adequate participation from women as well. Consultations have been carried out for the project in two stages. First stage consultation was undertaken during impact assessment process to identify the concerns of people, which were duly addressed through appropriate mitigation measures. Second stage consultation was undertaken as part of preparation of EIA report to assess the adequacy and acceptability of the proposed mitigation measures and management plan. Public consultations ensured involvement of public, experts in the project's pre-planning stage itself and redressal of their concerns and expectations from the subproject. The community members, government officials members opined that the proposed subproject would contribute to social and economic development of the area. The proposed project would contribute to increased employment opportunities for the local people during and after subproject implementation. The communities welcomed the subproject and all were in favour of the project. Issues raised by stakeholders were analysed for practical and scientific basis, and for developing an appropriate mitigation, management and monitoring plan, depending on its importance and practicality.

EA report for the Storm Water Drainage subproject of Bonpora-Padshahibagh Area and its executive summary shall be disclosed at JTFRP/PIU website as per provisions of World Bank disclosure policies.

3. PROJECT DESCRIPTION

3.1. Background

Srinagar, the summer capital of Jammu & Kashmir, is located in the heart of oval shaped valley of Kashmir. The Srinagar city lies 34^0 0' - $34^0$14'N (Latitude) and 74^0 43' - 74^0 52'E (Longitude) with an altitude of 1585 m (5200 ft) above mean sea level (msl). The city has a unique physiographic setup with steep hills in the East and North East, low lying paddy fields falling in the flood plain of Jhelum in the South and West, the Karewas of Budgam in the extreme South and towards the North we encounter the uplands with moderate slopes. It is well connected by air and road. Topographically, Srinagar city is located on a flatter terrain. Consequently, the drainage system of the city rely on lift system through drainage pumping stations, which lift surface water from wet well and discharge into the adjoining water bodies. The city receives most of the precipitation in winter and spring seasons in the form of snow and rain with an annual average rainfall of 710 mm.

The subproject "Construction of Storm Water Drainage System in Bonpora-Padshahibagh Area of Zone-1 in Srinagar" has been proposed under the component 3 "***Restoration of urban flood management infrastructure"*** of project development objectives for flood resilience under World Bank funded project. As per drainage master plan of Srinagar city, the entire city is divided into 3 zones. The proposed Bonpora-Padshahibagh area for the SWD scheme falls under drainage zone I of Srinagar city. In the assigned area, no surface water collection network system and disposal system existed. In order to alleviate the severe problem of water logging and associated adverse impacts on the health and socio economic profile of the community, an integrated drainage subproject has been proposed. Completion of the subproject will considerably rehabilitate the existing problem of water logging and associated adverse impacts on the health, hygiene and socio economic conditions of the community.

3.2. Project Location and Existing Condition

The proposed subproject "Construction of Storm Water Drainage Scheme" is located in Bonpora & Padshahibagh of Srinagar City having a geo-coordinates of $34^0$02'11"N (Lat) $74^0$49'25"E (Long) at Nowgam [5]IPS and $74^0$49'46"E (Lat) $34^0$03'13"N (Long) at Padshahi Bagh [6]MPS (refer Appendix 4 & 5). It is about 2km from the Srinagar Railway Station and 8 km from Srinagar International Airport. The subproject area is a built-up area and is very important interconnecting link road from bypass Nowgam via Padshahibagh and connects Lasjan, Jawahar Nagar, Rajbagh, Rambagh, Lal Chowk and rest of Srinagar. The final disposal point (outfall channel) is at Padshahibagh pumping station with already existing outfall channel into Padshahibagh nallah (at geo-coordinates of $34^0$02'14.5" N Lat $74^0$49'48.5" E Long). This small Padshahibagh nallah originates from the floodplains of Summerbugh Lasjan near River Jhelum and has an approx. length of 6 km.

[5] Intermediate Pumping Station
[6] Major Pumping Station

The water table in Bonpora-Padshahibagh area is <1 meter below NGL. The existing road condition is highly dilapidated condition due to the lack of essential drainage system in the area. As such locals have to face inconvenience especially during spells of precipitation. During the floods of September 2014, the whole area was inundated for the prolonged period which made the life of inhabitants miserable. Even short spell of rain causes excessive surface runoff/ waterlogging and resulting into inconvenience in all walks of life, like school going students, locals etc. During heavy precipitation, inner colony roads in proposed drainage site gets more frequently submerged thus causes huge inconvenience to general public. Location and area map of the proposed storm water drainage in Bonpora-Padshahibagh area of Zone 1 in Srinagar City is given in Fig 3.1 to 3.3 below;

Fig 3.1: Index Map of the Proposed Storm Water Drainage System in Bonpora-Padshahi Bagh Areas in Srinagar City.

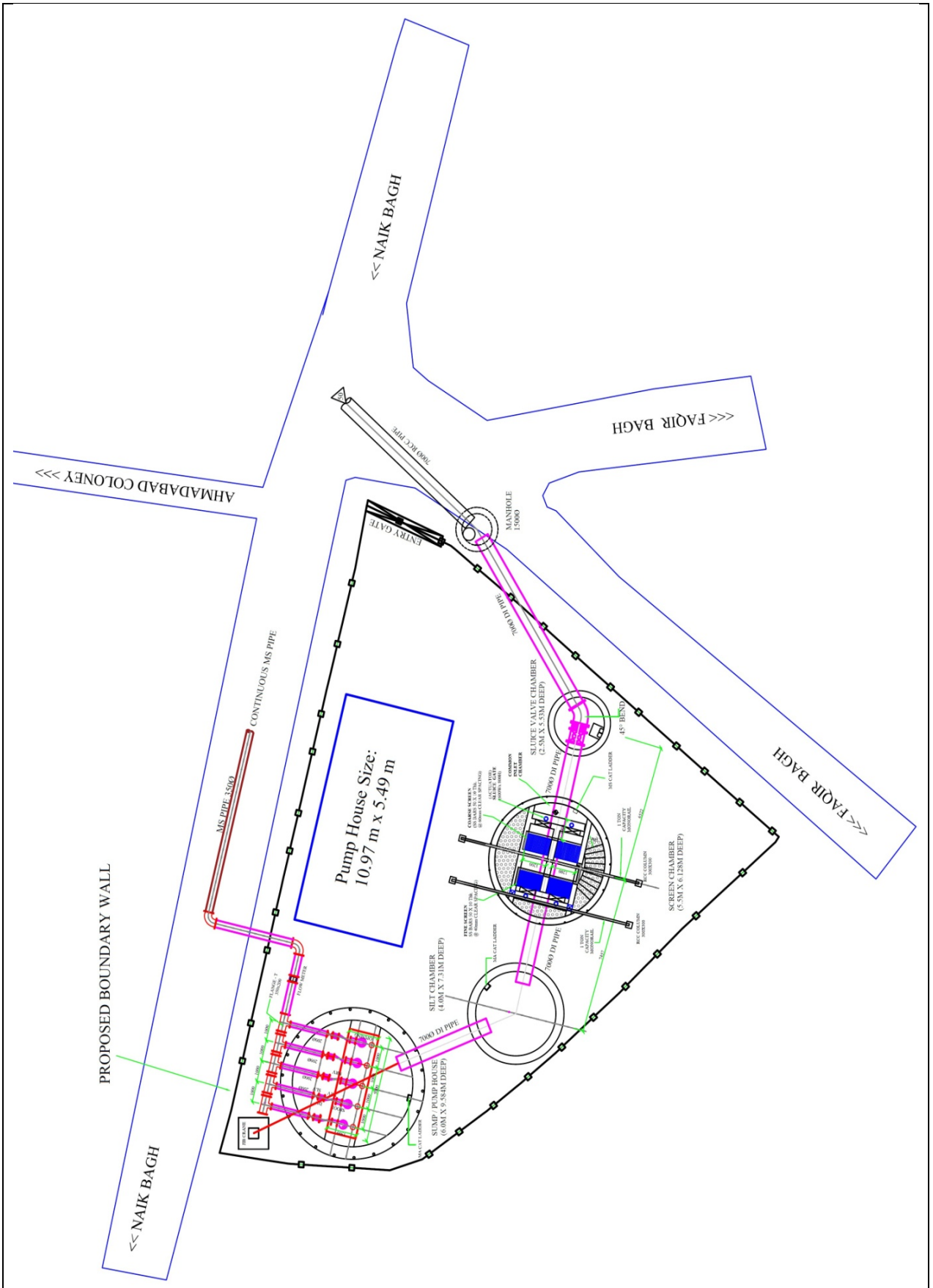


Fig 3.2: Layout Plan of Proposed Pumping Station (IPS) at *Bonpora* of Storm Water Drainage Bonpora Padshahibagh.

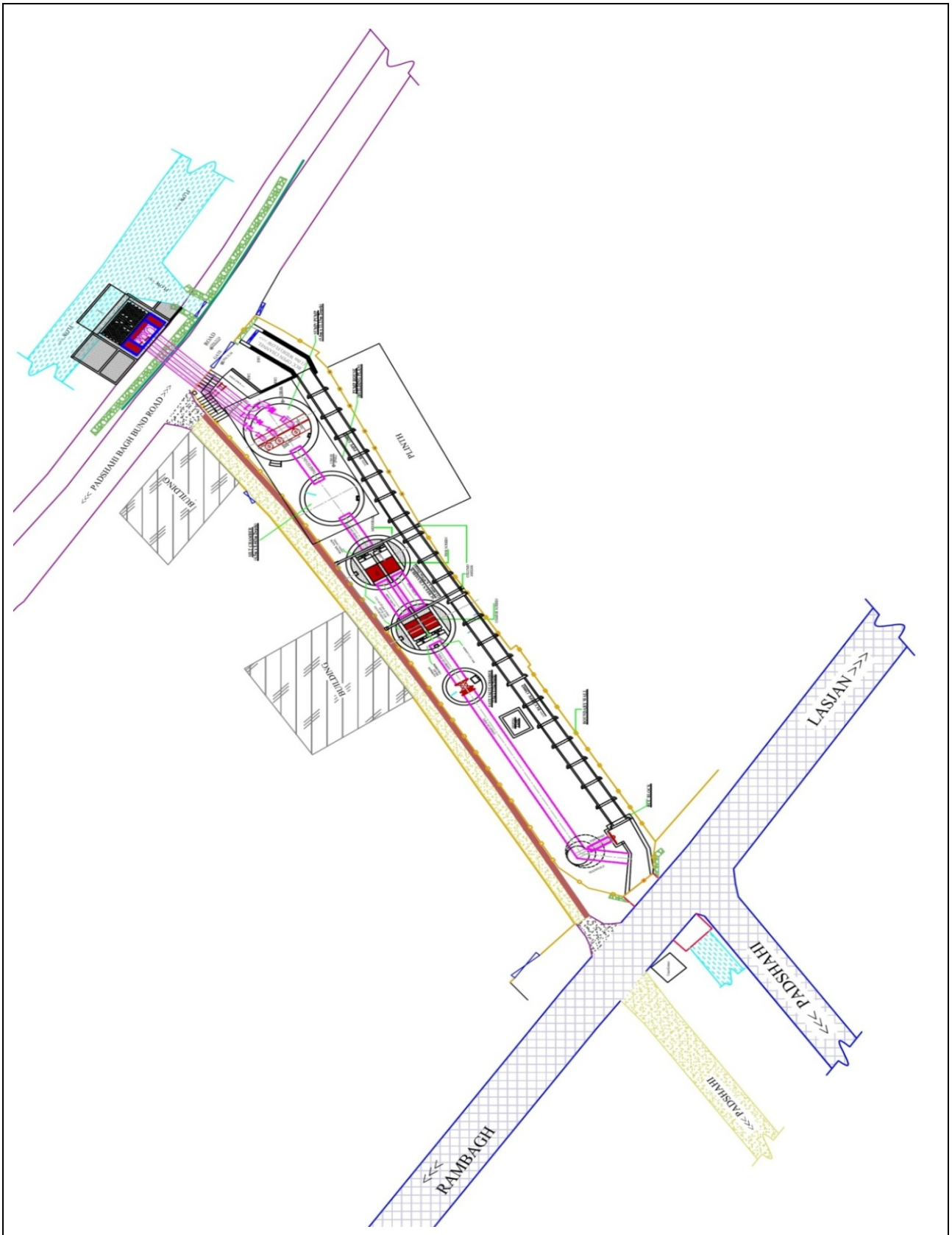


Fig 3.3: Layout Plan of Proposed Pumping Station (MPS) at *Padshahi Bagh* of Storm Water Drainage in Bonpora Padshahibagh, Srinagar

The proposed Storm Water Drainage subproject has a total length of 12 km of SWD drainage network with 2 pumping stations. The proposed sub-project involves acquisition of 995.00 m^2 of land for construction of one Intermediate Pumping station (IPS) and one Major Pumping Station (MPS). Layout Plan of IPS and MPS in Bonpora and Padshahi Bagh is given in Fig 2 & 3. The land required for two pumping stations as per revenue records falls under the category of Shamilat Deh Land. However, there is no impact on livelihood as the drainage work will be carried out within the available RoW. The drainage work is carried out on daily basis by way of laying of concrete pipes and the filling to make the surface restoration is done for the entire stretch simultaneously. The sites for two pumping stations are open land and free from any encroachment.

The major objectives of subproject are: (i) Reduction of water logging and flooding in sub-project area. ii) Establishment of an efficient drainage system. iii) Improved local environment and to reduce health risks to the inhabitants in the project area. The primary benefit of the sub-project would result in overall improved environmental conditions of the area by avoiding water logging especially during rainy seasons thereby leading to better quality of life.

3.3. Existing Drainage System

In Srinagar, there are about 55% drainage network of primary and secondary storm water drains identified by SMC. In addition to major drains, there are substantial amount of tertiary drains/deep drains. Due to the topography of the Srinagar City, the Drainage System is 90% dependent of Pumping stations and only 10% is under gravity.

Srinagar city, for the purpose of Storm Water Drainage System, has been divided into four drainage zones. The major drains, with boundaries of drainage zones marked, are shown in Drawing No. 1. The details of the drainage zones are as below. Drainage system in each of the drainage zones are characterized by numerous pumping stations. Locations of the pumping stations are shown in the Master Plan Drawing.

There had been no holistic approach for establishment of drainage system in the city till date. The drainage system was developed at the time of need or on emergent situations to cater to particular area or place with localized approach. Three types of Drainage Schemes viz. Lift, Gravity & Lift-cum-Gravity are being implemented.

3.3.1. Topography and Drainage Pattern

Topography. The subproject area is located in southwest direction of the Srinagar city. Physio-graphically, Srinagar city constitutes a part of the flood plain of Jhelum, which is largely flat and featureless with sub-recent alluvial deposits. The topography shows gentle terrain slope from East to West. General elevation of the subproject area varies between 1,585m and 1, 590m above mean sea level. Padshahi Bagh and Bonpora are low lying area and frequently gets submerged during floods and torrential rainfall. Proposed area is mainly a residential built-up area in Bonpora and Padshahi Bagh locality, paddy/ open fields

especially on LHS of the main drainage alignment (Ch 0+800- 2+600 in project influence area. On the right bank of the Padshahi Bagh, a small Padshahi Bagh water channel is flowing which joins River Jhelum at a confluence point near MPS site of Padshahi bagh.

Drainage Srinagar city is located on a flatter terrain. Therefore, the drainage system of the city relies on lift system through drainage pumping stations, which lift storm water from wet well and discharge into the adjoining water bodies. Majority of the drains are covered with RCC slabs with manholes provided at suitable intervals to facilitate maintenance of the drainage system. The proposed storm water drainage in Bonpora-Padshahibagh area of Zone 1 is of lift system type.

3.3.2. Drainage Zonation of Srinagar City

Srinagar city is located on a flatter terrain. Therefore, the drainage system of the city relies on lift system through drainage pumping stations, which lift surface water from wet well and discharge into the adjoining water bodies. Majority of the drains are covered with RCC slabs with manholes provided at suitable intervals to facilitate maintenance of the drainage system. About 89 drainage pumping stations are spread across Srinagar city. As per surface water drainage master plan, Srinagar city is divided into three drainage zones. The details of the drainage zones are as below.

- Zone- I: This zone includes areas from Pampore to Gawkadal, Dalgate to Nehru Park. Civil line areas, Raj bagh, Jawahar nagar to Allochibagh and areas across flood spill channel including Ram bagh, Natipora, Barzulla etc. New Storm Water Drainage schemes of Pohru to Chanapora bridge, Rawalpora Chowk to Tengpora Bridge, Bemina to Fruitmandi, Rawalpora Area to Chanapora bridge and Athwajan alongwith adjoining areas of NH-Byepass have been successfully executed and completed under J&K ERA of ADB loan (IND 2151) & (JKUSDIP-2925 & 3132).
- Zone- II: The zone includes areas from Amirakadal to Parimpora /Shallateng, including areas of New and Old Sectt. Batamalloo, Bemina, Nawakadal, Nawa bazaar and Safa Kadal etc.
- Zone –III: This zone includes areas from Dalgate to Noor bagh on one side and Dalgate to Naseembagh and areas around Iddgah, Nowshera, Ali Jan road, Soura, Buchpora etc.

There are about 55 existing drainage schemes having about 118.67 km of primary and secondary storm water drains. The Storm Water Drainage projects in Srinagar taken up by J&K Economic Reconstruction Agency (JK ERA) under Asian Development Bank (ADB) funding has increased the SWD from 118.67 km to 223.37 Km that is the increase of 104.68 Km in ten year period. In addition to such drains, there are substantial lengths of tertiary drains/ deep drains. List of such existing drainage schemes is given in **Table- 5** below:

Table-3.1: Zone wise list of drainage schemes in Srinagar city.

S.No.	Name of Drainage Scheme	Length of drain (m)
Storm water drainage zone 1:		
1	Drainage Scheme Old Barzula	2016
2	Drainage Scheme Rajbagh	8889
3	Drainage Scheme Ikhrajpora, Lal Mandi, Jawahar Nagar, Iqbal Park	5414
4	Drainage Scheme Polytechnic	3939
5	Drainage Scheme Sariaballa	966
6	Drainage Scheme Solina	998
7	Drainage Scheme Sonwar bagh; Dewatering Station	1180
8	Drainage Scheme Pandrathan; Dewatering Station	2200
9	Drainage Scheme Rawal pora; Dewatering Station	4695
10	Drainage Scheme Nowgam, Methan, Gulshan Nagar	582
11	Drainage Scheme Barzulla; Dewatering Station	10367
12	Drainage Scheme Natipora; Dewatering Station	1945
13	Drainage Scheme Budshah Nagar	1617
14	Drainage Scheme Chanapora	7116
15	Drainage Scheme NH Bye pass	2225
16	Drainage Scheme Rambagh area	563
17	Drainage Scheme Kacherpora	550
Storm Water Drainage Works Undertaken & Completed by J&K ERA (ADB Projects-2151, 2925 & 3132)		
18	Drainage Scheme Pohru to Chanapora (with 2 No. DWS)	19436
19	Drainage Scheme Rawalpora Chowk to Tengpora Bridge (with 1 No. DWS)	26485
20	Drainage Scheme Bemina to Fruitmandi (with 1 No. DWS)	9059
21	Drainage Scheme Rawlapora to Chanapora Bridge (with 3 No. DWS)	41770
22	Drainage Scheme Athwajan with adjoing area along NH Byepass (with 2 No. DWS)	8524
Storm water drainage zone II:		
23	Drainage Scheme Syed Hamidpura, Nawab bazar, Jamal latta	2541
24	Drainage Scheme Chotta bazaar, Guru Bazar.	1198
25	Drainage Scheme Daresh Kadal, Zampa kadal, Kaka saria, Karan nagar	1110
26	Drainage Scheme Batmaloo, Nursing garh, Bal Garden, Shutrashahi	4678
27	Green sewer	1960
Storm water drainage zone III:		
28	Drainage Scheme Bahu- ud- Din Sahib	700
29	Drainage Scheme Imptts to nallah Maar	4538
30	Drainage Scheme Khanyar	3670

31	Drainage Scheme Hawal, Alamgari Bazar, Mureedpura	3335
32	Drainage Scheme Budoo Bagh	555
33	Drainage Scheme Bhagwanpora, Noor Bagh	1647
34	Drainage Scheme BrariNambal	1190
35	Drainage Scheme Iddgah, Ganderpora, Laigar Doori, Saidpaora	1225
36	Drainage Scheme Rathpora	1204
37	Drainage Scheme Interior Dana mazar	390
38	Drainage Scheme Shaheen Colony Guzarbal Noorbagh.	1130
39	Drainage Scheme Zoonimar	885
40	Drainage Scheme Jamia Masjid	400
41	Drainage Scheme Soura, Buchpora, Vicharnag& its adjoining schemes	6709
42	Drainage Scheme Lal Bazar, Qurershi mohalla/ Botakadal	3647
43	Drainage Scheme ZahidporaHawal	1095
44	Drainage Scheme Bishember Nagar	2650
45	Drainage Scheme Mandirbagh and adjoining drains	990
46	Drainage Scheme Rattan Rani	1100
47	Dewatering Station Shora Khan	4950
48	Dewatering Station Court road	1530
49	Dewatering Station Abi Guzer	1085
50	Drainage Scheme Golf course Dewatering Station	1805
51	Dewatering Station Khidmat Press;Dewatering Station	840
52	Drainage Scheme Barber shah; Dewatering Station	738
53	Drainage Scheme Sonwar ; Dewatering Station Davis	2790
54	Drainage Scheme Shah Mohalla, Awantabhawan	769
55	Bilal colony	347
Total		**223,937**

3.3.3. Storm water drainage pumping stations

Three types of drainage Schemes viz. Lift, Gravity & Lift-cum-gravity schemes exist in the city. Approximately 89 drainage pumping stations exist in Srinagar city and number of mobile pumping station units which are being utilized during flash floods in various areas of Srinagar city. Some of these pumping stations (49) have been taken for up-gradation under JTFRP.

3.4. Scope of the Work In DPR of the Proposed Storm Water Drainage in Bonpora-Padshahibagh

3.4.1. Proposed Works

Proposed components of storm water drainage system of Bonpora-Padshahibagh consist of the following works:

i. Laying of Drainage Network.
ii. Taking the Machine floor Level 1m above HFL as recorded in 2014.

iii. Construction of new pumping stations (MPS/IPS) of required capacity with SCADA Automation and with non-clog submersible pumps.

Following factors are considered for the proposed storm water drainage system in Bonpora-Padshahibagh.

- Importance of the Area.
- Existing conditions.
- Number of people getting benefited.
- Chances and frequency of local flooding.
- Adjacent area and surrounding environmental problems
- HFL & MFL as compared to 2014 Floods
- Catchment Flow

3.5. Project Design

The proposed storm water drainage in Bonpora Padshahi Bagh area comprises of 120.88 hectares which is subdivided into 245 number of drainage areas/ sub catchments as per the topography of the area. In each drainage area the runoff shall be collected through a series of collection chambers/manholes of suitable size and RCC carrier pipe provided to carry the storm water into the trunk drain through a network of drains. All the collection chambers/manholes shall be provided with suitable gratings preferably of poly concrete cover of collection chambers. Series of collection chambers /gully traps connected to manholes have been provided to allow the runoff to enter the drain enroute. This is to restrict the debris/garbage from entering into drain. The topography of Bonpora area is such that Storm Water from the area cannot flow by gravity to the MPS at Padshahi Bagh The drainage areas of Bonpora shall be catered by the network of drainage system & collected at IPS location wherefrom it will be pumped to nearest manhole no. 59 on the main trunk drain going to MPS.

The trunk drains of each drainage area further fall into one long drain that ultimately carries the storm water to the disposal station called pumping station where it shall be disposed into existing spill channel. Enroute, the long drain receives discharge from the drains of adjacent drainage areas and also direct runoff from the collection chambers /manholes falling in the drainage area through which the long drain passes. Following is the details of the drainage area. The total length of the longest drain works out as 3015 m for Bonpora to Padshahibagh and the time of concentration at pumping station is 19.91 with intensity as 25.81 mm/hr at Bonpora and 90.46 minutes for MPS with intensity 7.69 mm/hr for Bonpora and Padshahi Bagh respectively. As such the discharge rate of 8 cusecs for IPS and 22 cusecs for MPS is achieved. Pumping Stations shall be designed for these flows. Distribution of drainage network areas in proposed Bonpora-Padshahibagh is eloborated in **Annexure XV** and Catchment map is shown in **Figure 3.4** below;

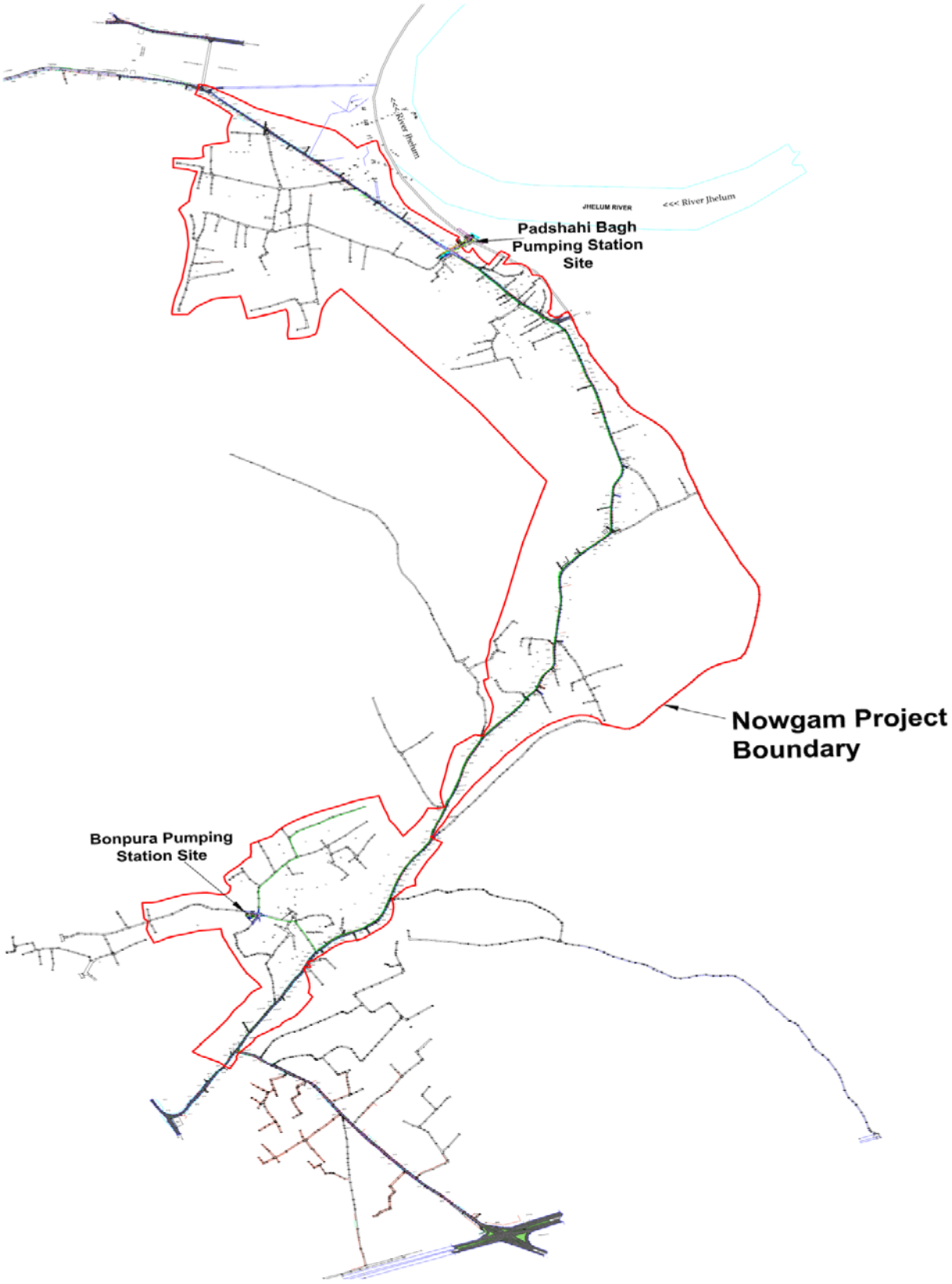


Fig 3.4: Catchment Area and Network Map of Storm Water Drainage in Bonpora-Padshahibagh Area of Zone-1.

3.5.1. Network Design Methodology

Starting from first point of collection, the time of flow from farthest point up to first collection point has been calculated and further the time of flow in the drain up to last node in the first drainage area is also calculated. Based on the total time of flow up to point of observation of first drainage area, intensity is calculated using parameters of a and n corresponding to once in a year intensity-duration curve. Subsequently the corresponding flow is calculated for the section of the drain upto point of observation. Further node to node sectional flows are calculated adding up drainage areas upstream contributing to section/node under calculation. The process is continued cumulatively till the last section at Pumping Station. Each section is then hydraulically designed to get the required inverts and profiles.

The detailed design based on the above engineering design criteria is annexed and according to it following provisions have been made:

3.5.2. Drains and Appurtenances:

Laying and jointing of following RCC NP – 3 pipes with necessary manholes.

Table 3.2: Description of RCC NP-3 Pipes

Sl. No.	Dia of Pipe/Bottom size of Covered drain (In mm)	Length (In m)	Remarks
1.	250 mm dia	1117.00	Covered Drain
2.	300 mm dia	2690.00	Pipe Drain
3.	350 mm dia	1246.00	Pipe Drain
4.	400 mm dia	784.00	Pipe Drain
5.	450 mm dia	1160.00	Pipe Drain
6.	500 mm dia	1079.00	Pipe Drain
7.	600 mm dia	508.00	Pipe Drain
8.	700 mm dia	1980.00	Pipe Drain
9.	800 mm dia	274.00	Pipe Drain
10.	900 mm dia	1078.00	Pipe Drain
11.	1000 mm dia	47.00	Pipe Drain
Total Length		**11963**	

3.5.3. Encasing of Pipe:

Sand / Stone crushed dust filling is used for encasing of pipe = 5332.43 cum.

3.5.4. Manhole Size:

i) 900 mm dia x 1.67 m depth- 263 Nos.
ii) 1200 mm dia x 2.30 m depth- 163 Nos
iii) 1500 mm dia x 4.95 m depth – 95 Nos.
iv) 1800 mm dia x 9.0 m depth – 40 Nos

3.5.5. Description of Rising Main

Table 3.3: Details of Rising Main

Sl. No.	Description	Dia in mm	Length in mtr.
Bonpora IPS			
1.	For 5 Nos. 2 Cusec Pumps	350 (MS Pipe)	240
Padshahi Bagh			
2.	For 1 Nos. 5 Cusec Pumps	300	38
3.	For 1 Nos. 7 Cusec Pumps	350	38
4.	For 1 Nos. 10 Cusec Pumps	450	38

3.5.6. Pumping Stations

Circular pumping sump at IPS Bonpora of 6.0 m internal diameter and 9.16 m deep has been proposed with 5 number of 2 cusecs non-clog submersible pumps installed (4 W+1S) and 3 number of 2 cusecs on shelf. At MPS circular sump of 5.0 m internal diameter and 11.13 m deep has been proposed with 3 number of non-clog submersible pumps installed: 1 No- 5 cusec (1W), 1 No.-7 cusec (W) & 1 No. -10 cusec (W). The submersible pumps shall have suction size to accommodate a minimum of 150 mm size solid waste and shall be with required 100% standby for each type of pump on shelf. The pumps of following configuration are proposed. Other installation of the pump house are also given in the table below;

Table 3.4: Description of the Intermediate Pumping Station at Bonpora Area

Sl. No.	Description	Sump Size	Pump rating / Pipe Size/Width	Motor rating	Remarks
1.	Pumping Sump	6.00m dia x 9.16 m deep	2 cusecs @ 18mwc	22.00 KW	5 Nos. (4W+1S) installed with 3 Nos. Standby on shelf.
2.	Silt chamber	4.00 m dia x 7.63m deep			1 No. Single Chamber
3.	Inlet Valve Chamber	2.50 m dia x 5.53 m deep	700mm		1. No. Actuated Gate Valve Compatible with SCADA
4.	Screen Chamber	5.50 m dia x 6.128 m deep	700 mm		2 No. 50 mm Manual screen+ 2 No. 20mm Fine Screen
5.	Delivery Lines		200 mm for 2 cusec		
6.	Common Header		350 mm for 2 cusecs pumps		
7.	Flow Meter		350 mm for 8cusecs flow		On common header.
8.	MCC & Panel Room				Housed in Annexe Building
9	Jib Crane		2 Ton		

Table 3.5: Description of the Major Pumping Station (MPS) at Padshahi Bagh Area

Sl. No.	Description	Sump Size	Pump rating / Pipe Size/Width	Motor rating	Remarks
1.	Pumping Sump	5.00m dia x 11.13 m deep	5 cusecs @ 18mwc 7 cusecs @ 18mwc 10 cusecs @ 18mwc	55.00 KW 75.00 KW 90.00 KW	3 Nos. Working with 3 Nos. Standby on shelf.
2.	Silt chamber	4.50 m dia x 8.46 m deep			1 No. Single Chamber
3.	Inlet Valve Chamber	3.00 m dia x 6.22 m deep	1000mm		1. No. Actuated Gate Valve Compatible with SCADA
4.	Screen Chamber (Coarse Screen)	4.5 m x 6.98 m deep	2 x1.2 m wide each		2 No. 50 mm Manual screens(1W+1S)
	Screen Chamber (Fine Screen)	4.5 m x 6.98 m deep	2 x1.2 m wide each		2 No. 20mm Fine Screens(1W+1S)
5.	Delivery Lines		300 mm for 5 cusec 350 mm for 7 cusec 450 mm for 10 cusec		
6.	Common Header		No common Header		Each delivery drops at outfall
7.	Flow Meter		300 mm for 5 cusec 350 mm for 7 cusec 450 mm for 10 cusec		Separate flow meters on each common delivery.
8.	MCC & Panel Room				Housed in Annexe Building
9	EOT Crane		3 Ton		

Due to space restrictions, the annexe building has been proposed over the Silt Chamber and pump sump with foundation on walls having an overall size of 16.3 m x 7.4 m.

The Equipment's for electrical, Instrumentation, PLC and SCADA are proposed to be housed in this building constructed as framed structure. The Electrical equipment's shall be installed at the floor level which shall be at least one metre above max recorded HFL in the area to avoid submergence of same during such floods. All the power and control cables from the Annexe building to Sump or any other installation like sluice gates, sluice valves and flow meter etc shall be carried through suitable size 3" /4" RCC Hume pipes. The building shall have an entry gate with Rolling shutter and EOT for handling equipment's. The room height of the building shall be such that sufficient headroom is available for the EOT crane.

Sl. No.	Description	Size
1.	For Bonpora IPS	10.98 m x 5.49 m
2.	For Padshashi Bagh MPS	16.3m x 7.4m

1 No. of D.G. Set of 250 KVA and 1 No D.G. set of 400 KVA are proposed to be housed in the respective Annexe Buildings at Bonpora and Padshahi Bagh respectively. All electrical panels and PLC equipment shall be housed in Annexe Building to be constructed as RCC framed structure as per the design attached with the DPR for each station.

3.5.7. Pipe Lines

The drainage pipes of required size as per network design shall be laid in grade from manhole to manhole with proper bedding as per bedding design shown in technical statement section. The drains of each drainage area shall converge into main drains and trunk drains as per network design. The maximum and minimum size of pipe drain are 1000 mm and 300 mm respectively. The initial drain section of each drainage area shall be Covered drain type due to non-availability of sufficient cover. The details of Covered drain are given in technical statement section.

3.5.8. Covered Drain

The starting reaches of network of those drainages areas where the flow is contained within 200/250mm dia in the corresponding design, and the soil cover of the pipe is very small, shall be Covered drains with bottom semicircle of 250 mm diameter and trapezoidal section with 1:15 side slopes and 150 mm cover slabs. The top slab of 150 mm thick shall be laid alternately with panels of 4 m length and 0.85 m length and a circular opening of 600mm dia shall be kept in 0.85 m panel to be covered with 560 mm diapolycrete covers.

3.5.9. Manholes

Manhole have been proposed @ 30m c/c on all lines for pipes of diameter more than 700mm, 25m c/c for pipe dia 500mm to 700mm and @ 20m c/c for pipes less than 500mm dia. in addition to manholes at all angles and junction points.

3.5.10. Valve Chambers

The Gate Valve Chamber for 1000 mm dia DI K-9 at Padshahi Bagh MPS and for 700mm dia DI K-9 at Bonpora accommodated in circular chambers of internal diameter 3.0m and 2.5m respectively. The valve shall be electrically operated /actuator controlled by PLC.

3.5.11. Screen Chambers

Bonpora IPS

As per the site condition and design the Screen Channels of 1.2 m clear width and required length along with receiving chamber, 4 Nos. MS sluice gates (electrically operated), Manually Operated Coarse Screen, Manually Operated fine screen are proposed to be constructed in a sink well of internal diameter **(5.5m).** The screen channel is provided with a standby channel of same capacity to facilitate maintenance. A perforated slab is proposed at mid level to serve as maintenance platform for clearance of debris etc. Staircase is also provided for access to the

maintenance platform. A common chamber is provided to receive flow from either of the twin screen channel and further carriage of flow into silt chamber through 700mm dia DI K-9 pipe.

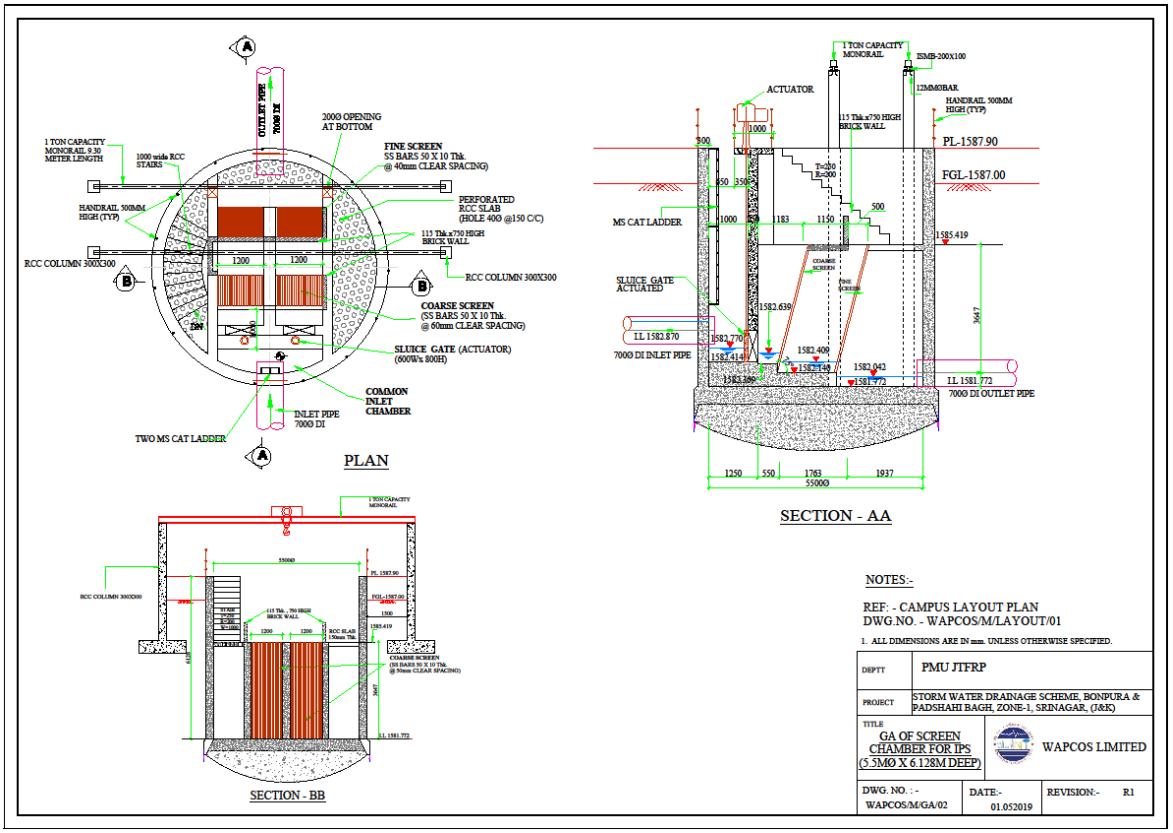


Figure 3.5: Screen Chamber of Bonpora Intermediate Pumping Station

Padshahi Bagh MPS

As per the site condition and design, the Screen Channel of 1.2 m clear width and required length along with receiving chamber, 2 Nos. MS sluice gates (1W+1S), manually operated coarse Screens (1W+1S) and Manually operated fine screens (1W+1S) with screen channels of 1.2 m width and common chamber , are proposed to be constructed in two no. of sink wells of internal diameter 4.50 m each as shown in layout . The screen channel is provided with a standby channel of same capacity to facilitate maintenance. A perforated slab is proposed at mid-level to serve as maintenance platform for clearance of debris etc. MS Cat ladders are also provided for access to the maintenance platform. A common chamber is provided to receive flow from either of the twin screen channels and further carriage of flow into silt chamber through 1000mm dia DI K-9 pipe.

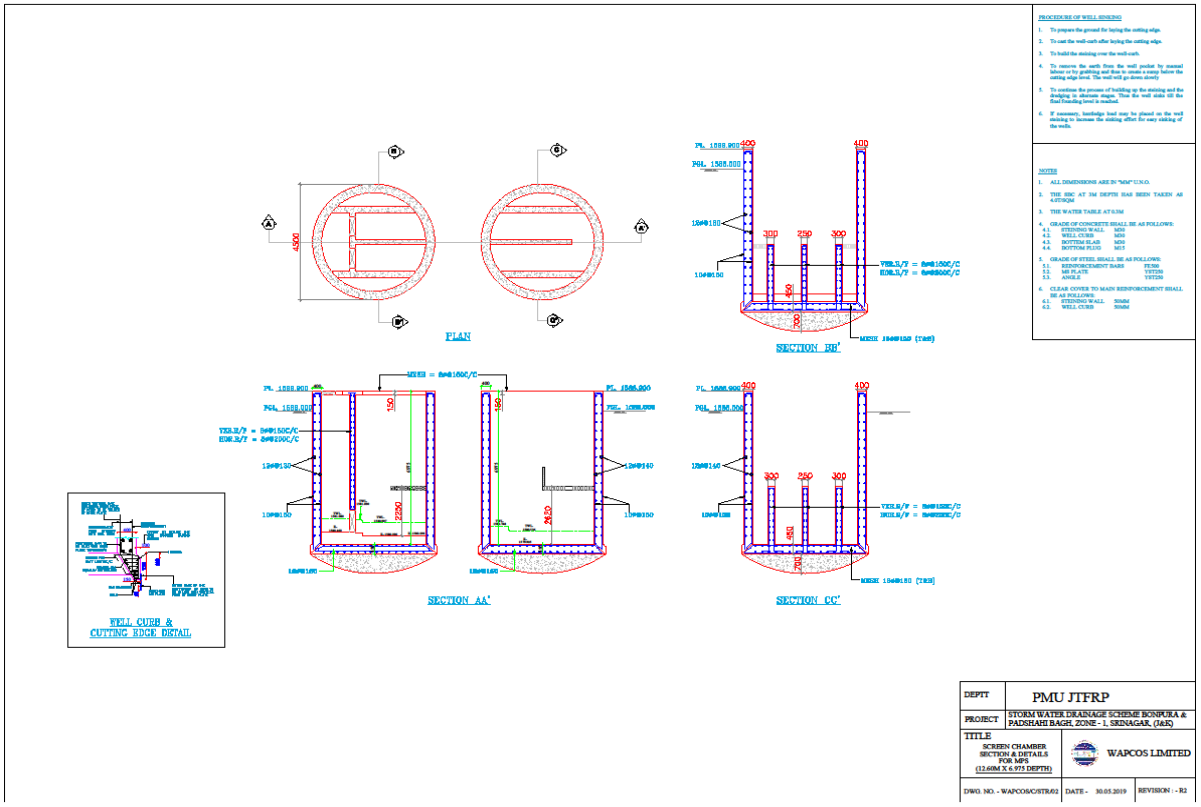


Figure 3.6: Screen Chamber of Padshahi Bagh Major Pumping Station

3.5.12. Silt Chambers

Circular Sinking Well type Silt Chambers of internal diameter of 4.0m and 4.5m and storage depth of 1.5m below incoming pipe invert level at Bonpora IPS and Padshahi Bagh MPS respectively has been proposed. Single Chambers without any partition wall is proposed with single pipe inlet and pipe outlet at designated levels for final entry through pipes of 700mm dia DI K-9 for IPS and 1000mm dia DI-K-9 for MPS to respective sump wells.

3.5.13. Pump Sump, Pumping Arrangement and Rising Main

Bonpora IPS:

Pump Sump of internal diameter 6.0 m and total height of 9.16 m between top of sump and invert level has been proposed. The sump capacity has been designed for the worst case of running 2 cusec pump with detention period of 14.50 minutes and 0.8m pump submergence. 5 no. -2 cusecs @18MWC pumps (4W+1S) are proposed to be installed and 3 no. -2 cusecs @ 18m MWC pumps shall be on shelf. The total capacity is designed for a storm flow of 8 cusecs. The pumps shall be non-clog submersible with guide pipe, auto coupler type duck foot bend to be mounted on a block for easy replacement during maintenance (details shall be as per vendor drawing obtained during procurement). The Double flanged column pipe in DI K-9 of 200mm dia for each 2 cusec pump are proposed. Electrically operated sluice valves on each delivery line are proposed along with Non Return Valve (NRV) of required size. E ach delivery line terminates into the common header pipe

of size 350 mm with unequal TEE.

Flow meter location with 5d / 3d considerations, so as to ensure full bore running of flow meter for accuracy of flow measurement is proposed on common header. After flow meter, 350mm MS pipe 6mm th 240m long Rising main shall carry the design flow to Manhole at node no 59.of trunk drain. as shown in the drawing Operating platform of structural steel ISMC 250 for beams with MS gratings using 25mm x 5 mm flats for platform has been proposed. Jib Crane of 2 Ton capacity has been proposed for maintenance of pumps etc.

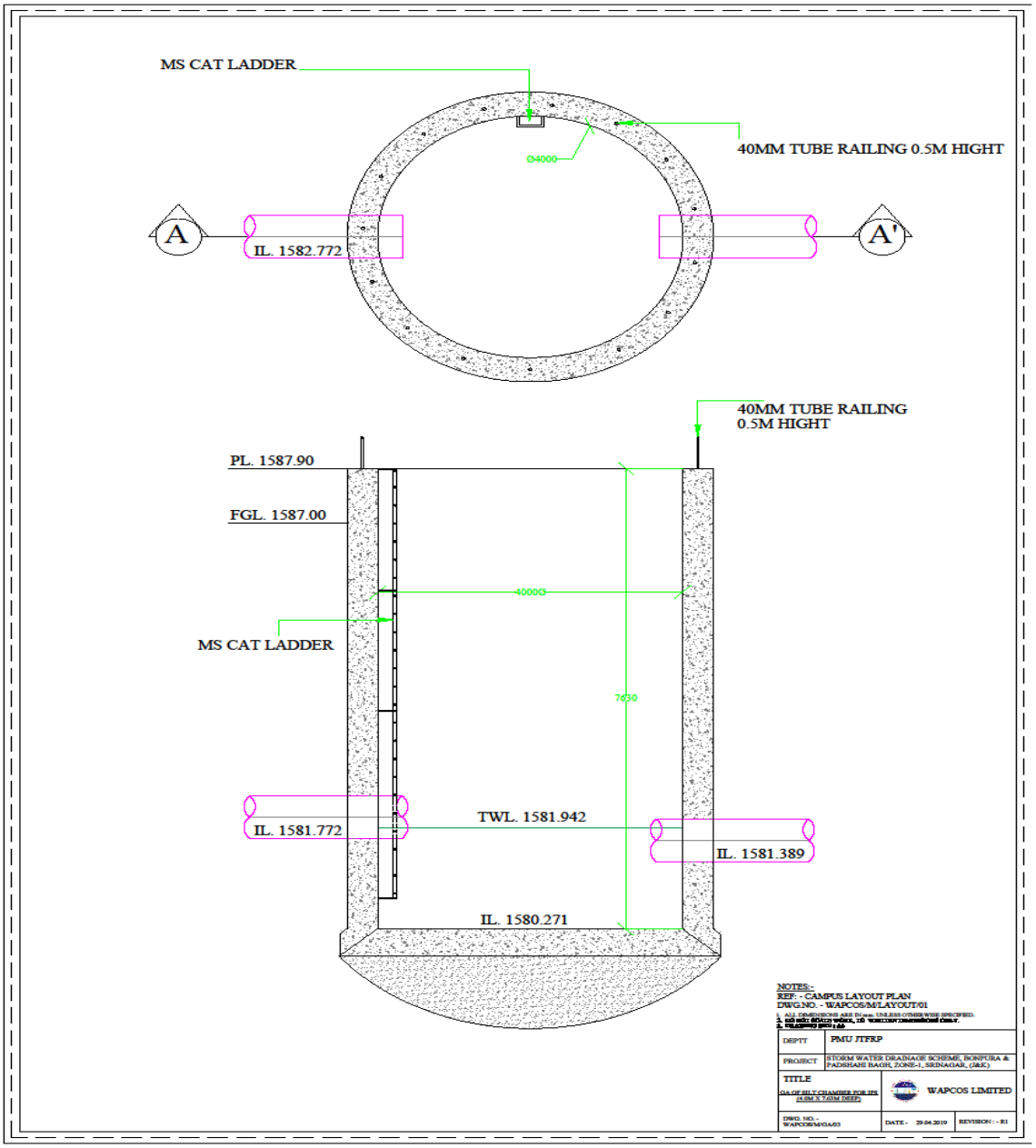


Figure 3.7: Silt Chamber of Bonpora Intermediate Pumping Station (IPS)

Padshahi Bagh MPS

Pump Sump of internal diameter 5.0 m and total height of 11.13 m between top of sump and invert level has been proposed. The sump capacity has been designed for the worst case of running 5 cusec pump with detention period of 6.92 minutes and 0.8m pump submergence.
1 no. -5 cusecs @18MWC pumps (1W),1 No 7 cusecs @ 18MWC and 1 No. 10 Cusecs @ 18 MWC are proposed to be installed and 100% pumps shall be on shelf. The total capacity is designed for a storm flow of 22 cusecs. The pumps shall be non-clog submersible with guide pipe, auto coupler type duck foot bend to be mounted on a block for easy replacement during maintenance (details shall be as per vendor drawing obtained during procurement).

The Double flanged column pipe in DI K-9 of 300mm, 350mm and 450mm delivery lines for 5 cusecs, 7 cusecs and 10 cusecs pumps are proposed. Electrically operated sluice valves on each delivery line are proposed along with Non Return Valve (NRV) of required size. Each delivery line terminates into the outfall structure across the bund road at water body directly with rising main length of 38m for each pipe.

Flow meter location with 5d / 3d considerations, so as to ensure full bore running of flow meter for accuracy of flow measurement is proposed on each delivery line. EOT Crane of 3 Ton capacity has been proposed for maintenance of pumps etc. which shall be housed in the ground floor of the annexe building proposed over the sump and silt chamber. The building shall be supported on the walls of silt chamber and sump well combined due to space limitations.

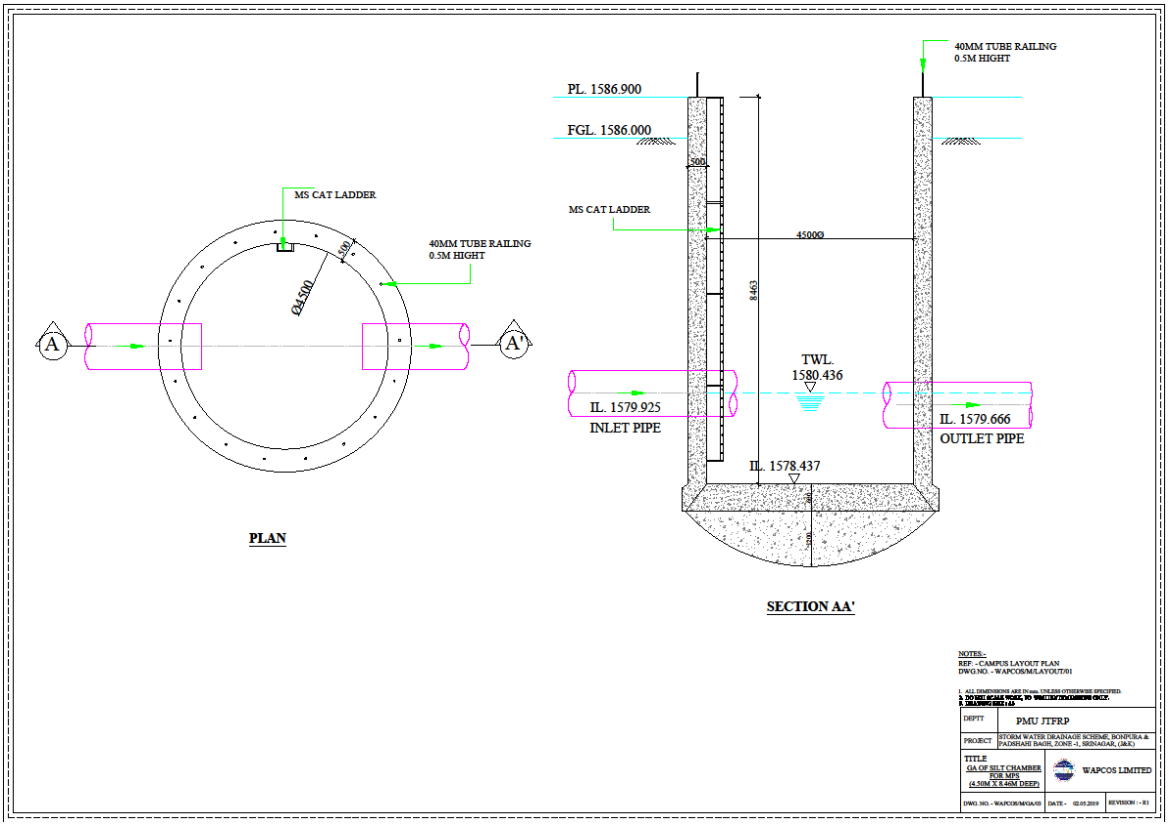


Figure 3.8: Silt Chamber of Padshi Bagh Major Pumping Station (MPS)

3.5.14. Outfall Structure for Padshahi Bagh MPS

The delivery level of Rising Main has been kept at 1589.17 m i.e. above normal flood level (1587.67) of the water body. A stilling basin of 4m x 1.54m x 1m size has been proposed to kill the energy. From the Stilling basin the discharge shall be allowed to flow over a sloping slab till it is arrested at the bed of water body by a cistern. A toe wall to support the structure is proposed.

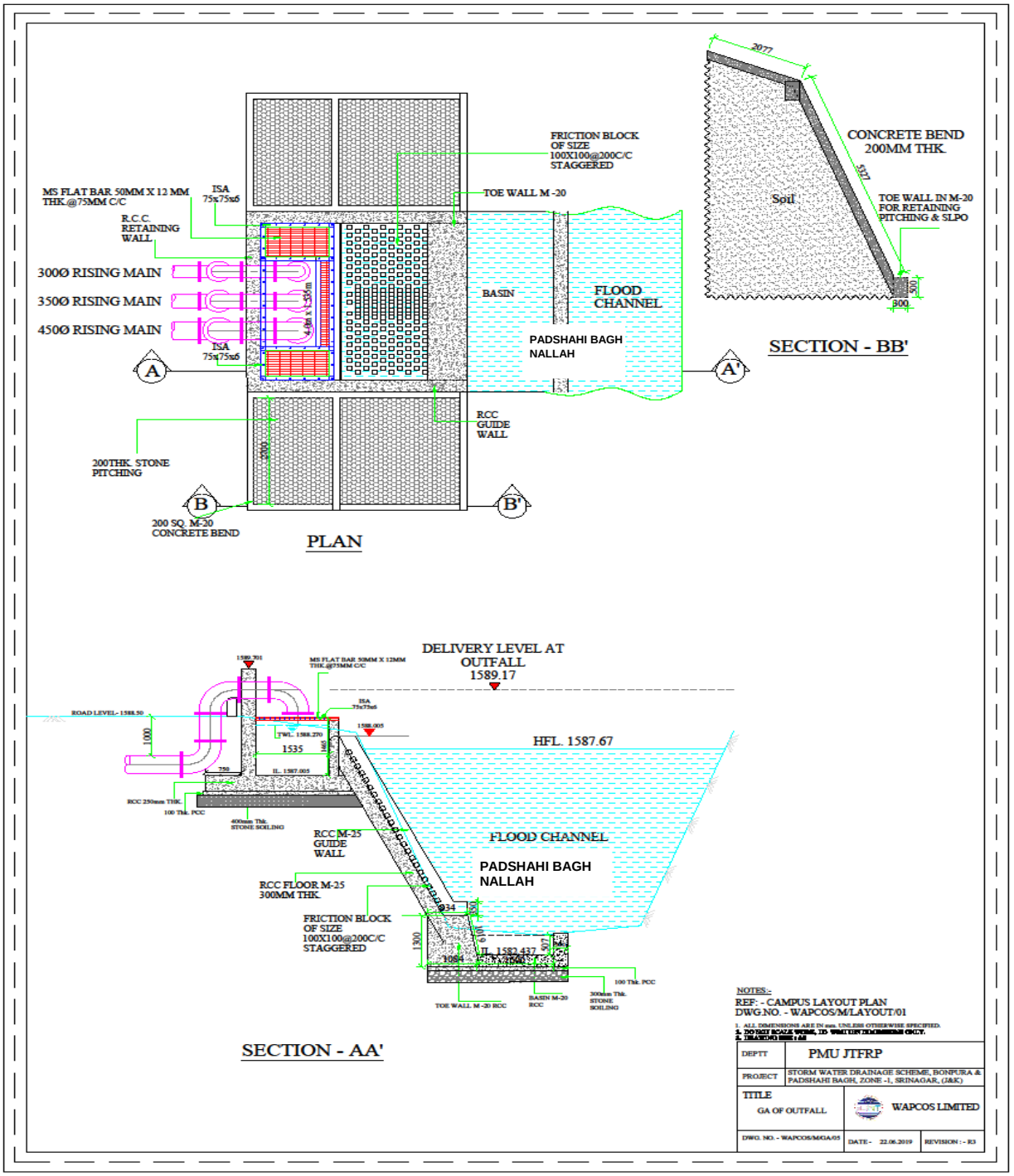


Figure 3.9: Outfall structure for Padshahi bagh Major Pumping Station (MPS)

3.5.15. Retaining Wall / Boundary Wall

Bonpora IPS:

Boundary wall in Brick masonary of suitable height has been proposed and on all other sides and suitable gate has been proposed. Minimum width of MS Gate shall be 3.5m.

Padshahi Bagh MPS:

Boundary wall in Brick masonary of suitable height has been proposed and on all other sides with suitable 2 nos. gates of 3.5 & 1.2 m on bund side and have respectively.
For access to the machinery floor, it has been proposed to create levelled ground infront of pump house /gate area, as such RCC retaining walls are proposed. Spiral stair also been proposed for Emergency.

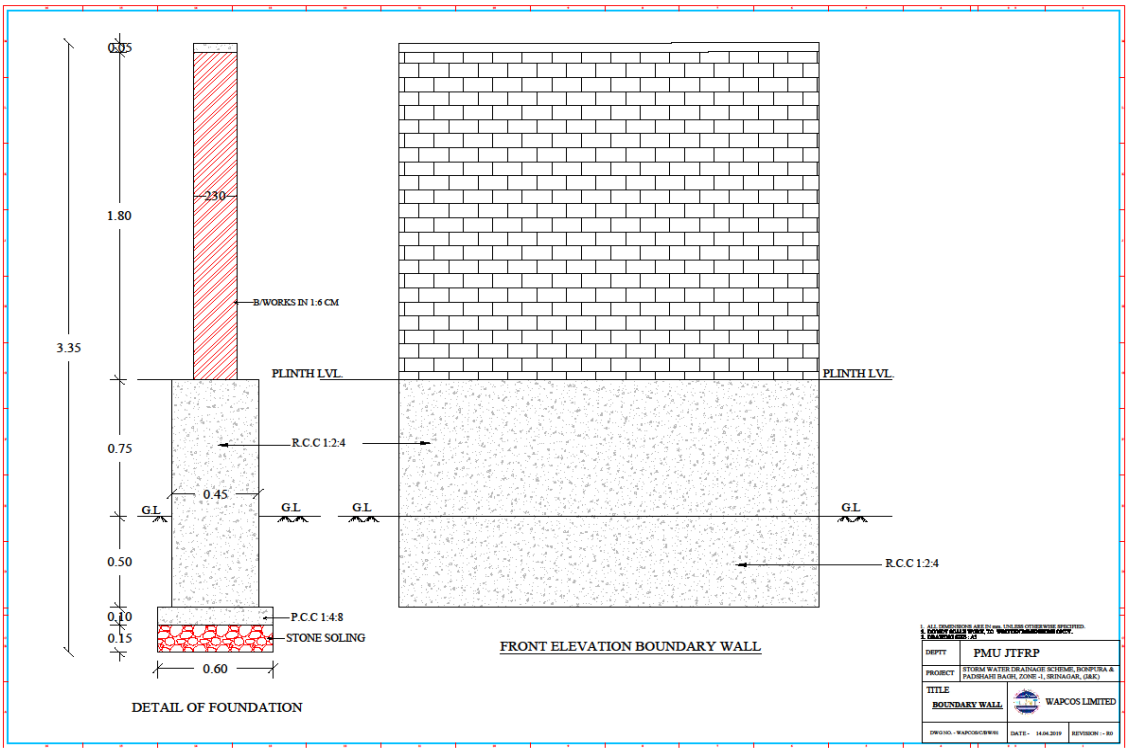


Figure 3.10: Retaining / Boundary Wall for Bonpora/ Padshahi Bagh Pumping Stations.

3.5.16. Training of Padshahi Bagh Nallah/Drain Traversing through MPS Location:

In order to create space for various civil components at Padshahi Bagh location, it has been proposed to train the nallah carrying surface flows to one side (upto flood gate on spill channel) of the plot by construction of Pipe drain of 1200mm dia RCC NP4 pipe

An interceptor arrangement for diverting Nallah flow to the main drain has been proposed before sluice valve chamber. This consists of a manhole of 1800mm dia with 500mm dia DI pipe connection from the concrete drain /Nallah controlled by a sluice gate at the drain. Under

normal conditions the nallah flow spills into the spill channel through an already existing sluice gate. During high flood levels in the spill channel, this gate shall be closed and as such nallah flow shall be diverted into the main incoming drain of MPS by opening the control gate u/s.

3.5.17. RCC ramp and stair;

A ramp, stair and spiral stair as an access to the equipment/ Operational floor has been proposed at MPS. Spiral stair has been proposed at IPS. The operational floor levels at MPS & IPS are 1592.33m & 1591.00 m respectively. The annexe building at IPS location has been located on road side to have access to the operational floor for placement of equipments.

3.5.18. Complex Development

The access routes around structures shall be paved with CC tiles/concrete at IPS and MPS bituminous road. Open spaces in each of pumping station (especially IPS site at Bonpora) shall be developed with green spaces and with the boundary plantation of Pine Trees/ ornamental flowering trees/ green turfing where ever applicable.

3.5.19. Transformer & Power Supply

A transformer of 11KV/0.415 KV of 250 KVA for Bonpora IPS and 1 No. 400KVA transformer for MPS are proposed. For uninterrupted power supply 1 Nos. D.G. sets of 250KVA and 400KA are proposed at IPS and MPS respectively. The transformer along with GOS etc. shall be two pole mounted at a suitable place. HT Panel and circuit breakers of required capacity shall be placed inside the annexe building closer to location of transformers at each station.

3.5.20. PLC &SCADA[7]

All electrically operated equipments like valves, sluice gates, pumps, flow meters, pressure transmitters and level indicators etc. shall be centrally controlled from PLC equipment placed inside the PLC room of annexe building. The control cable shall be laid from all equipments upto PLC room suitably.

3.6. OPERATION AND MAINTENANCE PLAN

3.6.1. GENERAL

A well designed Operation and Maintenance (O&M) Plan for a Drainage system is critical to ensure that the design discharge is carried adequately in daily operation without any nuisance, resulting in maximum benefit to the residents at the minimum possible level of

[7] Scope of PLC & SCADA is not part of Bonpora-Padshahi Bagh DPR.

investment. Proper implementation of the O&M plan results in low maintenance costs and ensures longer service life of all system components.

The critical issues that will be dealt in development of an O&M Plan will be the maintenance of drain cleaning equipments, efficient use of labours, preventive maintenance and crisis management system.

3.6.2. Existing status of Operation & Maintenance

Presently Operation & Maintenance work is looked after by SMC. Because of inadequate manpower, machinery and budget for O & M, SMC is unable to carry out work satisfactorily and to the satisfaction of the local public. Presently they are doing just fire fighting job. Whenever some problem occurs or some flooding occurs the manpower is collected and somehow temporary solution is worked out. However, there are no preventive O&M measures taken up on regular basis.
There is no record maintained for operation and maintenance like type of problem, re-occurrence of the problem, cause of problem, temporary measures adopted, expenditure etc.

The existing O&M plan of Srinagar City requires to be upgraded to reflect present day operational conditions and labour/material requirements to handle the existing system and proposed improvements. Presently, as is the situation in most municipalities in India, repairs are performed on a need basis without proper analysis directed towards identification and long term rectification of system deficiencies.

The Operation and Maintenance issues of the present drainage system in Srinagar City are:

- Un-availability of adequate funds to do preventive maintenance.
- Limited numbers of machineries, presently SMC is having one JCB and three dumpers to maintain drains of entire city.
- Lack of training to enhance skills of O & M staff.
- No periodic training of O & M staff is arranged by the department to upgrade the skills of O &M staff. The staff mostly learns the O & M practices during job.
- Field engineers are responsible for large areas. The jurisdiction areas of field engineers are large. This has resulted in insufficient attendance to the work fronts by the field engineers.
- Lack of motivation of operational and field staff.
- Operational and field staff is not motivated to perform efficiently in the organization. There is no incentive or reward in performing efficiently to operate and maintain storm water drainage system.

3.6.3. Proposed Maintenance System

3.6.3.1. Routine Maintenance or Annual Repairs of storm water drains

Regular maintenance of Storm water drainage system is absolutely necessary, for its best functioning for which the system is designed and built. The system should be periodically inspected and cleaned from time to time without waiting for the occurrence of blocking. Better Maintenance includes removing blockages, cleaning catch basins and repairing where necessary. The blockages in the drain are due to

- deposition of grit, silt and weeds
- penetration of roots from nearby trees through the cracks in the drains and growth of weeds inside the drain which eventually choke up the drains
- dumping of solid wastes, and construction debris

These blockages can be prevented by periodic cleaning and removing the plants and roots in the drain and by public awareness campaign by SMC.

3.6.3.2. Maintenance before monsoon

Pre-monsoon cleaning up of the storm water system is very important in order to ensure efficient functioning of the system during rainy days. Silt, weeds and debris are to be removed wherever there are blockages in drains.

- Any missing / damaged manhole cover or open joints in the masonry / concrete in the floor or sidewalls shall be properly replaced and repaired. Any deviation from the original formations on the bed and sides is to be noticed and reported.
- The weepholes in the sidewalls shall be cleaned of all extraneous matter to prevent of building up hydrostatic pressure on the wall.
- Arrangements for the surface drainage for its entry into the drain may be provided and maintained to enable surface water to drain without damaging the manholes.
- Condition of the Apron provided in front of upstream and downstream of cross drainage works may be replenished wherever required.

3.6.3.3. Maintenance during monsoon

- Backflow and eddies near cross drainage works may have to be carefully watched to ensure that no erosion takes place.
- It should be ensured that each inlet of covered drain is opened, checked and cleaned of all deposits at least once a month.

3.6.3.4. Maintenance after monsoon

- The settlement of shrinkage cracks, if any, in masonry / concrete shall be properly treated with CM 1:3 mix..
- Peeling off of mortar at the joint shall also be made good with cement mortar pointing. If wider cracks are noticed in revetment works, they shall be grouted with cement mortar.
- In case of excessive settlement of foundations, further settlement shall be prevented by under pinning of foundations.
- Any damage to the bed and sides is to be recorded and arrangements are to be made to rectify it.

3.6.3.5. Role of Srinagar Municipal Corporation

In order to achieve better maintenance of the storm water drainage system, Srinagar Municipal Corporation (SMC) has to take the following actions, so that the drainage system meets the desired goals.

- *Prevent flow of disposal of solid wastes into drains.* With implementation of solid waste management sub projects, it is hoped that this problem would get solved. A public awareness campaign by SMC to educate people not to dump solid wastes drains should be carried out.
- *Silting, weeding and blockage of secondary/tertiary drains*. Regular cleaning and maintenance by SMC coupled with deterrent punishment to persons who block the secondary/tertiary drains is to be carried out.
- *Encroachments of flow channels.* SMC must enforce measures to disallow any construction on drain beds and periphery. Encroached drain sections are to be cleared and drains provided with adequate cross section to carry the flow.
- *Lack of maintenance of drain channel and associated structures (e.g., culverts).* Some of the culverts, wing walls and parapet walls are in bad condition and are to be rehabilitated. Some parts of the lining have disappeared. There is a need to repair these and more essentially to clean and maintain them regularly by carrying out minor repairs.
- *Dumping of construction spoils and other materials into drains, especially tertiary drains.* Policing and stiff fines on offenders would act as a deterrent. Citizens should be encouraged by SMC to bring such violations to its notice by maintaining a complaints cell with a telephone. Public awareness campaign by SMC will improve the situation.

3.6.3.6. Staffing Pattern

It is suggested that the following guidelines be adopted for the staffing and equipment for a preventative maintenance program.

- Drains should be cleaned once in six months
- Task allocation for 1 cleaner should be 100 m length of primary/secondary drains or 200 m length of tertiary drains per day.
- Supervisors should be provided at the rate of 1 for 5 sweepers.
- Repair works / Maintenance works to plum concrete/masonry like reconstruction of damaged portions, grouting and pointing are to be attended by skilled masons wherever required. Task allocation for 1 mason should be 30 km of main drains as well as 100 m of tertiary drains.
- One sanitary inspector for overall in charge
- Adequate equipment should be provided for efficient operation of cleaning crews, including wheelbarrows and miscellaneous hand tools for each drain cleaner and dumper truck for waste transportation and disposal.

For Srinagar city it is envisaged that about 119 km of primary and secondary drains and substantial number of tertiary drains are to be taken up for routine preventative maintenance and operation. Based on the above, following staffing pattern is suggested for Bonpora-Padshahi Bagh storm water drainage scheme.

Staff for drain cleaning

S. No.	Staff	No. of Persons
1	Cleaner / Sweeper	8
2	Supervisors	2
3	Sanitary Inspectors	1

4. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This section presents the national and state level environmental legislations and regulations and World Bank Policies relevant to the "Construction of Storm Water Drainage/ Two Pumping Stations (MPS/IPS) in Bonpora-Padshahibagh area of Zone 1 in Srinagar City (J&K). The various regulation applicable and regulatory clearances required for the storm water drainage works to be carried in Bonpora-Padshahibagh Area, Srinagar are been incorporated in this section..

4.1. Legal Framework

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer, the legislation has been jointly entrusted to the Ministry of Environment, Forests and Climate Change (MoEF & CC) at National level, whereas Jammu & Kashmir Pollution Control Board (J&KPCB) at State level in the present context to storm water drainages works at Bonpora-Padshahibagh in Srinagar.

4.2. Applicable National and State Regulations

Table 4.1 Presents the key environmental and other regulations relevant to construction of storm water drainage system including a pumping station in Bonpora-Padshahibagh Area of Srinagar City and auxiliary works.

Table 4.1: Environmental Regulations Relevant to Storm Water Drainage Subproject in Bonpora-Padshahibagh Area, Srinagar

S. No.	Environmental and Other Regulations	Relevance to Construction of Storm Water Drainage System in Bonpora-Padshahibagh	Regulatory Clearances Required, if any	Authority
1.	EIA Notification, 14th Sept 2006 and subsequent amendments	This notification is not applicable as Construction of Storm Water Drainage is not listed in the Schedule of the notification and therefore out of the purview of notification	-	MoEF & CC, GoI and SEIAA/DEIAA,, GoJ&K
2.	Jammu and Kashmir Forest (Conservation) Act, 1997	This Act is not applicable as Storm Water Drainage works by way of laying drainage pipes within the existing road and construction of one pumping station at a designated land which does not require diversion of forest land.	-	Principal Chief Conservator of Forests, J&K Forest Department, Government of J&K
3.	Jammu and Kashmir Wildlife (Protection)	This act is not applicable as Storm Water Drainage works	-	Chief Wildlife Warden,

	Act, 1978	is under jurisdiction of Srinagar Municipal Corporation in Srinagar city and is not located in any National Parks and Wild Sanctuary.		Government of J&K
4.	Air (Prevention and Control of Pollution) Act, 1981	This act is applicable for construction stage to manage ambient air quality at work camp, concrete batch mix plants etc, for Storm Water Drainage works including construction of two pumping stations.	Consent to establish and Operate Pumping Station required. Consent for Establish (CFE) is to be obtained prior to establishing concrete batch mix plants sites. Consent for Operate (CFO) is to be obtained prior to commencement of operations at concrete batch mix plant	J&KSPCB, Government of J&K
5.	Water Prevention and Control of Pollution) Act,1974	This act is applicable for construction stage to manage liquid waste discharges at work camp, concrete batch mix plants, etc. The act will be applicable for control of water pollution from project activity.	Consent for Establish (CFE) is to be obtained prior to establishing concrete batch mix plant. Consent for Operate (CFO) is to be obtained prior to commencement of operations at concrete batch mix plant.	J&KSPCB, Government of J&K
6.	Noise Pollution (Regulation and Control Act),2000	This act will be applicable for all construction equipment/ plant and machinery including vehicles deployed for implementation of the storm water drainage project to regulate ambient noise levels	None. But noise levels are to be regulated during construction and operation/ maintenance for implementation of Storm Water Drainage works in conformity with permissible standards	J&KSPCB, Government of J&K
7.	Construction &	This rule shall be applicable	Construction	Srinagar

	Demolition Waste Management Rules, 2016	to generation of excavated material during laying of storm water drainage pipes on existing roads and other construction related activity. This will be mitigated within the ambit of this rule.	and Demolition Waste Management Plan should be prepared prior to commencement of works., prior to commencement of construction	Municipal Corporation (SMC)
8.	e-waste (Management) Rules, 2015	This rule shall be applicable as during the operation of SWD-pumping station	-	J&KSPCB, Government of J&K
9.	Public Liability and Insurance Act 1991	To protect damage to the public life and/or property as a result of negligence/accidents construction of Storm Water Drainage works in Bonpora-Padshahibagh.	Project operations are to be insured to cover damage to the public life and/or property due to accidents/ negligence during construction of Storm Water Drainage works.	State Labour Department
10.	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989 (and amendments)	This act will be applicable for all construction equipment/plant and machinery including vehicles deployed during construction of Storm Water Drainage works	(PUC), the vehicular emissions are to be regulated by project proponent in conformity with permissible levels/emissions	J&K Motor Vehicles Department
11.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996/ Jammu and Kashmir Building and Other Construction Workers (Regulation of Employment and Condition of Services) Rules, 2006	To ensure safety and welfare measures for workers employed at construction sites. The construction of Storm Water Drainage works is covered under other construction category.	NONE. Safety and welfare measures for work force employed at construction sites are to be regulated in conformity with the Jammu and Kashmir Building and Other Construction Workers (Regulation of Employment	Labour and Employment Department, Govt. of J&K

			and Condition of Services) Rules, 2006	
12.	Jammu and Kashmir Electricity Act, 2010 and amendments	This stipulates all technical and safety requirements construction of Storm water Drainage works in Bonpora-Padshahibagh area	NONE	J&K State Electricity Board
13.	Hazardous and other Waste (Management and Transboundary Movement) Rules,2016	The rule will be applicable to used oil generated from construction equipment/ machinery during construction stage of Storm Water Drainage works. The rule includes storage, handling, transportation procedures and requirements for safe disposal of all hazardous wastes.	Hazardous Waste Authorization With CTE and CTO	J&KSPCB
14.	Solid Waste Management Rules, 2016	This rule is applicable to all forms/types of solid waste generated at operational areas and work camp sites for construction of Storm Water Drainage works.	-	J&KSPCB/ Municipal Corporation
15	The Jammu and Kashmir Preservation of Specified Trees Act, 1969	The act preserves specified trees and for cutting of such trees, permission will be required from Concerned Department.	For cutting of any specified trees permission will be obtained from concerned Department.	J&K Forest Department / Revenue Deptt.

4.3. World Bank Safeguard Policies

World Bank safeguard policies are designed to prevent and mitigate undue harm to people and their environment in the development process. They lay out requirements that must be complied with for all Bank-funded projects (refer to World Bank's Website on Safeguard Policies). The safeguard policies of the World Bank relevant to the Construction of Storm Water Drainage are given in **Table 4.2**.

Table 4.2: Relevant and Applicability of WB Safeguard Policies for Storm Water Drainage in Bonpora-Padshahibagh Area in Srinagar

S. No.	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
1.	OP/BP 4.01 Environmental Assessment	Overall governing policy intended to ensure Bank-financed projects are	All potential impacts due to the Construction of Storm Water Drainage are to be	Triggered

		environmentally sound and sustainable	assessed and necessary mitigation measures are to be incorporated	
2.	OP/BP 4.04 Natural Habitats	Policy is intended to prohibit Bank financing of projects that degrade or convert critical habitats and supports projects that affect non-critical habitats only if no alternatives are available and if acceptable mitigation measures are in place.	Storm Water Drainage to be constructed within the existing roads, which is under the jurisdiction of Srinagar Municipal Corporation and the project site is not located in any forest area/ national park or wild sanctuary.	Not Triggered
3.	OP/BP 4.36 Forests	Policy is intended to support sustainable and conservation-oriented forest management, harness potential of forests to reduce poverty in a sustainable manner, integrate forests into sustainable economic development, and protect vital local and global environmental services and values of forests.	Storm Water Drainage to be constructed within the existing roads of Bonpora-Padshahibagh area, which is under the jurisdiction of Srinagar Municipal Corporation and is not located in any forest area.	Not Triggered
4.	OP/BP 4.11 Physical Cultural Resources	Policy is intended to ensure that projects identify and inventory cultural resources that are potentially affected by the project. Projects should include mitigation measures, when there are adverse impacts on physical cultural resources.	Storm Water Drainage will be constructed within the existing road of the Bonpora-Padshahibagh area and will avoid cultural property resources (CPR) and therefore does NOT warrant shifting or affect CPRs.	Not Triggered
5.	OP/BP 4.12 Involuntary Resettlement	Involuntary Resettlement Policy addresses direct economic and social impacts from project activities that may cause involuntary taking of land resulting in: (i) relocation or loss of shelter, (ii) loss of assets or access to assets, and/or (iii) loss of income sources or livelihoods.	Storm Water Drainage in Bonpora- Padshahibagh area includes construction of two pumping stations (MPS/IPS) and the proposed site is a barren community land and Padshahibagh Nallah and hence does not involve Involuntary Resettlement.	Not Triggered

4.4. Environmental Standards

Various environmental standards applicable to the proposed "Construction of Strom Water Drainage in Bonpora- Padshahibagh Area of Zone-1 in Srinagar are described below:

4.4.1. National Ambient Air Quality Standards

The National Ambient Air Quality Standards are mentioned in **Table 4.3.**

Table 4.3: National Ambient Air Quality Standards (NAAQS)

	Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central Government)
1	Sulphur Dioxide (SO_2) in µg/m^3	Annual*	50	20
		24 hours**	80	80
2	Nitrogen Dioxide (NO_2) in µg/m^3	Annual*	40	30
		24 hours**	80	80
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual*	60	60
		24 hours**	100	100
4	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ µg/m^3	Annual*	40	40
		24 hours**	80	80
5	Carbon Monoxide (CO) in mg/m^3	Annual*	02	02
		24 hours**	04	04

** Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.*
*** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time, they may exceed the limits but not on two consecutive days of monitoring.*
Source: National Ambient Air Quality Standards, Central Pollution Control Board Notification in the Gazette of India, Extraordinary, New Delhi, 18th November, 2009.

4.4.2. Discharge Standards for Waste Water

The Discharge Standards for Waste Water as prescribed by the Central State Pollution Board (CPCB) are mentioned in **Table 4.4.**

Table 4.4: Discharge Standards for Waste Water

Sl. No	Parameter	Standards (CPCB, 2008)		
		Inland surface water	Public Sewers	Land for irrigation
1.	Colour and odour	--	--	--
2.	Suspended solids mg/l	100	600	200
3.	pH	5-5-9.0	5-5-9.0	5-5-9.0
4.	Temperature[8] (°C)	≤5°C	--	≤5°C
5.	Oil and grease (mg/l)	10	20	10
6.	Total residual chlorine (mg/l)	1.0	--	--
7.	Nitrate-nitrogen (mg/l)	50	50	--

[8] Temperature shall not exceed 5°C above the receiving water temperature

8.	BOD3[at 27°C] (mg/l)	30	350	100
9.	Chemical Oxygen Demand	250	--	--
10	Arsenic (as As), mg/l, max.	0.2	0.2	0.2
11	Mercury (as Hg), mg/l, Max	0.01	0.01	--
12	Lead (as Pb) mg/l, Max.	0.1	1.0	--
13	Cadmium (as Cd) mg/l, Max.	2.0	1.0	--
14	Chromium (Cr+6) (mg/l)	0.1	2.0	--
15	Copper (mg/l)	3.0	3.0	--
16	Zinc (mg/l)	5.0	15	--
17	Selenium (mg/l)	0.05	0.05	--
18	Nickel (mg/l)	3.0	3.0	--
19	Fluoride (mg/l)	2.0	15	--
20	Dissolved Phosphates (mg/l)	5.0	--	--
21	Sulphide (mg/l)	2.0	--	--
22	Phenol (mg/l)	1.0	5.0	--
23	Manganese (mg/l)	2	2	--
24	Iron (mg/l)	3	3	--
25	Vanadium (mg/l)	0.2	0.2	--

4.4.3. Ambient Noise Standards

The ambient noise standards are mentioned in **Table 4.5.**

Table 4.5: Ambient Noise Standards

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note : - 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.
** dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.*
A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.
Leq: It is an energy mean of the noise level over a specified period.

5. DESCRIPTION OF THE ENVIRONMENT: BASELINE SETTINGS

5.1. General

Srinagar is the largest city and the summer capital of the state of Jammu and Kashmir. It lies in the Kashmir Valley on the banks of the Jhelum River, a tributary of the Indus, and Dal and Anchar lakes.

In September 2014, J&K experienced torrential monsoon rains in the region causing major flooding and landslides. The continuous spell of rains from September 2-6, 2014, caused Jhelum and Chenab Rivers as well as many other streams/tributaries to flow above the danger mark. The Jhelum River also breached its banks flooding many low-lying areas in Kashmir, including the capital. Post 2014 floods, the High Flood Level (HFL) of the city got raised by 8 to 10 feet at most of the locations. The unprecedented floods of 2014, in the context of the climate change and failure of an efficient warning system in Jammu & Kashmir, coupled with the poor infrastructure and deficit of disaster management facilities, resulted in huge losses of life and property. Due to heavy rainfall the catchment areas particularly the low lying areas were flooded for more than two weeks. Some areas in urban Srinagar stayed flooded for 28days. Water levels were as high as 27 feet in many parts of Srinagar. The areas from the main tributaries of river Jhelum vis-à-vis Brengi nallah, Vishav nallah, Lidder nallah and Sandran nallah started overflowing due to the heavy rainfall causing water levels in Jhelum river to rise to unprecedented levels. Impact of floods resulted in catastrophic devastation in most districts of the J&K state. The lack or unavailability of proper evacuation and escape routes complicated the problem and people suffered heavy losses and hardships. Considering the damages caused by the floods of 2014, efforts have been initiated to strengthen capacity and infrastructure, so as to avoid and minimize such damages in the future.

Under Component-3, "***Restoration of urban flood management infrastructure",*** one of the subproject identified is the "Construction of Storm Water Drainage Scheme in Bonpora- Padshahibagh area of Zone-1" in Srinagar City. The subproject area usually remain waterlogged during rainy seasons or even short spell of precipitation which is mainly attributable to low lying nature of the area. Whole Padshahibagh and Bonpora, Nowgam area lacks essential drainage system resulting into frequent water logging/ submergence of the area. The subproject site being getting submerged locals, officials have to face inconvenience during rains as the storm water more frequently inundate the Road. In 2014 floods, the HFL of this area got raised by at least 2-5 m.

5.2. Study Area

The Srinagar city lies $34^0$0' - $34^0$14'N (Latitude) and $74^0$43' - $74^0$52'E (Longitude) with an altitude of 1585 m (5200 ft) above mean sea level (msl). The city has a unique physiographic setup with steep hills in the East and North East, low lying paddy fields falling in the flood plain of Jhelum in the South and West, the Karewas of Budgam in the extreme South and towards the North we encounter the uplands with moderate slopes. The famous *Dal* lake is situated in the heart of the city. The city of Srinagar experiences a temperate type of climate. The city receives most of the precipitation in winter season in the form of rain and snow with an annual average rainfall of 710 mm.

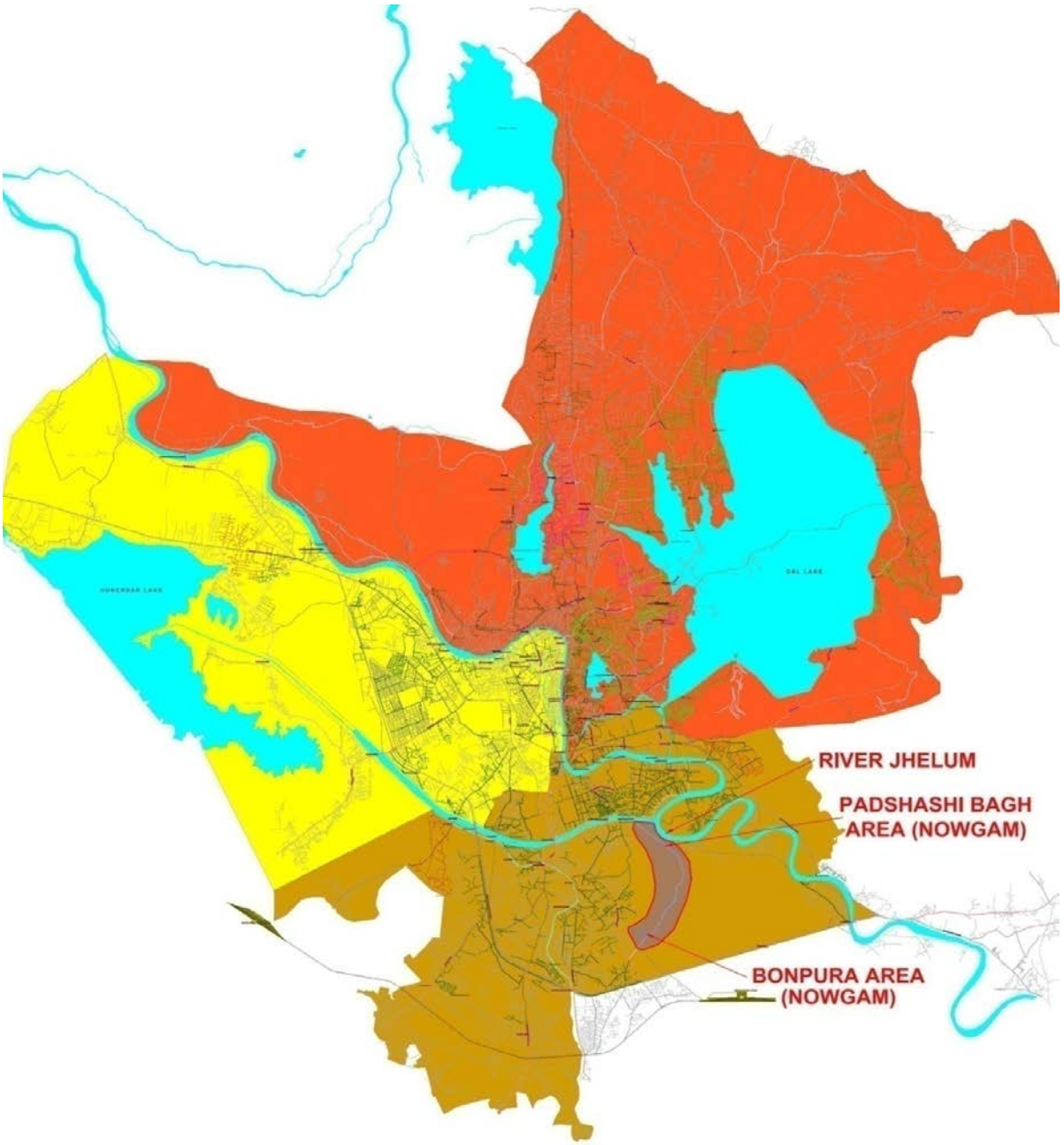


Fig 5.1: Map of Srinagar City showing Project/Study area (SWD Bonpora-Padshahibagh)

The proposed subproject *"Construction of Storm Water Drainage Scheme" is situated in Nowgam Bonpora-Padshahibagh area of Srinagar City"* having a geo-coordinates of $34^0$02'11"N (Lat) $74^0$49'25"E (Long) at Nowgam [9]IPS and $74^0$49'46"E (Lat) $34^0$03'13"N (Long) at Padshahi Bagh [10]MPS (refer Appendix 4 & 5). It is about 2km from the Srinagar Railway Station and 8 km from Srinagar International Airport. The subproject area is a built-up area and is very important interconnecting link road from bypass Nowgam via Padshahibagh and connects Lasjan, Jawahar Nagar, Rajbagh, Rambagh, Lal Chowk and rest of Srinagar. The final disposal point (outfall channel) is at Padshahibagh pumping station with already existing outfall channel into Padshahibagh nallah (at geo-coordinates of $34^0$02'14.5" N Lat $74^0$49'48.5" E Long). This small Padshahibagh nallah originates from the floodplains of Summerbugh Lasjan near River Jhelum and has an approx. length of 6 km.

The subproject area is mainly a built-up area with pockets of paddy fields. The area is close to Srinagar Railway station at approximate distance of 2km and on the right side of the Padshahibagh area (from Bonpora to Padshahibagh) is the river Jhelum and it's Flood Spill Channel at the bund side. The area lies on the right bank of the River Jhelum (from Padshahibagh side) and usually remain inundated during episodes of high floods. Being a very low lying area & lies on the banks of the River Jhelum, the area is low lying area and accumulated water flows have no disposal. The water table in most parts of the area is over the Natural Ground Level or just flowing with the NGL. The wastewater is seen flowing on the damaged roads and oozing out of the compound walls, residential houses (refer Annexure-2 for photos). Risk of health issues/ epidemic like diarrhoea, cholera, and other water-borne diseases cannot be ruled out and other health issues like breeding grounds for mosquitoes and foul smell emanating from the stagnated water. There is every possibility of epidemic & waterborne disease as potable/ drinking water lines are running below the contaminated stagnant water.

The proposed Storm Water Drainage subproject has a total length of 12 km of SWD drainage network with 2 pumping stations *(Fig 1-3 Index map/ IPS/MPS)*. *The proposed sub-project required 995.00 m^2 of land for construction of one Intermediate Pumping station (IPS) and one Major Pumping Station (MPS).* The land required for two pumping stations as per revenue records falls under the category of Shamilat Deh Land. However, there is no impact on livelihood as the drainage work will be carried out within the available RoW. The drainage work is carried out on daily basis by way of laying of concrete pipes and the filling to make the surface restoration is done for the entire stretch simultaneously. The sites for two pumping stations are open land and free from any encroachment.

5.3. Topography and Physiography

Srinagar city is located at an average elevation of 1585 meters above mean sea level and it is spread over in the heart of the oval shaped Valley of Kashmir. It is

[9] Intermediate Pumping Station
[10] Major Pumping Station

situated between 74-56′ and 75-79 E, Longitude and 33-18′ and 34-45′ N Latitude. The city as well as its hinterland is bounded by natural wall of mountains (sub-mountain branches of Pir Panjal Ranges and Zanskar mountains). In the east city is bounded by Zabarwan mountains with lush green vegetation, locating famous Dachigam Sanctuary and Mughal Gardens and is environed by the shallow and swampy lakes of Dal and Nagin with the eminence of hillocks of Takth-i-Suliman in the east and Kohi-Maraan (Hariparbat) in the centre adding to its beauty and making surroundings of the city invigorating. Srinagar is well connected with other District Headquarter Towns, Tourist Resorts, Ladakh and Jammu Division of the State. Because of its location advantage of being located in the heart of Kashmir Valley, it has acquired greater degree of centrality despite the constraints which the surroundings and physiography of the region pose to the physical growth of the city. Being the capital city and the largest urban settlement, it has become hub of major administrative, political, economic, commercial and other activities. It also acts as major tourist destination and terminating centre in Kashmir Valley. It constitutes 73.18 per cent of the urban population of Valley and 48.55 per cent of the urban population of the State which has given its complete supremacy in urban settlement system in Kashmir with pronounced regional urban primacy.

The city enjoys a sub- Mediterranean type climate with severe winters and moderate summers associated with relatively higher humidity throughout the year varying from 78 per cent to 91 per cent (minimum 45 per cent). Normally the temperature ranges between 29 to 34 °C, in summer and in winter temperature varies from -5 C to 10 C. About the wind direction, northerly, north-westerly kms per hour. However, interspersed hillocks and water bodies in and south-westerly winds are more predominant with an average wind velocity of 2 to 5 and around the city produce considerable micro-level variation in direction and speed of winds. The severe winter and moderate summer climate conditions are suited for low- rise high -density development of residential areas. The micro-climatic variation also plays a very important role in orientation and design of buildings. Precipitation in the city is almost spread over throughout the year varying from 1.5 to 21 centimetres. During winter season, it is in the form of snow and sleet while as in the rest of the year it is in the form of rains and hail. As Srinagar is located in the Valley with large pockets in low-lying and flood prone areas, every year torrential and concentrated rains cause considerable damage to standing crops, houses and road infrastructure. Moreover, sanitary conditions in almost whole of the city which already is unsatisfactory, gets further aggravated during the constant and heavy rains.

The district is surrounded by the Hurmukh mountain (16,903 feet) in the East, Tosh Maidan (4,000 feet) in the North and Snony Kazi Nag (12,125 feet) in the North-West and also the Mahadev mountain. The area is a land of lakes, clear streams, green meadows and magnificent trees. The river Jhelum dissects the district diagonally from south east to north-west. The geographical area of the district is 2,228 sq. km. Physiographically, it is about 30 to 500m away from the river Jhelum, which is

largely flat and featureless with sub-recent alluvial deposits. The topography shows plain to gentle terrain slope in the Srinagar area.

5.4. Geology and Soil of the Area

The main geological formations in the district are Karewas and Paleozoic Sedimentaries and Volcanic type. These formations are overlain by a thin mantle of recent alluvium. The Karewas are overlying the folded Zeewan formation and Panjal volcanics. In the northern extremity of the valley portion Karewa formations rests over the Cambrio-Silurians. The general geological successions of the area are as under: Table 5.1.

Table 5.1: Geology and Soil of the Area

Group /Formation	Lithology	Age
Scree material & Alluvium	Heterogeneous Clastic sediments comprising of Sand, Silt, Clay	Sub-Recent to Recent
Upper Karewas Naugam Formation	Loams, Silts & Silty brown-grey Clays unstratified, laminated to marls, sands, silts, and plastic clays. Glacier boulder bed II, glacial stage	Lower to middle Pleistocene to Lower Pliocene
Lower Karewas Hirpur Formation	Plastic bluish grey clays, sandy clays and sand with lignite at places Glacier boulder bed I, glacial stage	
Zeewan beds	Limestone & Shale	Middle to late Permian

The soils in J&K are loamy and there is little clay content in them. Poor in lime but with a high content of Magnesia, the soil is treated with chemical fertilizers and enriched with green manure and legume before cultivation. There is sufficient organic matter and nitrogen content in the alluvium of the Kashmir valley as a result of plant residue, crops stubble, natural vegetation and animal excretion. The valley of Kashmir has many types of soils like: Gurti (clay), Bahil (Loam), Sekil (Sandy), Nambaal (Peats), Surzamin, Lemb, Floating garden soils and Karewa soils. No wonder, in Kashmir, soil is virtually worshipped as a miracle of divinity as it is a source of wealth of the land. The subproject area of both Bonpora and Padshahi Bagh are floods plain area of Jhelum River and classic example of Alluvium formation.

The soils of the Kashmir Valley are broadly divided into two types viz, Hapludalfs and Ochraqualfs and the same is true for the Srinagar district also. These soils are described below:

5.4.1. Hapludalfs Soil Type

These soils are found on Karewa tops and uplands with a slope variation of 1-3%. These are very deep soils, well drained with moderate permeability. These soils are severely eroded resulted in the formation of gullies and ravines. These are medium to fine textural soils and the surface texture varies from clay loam to silty clay loam. The colour of the soils varies from Yellowish Brown to dark Brown. These soils are mostly used for cultivation of Wheat, Maize and pulses.

5.4.2. Ochraqualfs Soil Type

These soils are found in plain to mid upland topography. These soils are moderately fine textured with clay loam as the predominant surface texture. The extent of erosion on such soils is much less. These are dark brown to dark yellowish Brown in colour. These soils are mostly used because of their low permeability for the cultivation of Paddy, Mustard etc.

5.5. Natural Hazards

The state of Jammu and Kashmir is very distinct from the rest of the country with respect to topography, climate, economy, social setting and strategic location. Spread over an area of 2,22,236 square kilometers the state is divided into 3 regions namely Kashmir Valley, Jammu and Ladakh. The state is a multi-hazard prone region with natural disasters like earthquakes, floods , landslides, avalanches, high velocity winds, snow storms, cloud bursts, besides manmade disasters including road accidents and fires etc. occurring in various parts of the state. The devastating floods of 2014 and 2005 earthquake and the Leh cloud burst and flash floods are still afresh in our memories which constrained State establishment as well as local authorities and civil society to think and form an effective Disaster Management Policy in the state of J&K under Jhelum Tawi Flood Recovery Project (JTFRP).

5.5.1. Floods

Although flooding is a major hazard to lives and infrastructure the world over, but mechanism and trends in flood hazards are poorly understood. Normally, the pro-longed and high intensity rainfall is the trigger for floods, however, the geomorphic setup and nature of the socio-economic development in the river basin would either ameliorate or exacerbate the flooding under various scenarios. Recently, the frequency of extreme rainfall events and floods has increased worldwide including the NW Himalayas. The extreme rainfall event, as evident from the 7-day antecedent rainfall data observed in the Jhelum basin, turned into one of the worst disasters in the flood history of the Jhelum compounded by the existence of the injudicious socioeconomic structures and massive land system changes in the floodplains that interfered with the hydraulic and hydrological processes during the flooding The scenario was further worsened due to the dilapidated flood control structures and the institutional failure on managing the enormity of the extreme flooding.

The 2014 flood was very devastating killing more than 100 people and causing colossal loss to the infrastructure to the tune of INR 1 trillion (World Bank 2015). The Jhelum waters, that used to be the provider of life and sustenance, suddenly became a monstrously destructive force against the human life and the infrastructure that cohabit its backyards since millennia. The high discharge levels of the Jhelum persisted for more than a week, flooding the vast low lying areas of the valley. The scene was frightening making the people fear for a high human loss and total destruction of the capital city, Srinagar. Even though there is tremendous advancement in the flood hazard prediction globally during the last few decades, but there is insignificant progress in translating the benefits of the scientific advancements for the flood risk reduction of the society as was evident from the high loss of life and property during the 2014 Kashmir flooding. Dilapidated flood control infrastructure, shrinking of the wetlands, deforestation, high rate of the urbanization of Jhelum floodplains and siltation of the watercourses witnessed in the Kashmir valley during the last few decades has degraded the ability of the environment to absorb the excess rainwater in Jhelum basin and thus, increased the vulnerability of the basin to flooding which is manifest in the frequent flash floods and recurrent water logging observed in the floodplains of Jhelum

The construction of Jhelum flood spill channel in 1904 by then Maharaja relieved the strain on the Jhelum in the city of Srinagar there by making the city safer from floods. This flood channel takes 2/3rd of the total flow from the river thus helps the river Jhelum to regulate its water level while passing through the city thus saves it from being flooded.

Bonpora-Padshahibagh areas where affected with HFL of 2 to 5 m during the unprecedented floods in the month of September 2014. The area has frequent history of floods as it a detention basin and floodplain of River Jhelum.

5.5.2. History of Earthquakes and Seismic Zonation

The Indian subcontinent has a history of devastating earthquakes. The major reason for the high frequency and intensity of the earthquakes is that India is driving into Asia at a rate of approximately 47 mm/year. Geographical statistics of India show that almost 54% of the land is vulnerable to earthquakes. The latest version of seismic zoning map of India given in the earthquake resistant design code of India [IS 1893 (Part 1) 2002] assigns four levels of seismicity for India in terms of zone factors. In other words, the earthquake zoning map of India divides India into 4 seismic zones (Zone 2, 3, 4 and 5) unlike its previous version which consisted of five or six zones for the country. According to the present zoning map, Zone 5 expects the highest level of seismicity whereas Zone 2 is associated with the lowest level of seismicity. The subproject area of Bonpora-Padshahibagh falls in seismic Zone 5, which stresses earthquake resilient infrastructure development.

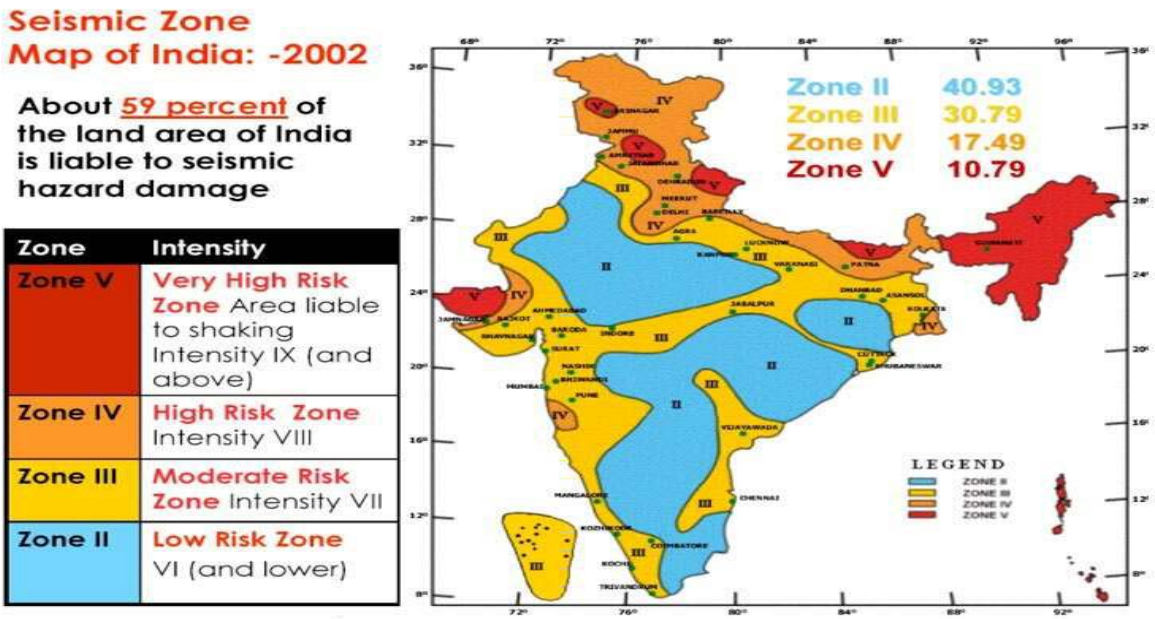


Figure 5.2: Seismic Zone Map of India (2002)

The state of Jammu & Kashmir is the western most extension of the Himalayan mountain range in India. Here it comprises of the Pir Panjal, Zanskar, Karakoram and Ladakh ranges. The Main Boundary Thrust (MBT) underlies the Pir Panjal Range and is known as the Panjal Thrust in the region. The Zanskar ranges which are part of the Great Himalayan range are underlain by the Zanskar Thrust. The Kashmir Valley lies between the Pir Panjal and the Zanskar thrusts, making it very vulnerable to earthquakes. Other northern parts of Jammu & Kashmir are heavily faulted. Along the Zanskar and the Ladakh ranges runs a North West (NW) – South East (SE) trending strike-slip fault, the longest in the Jammu & Kashmir area. Apart from the routine small tremors, moderate to large earthquakes have hit nearly all parts of the state. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located farther away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes. There are atleast four regions of the Himalaya where earthquakes of magnitude 8 or above are likely to occur in near future. 2005 earthquake of MW 7.6 has released only 1/10th of the stress generated within the region and remaining has to go in future great earthquakes. The damage occurred in Uri, Kupwara and Baramulla districts in Kashmir province and in the Poonch town and its surrounding areas are along the line of control. This earthquake was the strongest in over 120 years in the area. Efforts at all levels need to be taken to ensure whatever new structures are built are able to withstand future major earthquakes. The earthquake zonation map of Jammu and Kashmir is given below in **Figure 5.2;**

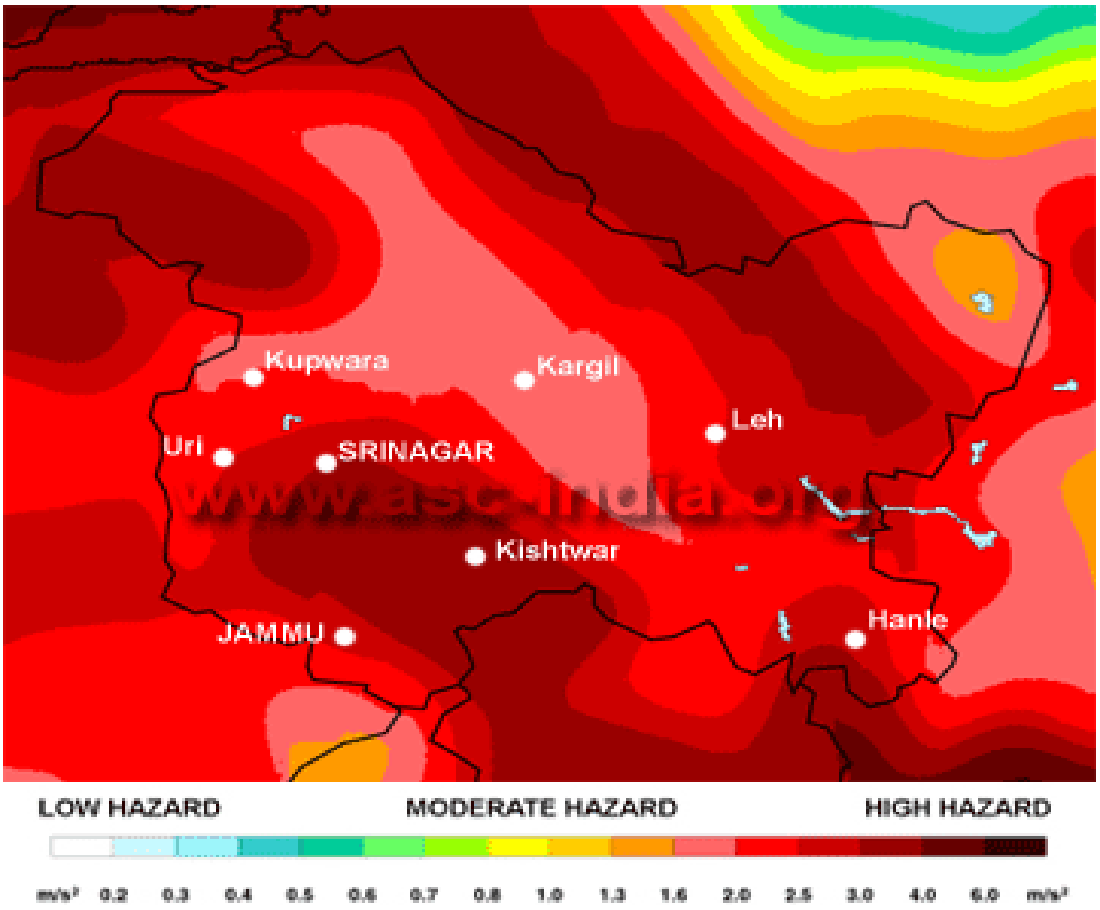


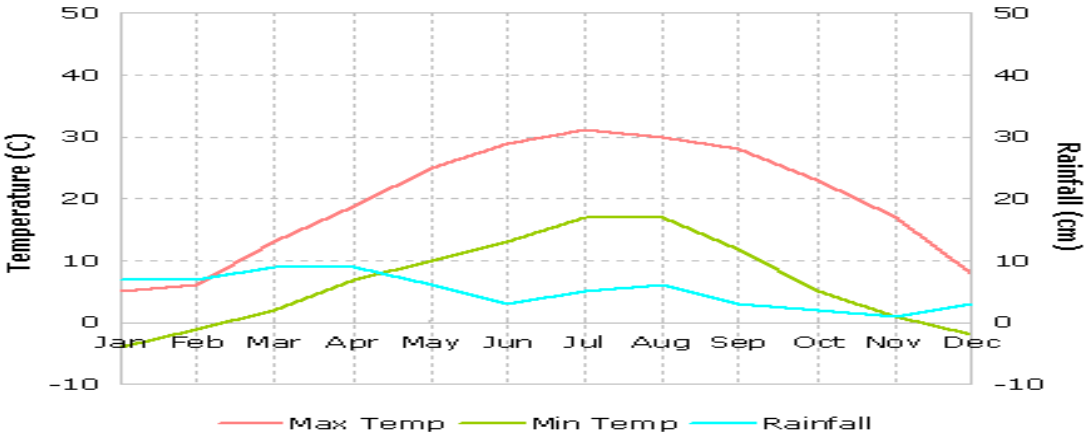
Fig 5.3: Jammu and Kashmir earthquake zones.

The Storm Water Drainage project in Bonpora-Padshahibagh falls in a seismically active part (Zone-V) of Kashmir valley. The design parameters for the storm water drainage and pumping station building including its foundation should conform with BIS code of Practice (IS-1893-2002). Keeping in view the maximum credible earthquake magnitudes in the region, the site area is classified in Zone-V as per the Bureau of Indian standards (BIS) code of Practice (IS-1893-2002). These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault, based on the current understanding of the regional Geo-tectonics.

5.6. Air Environment

5.6.1. Meteorology and Climatology

The climate of Srinagar city, in general, is characterized by temperate summer and cold/mild winters. Annual rainfall in the city is of the order of less than 26 inches – most of it in winter and spring seasons. Weather Graph for Srinagar is shown in **Figure 5.3** below.



Source: Indian Meteorological Department

Fig 5.4: [11]Weather graph of Srinagar

5.6.2. Temperature

The hottest months of the year are July and August, while December and January are the coldest. The temperature varies from cold in winter with minimum temperature touching even -3.7 °C to mild hot in summers when the temperature shoots up to 30 °C. The mean maximum and minimum temperature (°C) recorded at meteorological observatory (Rambagh, Srinagar) during 2005 - 2014 are summarized in Table 5.2:

Table 5.1: Mean maximum and minimum temperature of Srinagar city

Year	Temp in (°C) Max/Min	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Max	7.5	6.5	14.7	20.	21.8	29.3	28.9	30.4	29.3	22.7	15.8	9.9
2005	Min	-0.3	0.7	5.3	7.1	9.9	14.4	18	16.9	13.7	5.8	-0.2	-3.3
2006	Max	4.3	13.4	16	21.	28.2	27.6	30.9	28.7	25.9	22.9	15	8.4
	Min	-1.3	3.3	4.7	7.2	13.3	14.7	19.3	18.3	12.3	8	3.5	0
2007	Max	10	12	14.7	25.	25.5	27.8	29.8	30.1	27.3	24.1	17.1	9.9
	Min	-2.5	2.9	3	8.9	11.9	16	17.8	17.8	13.3	3.9	-1.1	-2
2008	Max	5.5	8.7	20	20.1	25.6	29.6	29.9	29.5	6.5	NA	NA	NA
	Min	-2.5	-1.4	5.3	7.7	11.5	18.3	19.1	17.8	11.3	NA	NA	NA
2010	Max	10.9	9.8	20.	21.3	22.7	25.7	28.9	28.5	26.6	23.8	18.6	11.3
	Min	-1.5	0.4	6.5	9.0	11.1	13.5	17.7	18.8	13.3	7.3	2.2	-3.7
2011	Max	9.5	17.1	18.6	27.7	30.3	29.8	30.1	27.8	22.3	15.7	10.4	7.9
	Min	-2.7	1.5	3.9	7.0	12.6	16.7	18.3	18.1	14.1	6.9	2.8	-1.9
2012	Max	4.8	9.7	16.2	19.9	23.8	27.4	30.9	29.9	26.3	21.2	16.8	9.0
	Min	-3.1	0.2	4.3	8.2	10.1	14.1	18.6	19.1	14.5	5.8	1.6	-0.4
2013	Max	07.8	10.8	18.3	20.0	24.9	29.4	31.1	28.8	27.6	24.4	15.9	10.7
	Min	-02.2	0.9	5.4	8.3	11.4	16.9	19.3	19.1	13.9	9.7	0.6	-1.4
2014	Max	5.5	9.9	12.3	19.0	23.9	29.4	30.4	29.3	24.8	21.8	14.8	10.7
	Min	-1.4	0.5	3.4	07.7	11.3	15.2	19.2	16.9	13.7	8.7	2.0	-2.6

***Source**: Indian Meteorological Department, Srinagar*
NA: Not Available

[11] These are average maximum and average minimum temperature for Srinagar. The highest temperature in Srinagar for the month is usually higher than the average maximum temperature. Similarly, the lowest temperature in Srinagar for the month is usually lower than the average minimum temperature.

5.6.3. Rainfall

The area experiences rain fall during winter and early summer from western disturbances. The month's total rainfall (MTR in millimeters) recorded at meteorological observatory at Rambagh, Srinagar during 2001 to 2014 is shown in Table 5.3.

Table 5.2: Rainfall data of Srinagar (Month's Total Rainfall in mm)

Months/ Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	21.3	46.1	56	57	37	52.8	80.8	67.8	33.5	15.9	36	8
2002	35.5	105.8	105.1	77.7	47.3	82.2	16.8	75.3	54.5	8.2	0	8.9
2003	28.7	180	173.4	127.6	91.4	20.4	97.9	19.8	62.4	8.7	14.6	59.4
2004	79.2	38.1	9.6	145.4	86.6	36.7	58.3	62.3	12	61.3	33.2	12.5
2005	86.6	188.5	104.8	48.1	63.6	8.3	115.5	15.6	16.8	18.6	14.4	0
2006	134	63.3	48.2	52.7	26.3	33.9	103.3	171.3	93.3	15.3	73.5	72.2
2007	8.1	52.6	210.3	1.5	46.2	50.9	54.9	47.4	14	0	0	15.9
2008	76.3	105	9.4	81.5	52.3	24.7	33.1	65.3	22.5	--	--	--
2010	24.1	88.9	61.0	126.8	186.4	45.3	69.8	132.1	16.9	51.4	2.0	43.0
2011	54.2	100.9	100.8	105.8	20.1	27.0	37.1	68.4	46.5	29.1	24.1	33.1
2012	60.2	78.7	58.0	82.7	39.8	24.3	12.1	26.6	111.5	10.8	11.7	27.1
2013	58.7	111.9	69.4	102.0	51.8	54.1	79.8	88.8	34.2	18.5	04.1	16.6
2014	86.9	39.1	220.1	113.7	50.9	18.6	55.8	72.2	184.8	35.7	15.1	0.0

***Source**: Indian Meteorological Department, Srinagar*

5.6.4. Humidity

The humidity levels in the area are observed as maximum up to 95% in the months of July and August and minimum humidity levels between 30% – 40% prevail during December and January months. The mean relative humidity (MRH %) recorded at meteorological observatory at Rambagh, Srinagar during 2006 to 2008 at 08:30a.m. and 05:30p.m. Indian Standard Time (I.S.T) are presented in Table 5.4 below.

Table 5.3: Monthly Relative Humidity (%) Data of Srinagar City

Months		Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
2006	Max	90	87	77	60	71	77	75	77	77	68	81	87
	Min	54	60	52	34	47	50	55	52	52	42	53	65
2007	Max	90	87	77	60	71	77	75	77	77	68	81	87
	Min	54	60	52	34	47	50	55	52	52	42	53	65
2008	Max	89	87	69	73	70	73	75	76	76	NA	NA	NA
	Min	70	63	40	52	53	51	53	51	49	NA	NA	NA
2010	Max	88	87	71	77	78	74	75	85	78	77	85	90
	Min	-	-	-	-	-	-	-	-	-	-	-	-
2011	Max	84	87	75	75	66	65	73	76	77	81	87	88

Months		Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
	Min	60	66	52	58	44	47	51	50	54	57	64	64
2012	Max	88	86	70	73	71	66	70	78	81	81	83	89
	Min	70	61	43	55	49	43	45	56	60	54	56	71
2013	Max	87	88	74	74	69	71	72	80	78	78	82	86
	Min	63	58	43	53	45	46	47	60	51	55	54	65
2014	Max	88	87	84	73	73	63	73	77	86	84	90	90
	Min	69	60	64	53	58	41	52	54	60	60	66	65

Source: Indian Meteorological Department

5.6.5. Wind

Wind speed and wind directions have a significant role on dispersion of atmospheric pollutants and therefore, it affects the ambient air quality of the area. Ground level concentrations for the pollutants are inversely proportional to the wind speed in the downwind direction, while in upwind direction no effect is observed and in crosswind directions partial effect due to emission sources is observed. Winds are generally light but do gain some strength during the late summer and early part of the monsoon season. In the southwest monsoon season winds from easterly and south-easterly directions are more common with north-westerly blowing on some days. In the post-monsoon and winter seasons, the predominant wind direction is north- westerly. In the summer, winds are generally from north-westerly direction but on some day they blow from southeast. Windrose diagram is provided below;

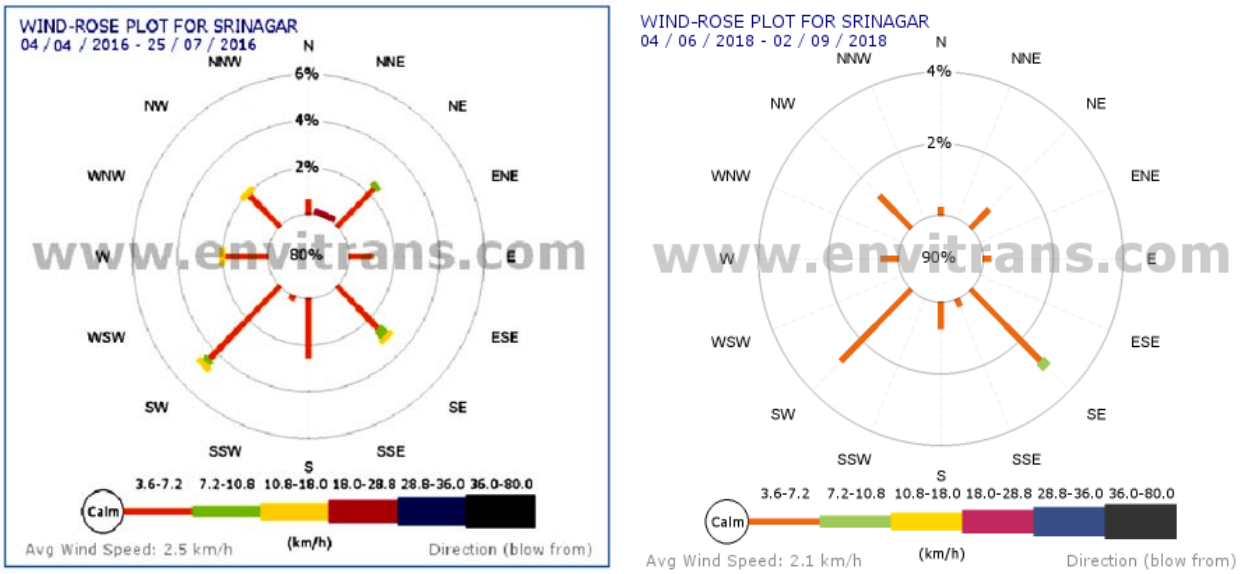


Figure 5.5: Windrose diagram/plots (2016 & 2018) of Srinagar City (Source: Envitrans)

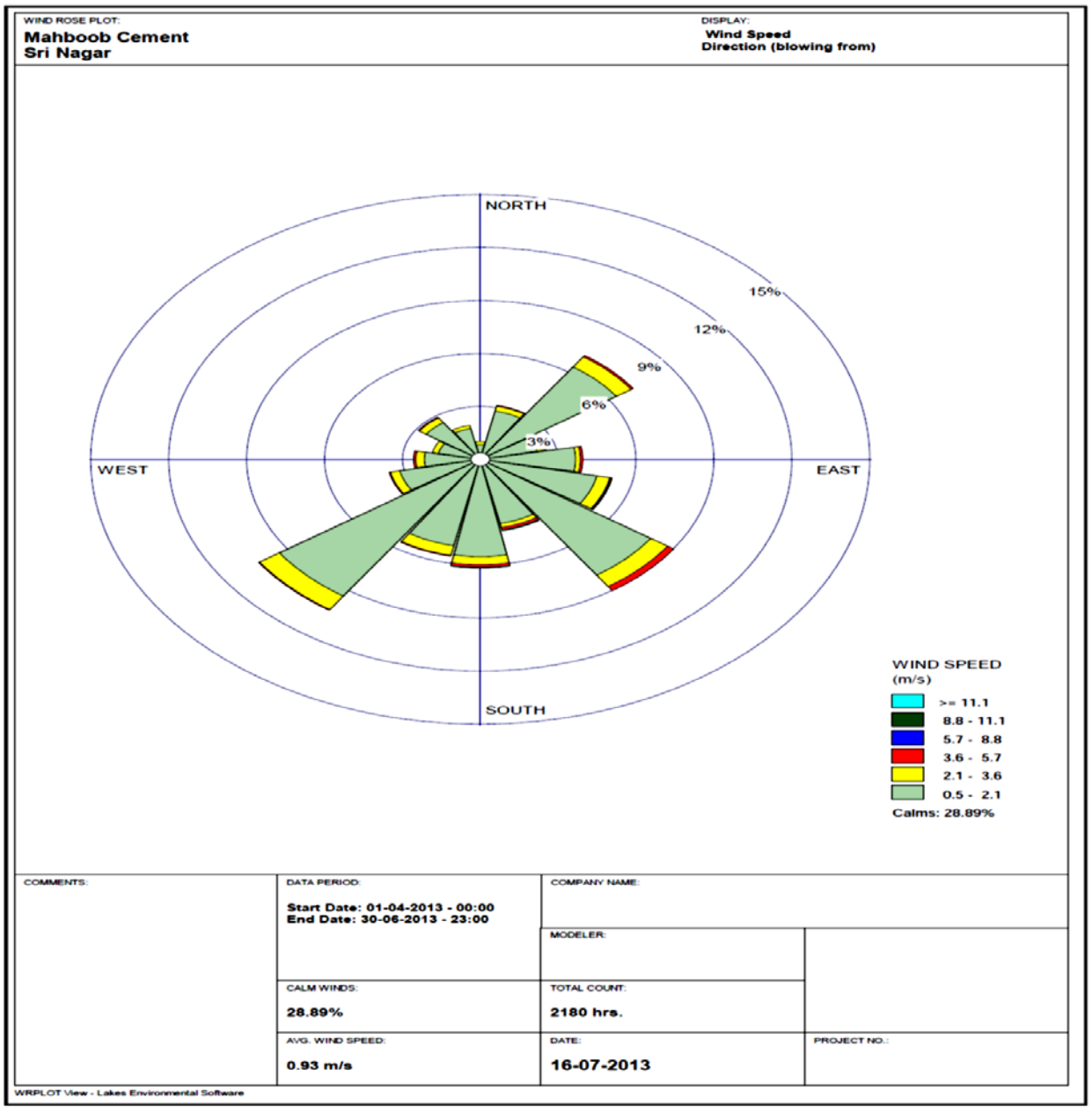


Figure 5.6: Windrose Diagram Srinagar (2013) Source: EIA/EMP Report of Mehboob Cement Industries (Pvt.) Ltd. A Cement Manufacturing Unit of Capacity 600 TPD at Village – Wuyan Bala

Above Windrose diagrams shows overall predominant wind direction on 24 hourly bases was observed to be blowing from SW to NE. As per Windrose diagram, calm was observed to be 28.89 %. The wind speed during this period was observed to be in the range of 0.93 m/s. (Extract from the report). Similarly, the Envitrans Windrose diagram shows same predominant wind direction of SW to NE.

March to July are windiest month, whereas the October and November months are the calmest months with low wind speed conditions. Most predominant wind direction is north-west from March to May.

5.6.6. Ambient Air Quality

Vehicular emissions are the predominant source of air pollution. The ambient air quality data available with J&K Economic Reconstruction Agency (ERA) was used as a reference data to interpret existing ambient air quality condition o the project area in Padshahi bagh area which lies in Project Influence Area. The aim of using this data was to establish the present trend of air quality in the project influence area of the proposed scheme of storm water drainage (SWD) and to design adequate mitigation measures. The activities, which generate or modify atmospheric air quality, are transportation, domestic and construction related. The Ambient Air Quality near subproject area are presented in Table 5.5.

Table 5.4: Ambient air quality monitoring near Padshahi Bagh Area

Ambient Air Quality: Sampling site near Padshahi Bagh.							
Site Code	Month of Sampling with date	Sampling Site/ Location	Site Type	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)
				Permissible Limits/ Standards			
				100	60	80	80
S-A3	August 08-08-2017	Mehjoor Bridge site (Near Padshahi Bagh)	Residential area	81.6	26.7	7.2	9.5

Source: JK ERA- Semi-annual Environmental Monitoring Report (2017, 2018)
*PM-Particulate Matter, SO_2-Sulphur dioxide, NO_2-Nitrogen Dioxide

The monitoring results of particulate matter PM_{10} shows observed values at 81.6µg/m^3 and $PM_{2.5}$ values at 26.7µg/m^3 which were within the permissible levels and in compliance with the NAAQ standards. The SO_2 & NO_2 parameters were well within the permissible limits during the sampling period. Comparative analysis of site S-A3 with NAAQ standards is illustrated below;

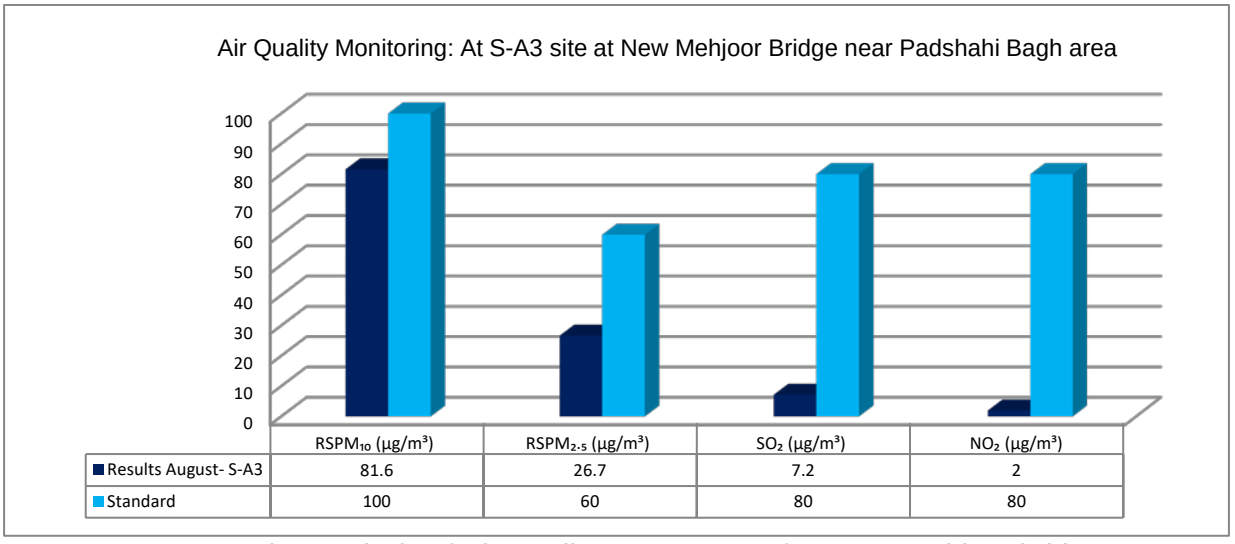


Figure 5.6: Comparative analysis of Air Quality parameters of S-A3 at Mehjoor bridge near Padshahi Bagh area with NAAQ standards in Srinagar.

5.7. Noise Environment

5.7.1 Ambient Noise Levels

The proposed subproject of Storm Water Drainage is located in Bonpora-Padshahi Bagh areas in Srinagar City. These areas are built-up areas which fall in residential category.

The noise quality monitoring shows slightly higher levels in the Alamdar Colony near project site of Bonpora-Padshahibagh than the permissible levels. This data is taken for the reference for the proposed site of SWD in order to ascertain the trend of noise levels in the area. Main contribution of the noise comes from the plying of the local traffic in the residential areas. The baseline monitoring will be conducted in the pre-construction stage of the project.

The sampling site is located at residential colony near Padshahi Bagh area which is close to the proposed subproject of SWD in Bonpora-Padshahibagh area within project influence area. The result of the tests concludes that the values of all parameter are below the NAAQ standards.

Table-5.6: Noise level monitoring at Mehjoor Bridge near Padshahi Bagh Area

Site Code	Month of Sampling with date	Sampling Site/ Location	Site Type	*Day Time Noise Levels dB (A) Leq*	*Day Time Noise Quality NAAQ Standards dB (A) L_{eq}*
S-N3	August 08-08-2017	Near New Mehjoor Bridge	Residential	*57.5*	*55*

Noise quality monitoring was conducted in August 2017 at Mehjoor bridge near Padshahi Bagh area. The average day time noise levels dB (A) Leq recorded is 57.5 dB. Noise levels were slightly above NAAQ standards. Slight increase is mainly attributed vehicular traffic movement. Comparative analysis of S-N3 is illustrated below in Figure 5.7;

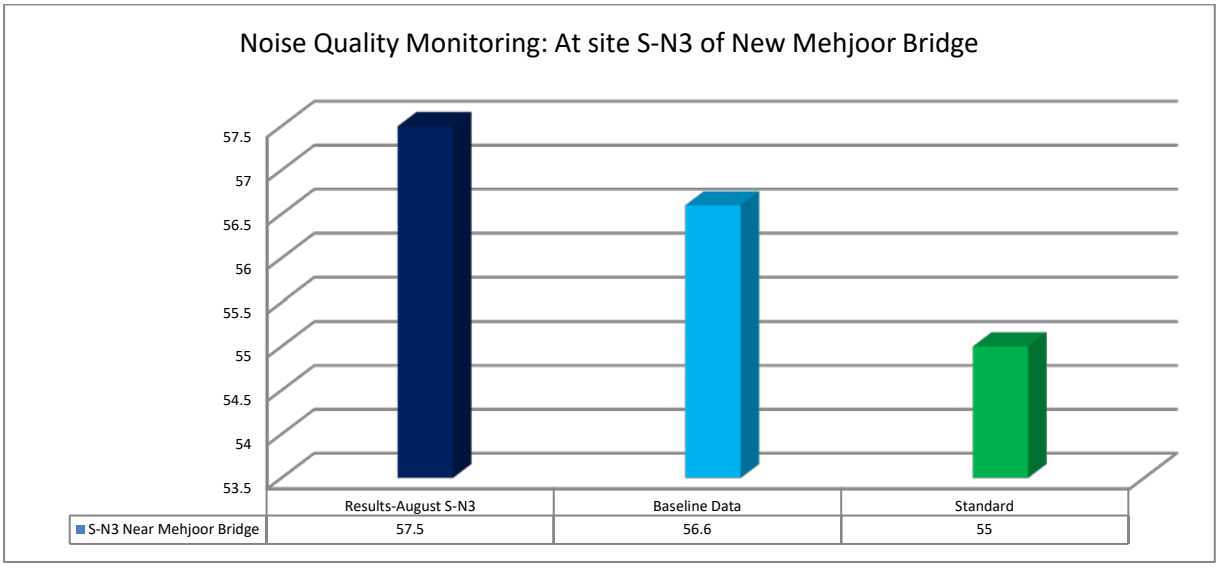


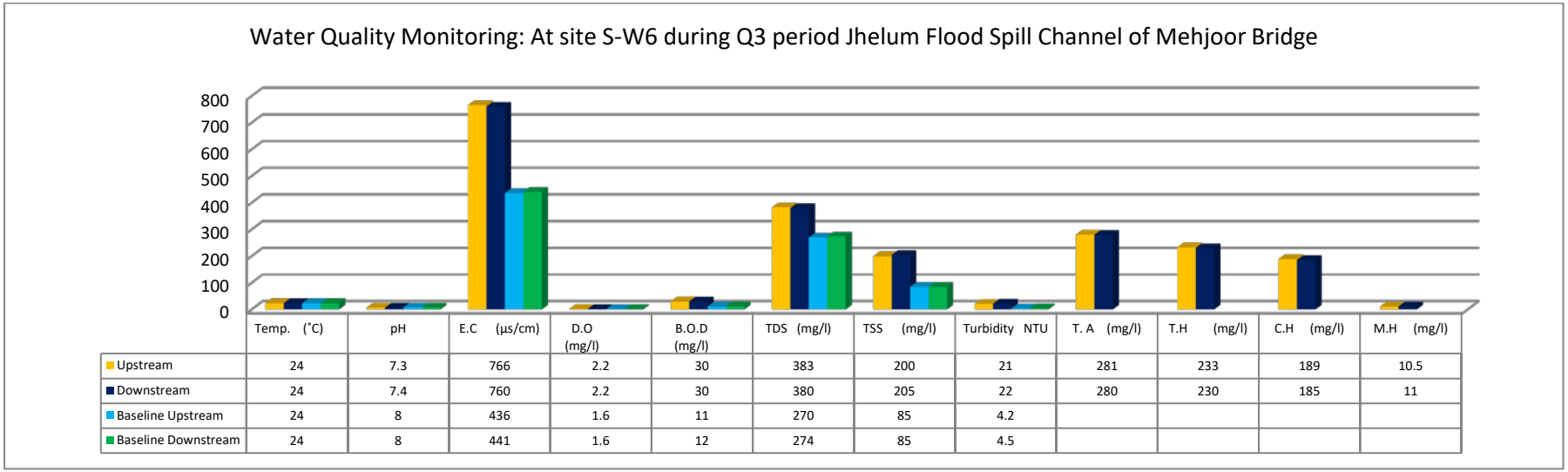
Figure 5.7: Comparison of day time noise levels observed near new Mehjoor Bridge at S-N3 near Padshahi Bagh area

5.8. Water Environment

Table 5.7: Water Quality monitoring of Floodspill Channel of River Jhelum near Padshahi Bagh Area

Water Quality Data															
Site Code	Month of Sampling with date	Sampling Site	Location	Temp ºC	pH	E.C µs/cm	D.O mg/l	B.O.D mg/l	TDS mg/l	TSS mg/l	Turbidity NTU	T.A	T.H	C. H	M.H
				Permissible Limits											
				-	*6.5-8.5*	*≤500*	*>6*	*5*	*≤500*	*≤120*	*5-10*	*200-600*	*300-600*	*75-200*	*30-75*
At Mehjoor Bridge near Padshahi Bagh Area															
S-W6	August 25-08-2017	Near Mehjoor Bridge Site	Upstream	24	7.3	766	2.2	30	383	200	21	281	233	189	10.5
			Downstream	24	7.4	760	2.2	30	380	205	22	280	230	185	11.0

Water quality monitoring was conducted at S-W6 site and water samples were collected from the upstream and downstream of River Jhelum Flood Spill Channel near Mehjoor Bridge. Flow regime was normal during this period. Flood spill channel also receives number of waste water from various dewatering pumping stations of city drainage. The analysis of the Water samples shows poor dissolved oxygen content. TSS and Turbidity was on higher side. BOD was also observed on higher side with high organic load which is mainly attributed to number of dewatering stations and disposing of drainage waste water directly into the spill channel which led to increase in these values. Conductivity was observed high. pH and TDS were in permissible. The comparative analysis is illustrated in Figure 5.8 below;



	Temp. (˚C)	pH	E.C (µs/cm)	D.O (mg/l)	B.O.D (mg/l)	TDS (mg/l)	TSS (mg/l)	Turbidity NTU	T. A (mg/l)	T.H (mg/l)	C.H (mg/l)	M.H (mg/l)
Upstream	24	7.3	766	2.2	30	383	200	21	281	233	189	10.5
Downstream	24	7.4	760	2.2	30	380	205	22	280	230	185	11
Baseline Upstream	24	8	436	1.6	11	270	85	4.2				
Baseline Downstream	24	8	441	1.6	12	274	85	4.5				

Annotation: T.A: Total Alkalinity; T.H: Total Hardness; C.A: Calcium Hardness; M.H: Magnesium Hardness

Figure 5.7: Water quality characteristics of Floodspill Channel of River Jhelum site near Mehjoor Bridge at S-W6 (near Padshahi Bagh) in Srinagar city.

5.9. Biological Environment

Plant and animal communities are indicators of the environment. They respond not only to one environmental factor, but also to an interacting group of factors. The plant and animal communities integrates these influences and reacts sensitively to changes in the balance of environmental stresses. Vegetation is usually the most readily recognized component of ecosystems. Plant communities followed by used often to identify and biological balance through biotic or abiotic pressure or through direct interference by man are readily recognized by changes in the physiognomy, structure and species composition of the flora and fauna. Since the ecological integrity is one of the fundamental factors towards attaining a sustainable ecosystem, following biological status survey study in the study area was undertaken.

5.9.1. Forests

The proposed Storm Water Drainage subproject does not fall in any forest area. There is no natural forest like Reserved Forest, Protected Forest or natural heritage sites of national and international importance along the one km radius of project site or beyond that. The Bonpora, Padshahibagh & Nowgam area lies on a flatter terrain of the extended part of Srinagar city.

5.9.2. Flora

The proposed subproject area is a built-up area as can be seen in map (refer appendix-3 Google map) and having a geo-coordinates of 34002'11"N (Lat) and 74049'25"E (Long). The location of Major pumping station (MPS) of Bonpora-Padshahibagh comprise of Padshahi Nalla which has aquatic plants mainly dominated by emergent growth of *Typha augustata, Phragmites communis,* rooted-floating leaf type *(Nymphoides peltata, Nymphaea alba),* free floating type like *Lemna sp.*, and trees like Salix sp.

The prevailing and predominant vegetative species observed in the direct project corridor/ area of influence in the study area mainly comprise of local flora. The dominant species observed and documented during the field study is present in Table 5.10 below;

Table 5.8: List of Flora in the Project Influence Area (PIA)

S.No	Common Name	Scientific Name
A	Scheduled Trees	
1	Chinar (Boeen)	*Platanus orientalis*
2	Mulberry (Tul Kul)	*Morus sp.*
B	*Ornamental Trees (Airport Roads side/ central verge)*	
3	Cypress	*Cupressus sp.*
	Indigenous trees	
4	Willow	*Salix alba*
5	Poplar	*Populus sp.*
	Grasses/ Herbs	
6	Grass (Bermuda Grass, Doob)	*Cynodon dactylon*
7	Grass (Bakung)	*Poa annua*

8	Grass	*Stipa sibrica*
9	Grass (Bairan Ghaas)	*Chrysopogon gryllus*
10	Herb (Batak Nyoor)	*Trifolium repense*

5.9.2.1. Protected (Scheduled) Trees of the J&K State.

As per the Jammu & Kashmir Preservation of Specified Trees Act, 1969, Chinar (Platanus orientalis), Mulberry (Morus sp.), Walnut (Juglans regia) and Deodar (Cedrus deodara) are scheduled and protected trees of Kashmir region. Only one tree of Mulberry is required to be cut down at proposed site of Padhshai Bagh MPS. However, 1 Chinar tree is located at Ch 2+500 (LHS) in Padshahi Bagh area. The protective and safeguard measures with technical instructions during excavation/ concreting/ metaling have been devised and reflected in EMP. Details of the Chinar (Platanus orientalis) and Mulberry trees along with the chainage wise details is provided in Table 5.9

Table 5.9: List of Protected (Scheduled) Trees located along the Project Corridor

S.No	Name of the Scheduled Tree	Location	Chainage	Alignment (LHS/RHS
1	Chinar Tree	Padshahibagh	Ch 2+500	LHS
2	Mulburry Tree	(Padshahibagh)	MPS	At MPS site

5.9.3. Fauna

No forest is present along the subproject area, the terrestrial fauna is common stray dogs, cats, cattles There are no Schedule-I terrestrial mammal" species observed in proposed sub project area.

5.9.4. Wetlands

No designated wetland is located within the project influence area (PIA) of 1km.

5.9.5. Ecological Sensitive Areas

The Storm Water drainage subproject is located in Bonpora, Padshahibagh & Nowgam area which is a built up area. The project corridor does not pass through or comes within any Biosphere Reserve, National Park, World Heritage Sites, Wildlife sanctuaries and other ecological areas of importance.

5.10. Socio-Economic Profile

5.10.1. Distribution of Population in Srinagar

Srinagar is the summer capital of Jammu and Kashmir. It is a hub of all sorts of activities particularly relating to trade, business and tourism and poignant Kashmir valley. It is an ancient historic city, a holiday resort, a venue for conference, seminars, workshops and similar other gatherings of National and State level importance. Distribution of population in Srinagar is given Box 5.1 below;

Table 5.10: Distribution of population in Srinagar City (As per Census 2011)

Population Distribution	Total	Persons	1236829
		Males	651124
		Females	585705
	Rural	Persons	17313
		Males	8916
		Females	8397
	Urban	Persons	1219516
		Males	642208
		Females	577308

The total population of the district as per 2011 Census is 1236829 persons. It consists of 651124 males and 585705 females. The rural sector of the district is inhabited by 17313 persons comprising of 8916 males and 8397 females spread over the 11 inhabited villages. The district constitutes two tehsils. The number of inhabited as well as uninhabited villages in each tehsil is given in Table 5.10 below;

Table 5.11: Number of Inhabited and Unhabited Villages in Srinagar Tehsils (North/ South)

Tehsil	Number of Villages		
	Inhabited	Uninhabited	Total
Srinagar (North)	8	0	8
Srinagar (South)	3	0	3
District Total	11	0	11

The literacy percentage in the district is recorded as 69.41 which is higher by 2.24 per cent than the State literacy rate and this has ranked the district at 6th in the literacy in the State. The literacy level in rural and urban sector stands at 53.51 and 69.63 per cent against the State literacy rate of 63.18 and 77.12 per cent respectively.

The demographic profile of Jammu and Kashmir is presented in Table 5.11 below;

Table 5.12: Demographic status of Jammu and Kashmir

Division	Population
Kashmir (53.9%)	5,476,970
Jammu (43.7%)	4,430,191
Ladakh (2.3%)	236,539
Jammu and Kashmir	10,143,700

Source: Census 2011.

The economy is predominantly dependent on agriculture and allied activities. The Kashmir valley is also known for its sericulture and cold-water fisheries. Wood from Kashmir, popularly known as Kashmir Willow, is used to make high-quality cricket bats. Kashmiri

saffron is also very famous and brings the state a handsome amount of foreign exchange. Agricultural exports from Jammu and Kashmir include apples, barley, cherries, corn, millet, oranges, rice, peaches, pears, saffron, sorghum, vegetables, and wheat, while manufactured exports include handicrafts, rugs, and shawls. Horticulture plays a vital role in the economic development of the state. With an annual turnover of over Rs. 300 crore, apart from foreign exchange of over Rs. 80 Crores, this sector is the next biggest source of income in the state's economy. The region of Kashmir is known for its horticulture industry and is the wealthiest region in the state. Horticultural produce from the state includes apples, apricots, cherries, pears, plums, almonds and walnuts.

The region in general is poor in industrialization. However, as per the Master Plan for Srinagar 2001-2021, about 295 hectares land is under the use of industrial purpose of which 155 hectares is by service industries. Major but small scale industrial units in the city include silk factories, woollen mills, Khadi and Village industries, spinning mills, telephone factory, carpet making, food processing units, brick and tile factory, cottage industries, etc. However, such units have not been recorded in the immediate vicinity of the subproject site.

Primary Census Data (2011) of Subproject Area.

Now Gam is a Census Town city in district of Srinagar, Jammu and Kashmir. The Now Gam Census Town has population of 2,490 of which 1,289 are males while 1,201 are females as per report released by Census India 2011.

Population of Children with age of 0-6 is 299 which is 12.01 % of total population of Now Gam (CT). In Nowam Census Town, Female Sex Ratio is of 932 against state average of 889. Moreover Child Sex Ratio in Now Gam is around 823 compared to Jammu and Kashmir state average of 862. Literacy rate of Now Gam city is 73.71 % higher than state average of 67.16 %. In Now Gam, Male literacy is around 81.69 % while female literacy rate is 65.29 %.

Nowgam Census Town has total administration over 420 houses to which it supplies basic amenities like water and sewerage. It is also authorize to build roads within Census Town limits and impose taxes on properties coming under its jurisdiction.

Kursu Padshahi Bagh is a medium size village located in Srinagar South Tehsil of Srinagar district, Jammu and Kashmir with total 248 families residing. The Kursu Padshahi Bagh village has population of 1411 of which 716 are males while 695 are females as per Population Census 2011.

In Kursu Padshahi Bagh village population of children with age 0-6 is 135 which makes up 9.57 % of total population of village. Average Sex Ratio of Kursu Padshahi Bagh village is 971 which is higher than Jammu and Kashmir state average of 889. Child Sex Ratio for the Kursu Padshahi Bagh as per census is 985, higher than Jammu and Kashmir average of 862.

Kursu Padshahi Bagh village has higher literacy rate compared to Jammu and Kashmir. In 2011, literacy rate of Kursu Padshahi Bagh village was 71.08 % compared to 67.16 % of Jammu and

Kashmir. In Kursu Padshahi Bagh Male literacy stands at 80.09 % while female literacy rate was 61.78 %.

As per constitution of India and Panchyati Raaj Act, Kursu Padshahi Bagh village is administrated by Sarpanch (Head of Village) who is elected representative of village. Our website, don't have information about schools and hospital in Kursu Padshahi Bagh village.

Table 5.13: Primary Census Data of Project Area

Particulars	Total	Male	Female
Kursoo-Padshahi Bagh			
Total No. of Houses	420	-	-
Population	1,411	716	695
Child (0-6)	299	68	67
Schedule Caste	0	0	0
Schedule Tribe	0	0	0
Literacy	71.08 %	80.09 %	61.78 %
Total Workers	415	379	36
Main Worker	390	-	-
Marginal Worker	25	11	14
Nowgam			
Total No. of Houses	420	-	-
Population	2490	1289	1201
Child (0-6)	299	162	135
Schedule Caste	0	0	0
Schedule Tribe	0	0	0
Literacy	73.71 %	81.69 %	65.29 %
Total Workers	810	668	142
Main Worker	687	641	46
Marginal Worker	123	27	96

5.11. Sensitive Environmental Receptors

The sensitive environmental receptors existing along the alignment of proposed storm water drains in subproject include religious place like mosques and schools. The details of the existing sensitive environmental receptors are given in Table 5.13.

Table 5.14: Sensitive environmental receptors in subproject area

Sensitive Feature	Location	Alignment (RHS/LHS)[12] vis-à-vis the flow in the proposed drain	Distance (m) from the central alignment
Advent Private School	Bonpora, Nowgam	LHS	21
Mosque	Bonpora (Internal road)	RHS	22
Govt. School	Bonpora (Internal Main Road and 68 m from IPS	LHS	2..4

[12] LHS-Left Hand Side RHS-Right Hand Side

	site)		
Iqra Private School	Bonpora	RHS	6
Kids Campus Private School	Padshahi Bagh	RHS	25
Govt High School	Padshahibagh	LHS	5
Fayaz Educational Institute (2 buidlings)	Bonpora, Nowgam	RHS	2.4
Mosque Numaan	Bonpora Nowgam	LHS	2.5
Mosque	Padshaibagh	RHS	3.1
Mosque	Padshahibagh	RHS	3
Khalid bin Waleed Mosque	Padshahibagh	RHS	5
Saint Mary's School (Boys &Gilrs)	Padshahibagh near Bund	LHS	5.5
Global Islamic School	Padshahibagh near Bund	LHS	3.2
Mosque Qadeem Ahlihadith	Bonpora, Nowgam	LHS	7
Sheikh Mosque	Bonpora, Nowgam	LHS	10
Grave yard	Bonpora, Nowgam	LHS	2.8
Graveyard	Bonpora, Nowgam	RHS	2.8
Graveyard	Bonpora, Nowgam	RHS	2.9

6. IMPACT ASSESSMENT

6.1. Introduction

A study of potential environmental impacts as a result of the proposed project was carried out. From observations made in the field and discussions held with various people, a number of aspects affecting the natural, physical, economic and social environment were noted. These observations are also intended as useful pointers during the design stage of this project.

Once potential impacts of the proposed project were identified, the team went further to predict the nature of the impacts. Predictions are generally based on unequivocal assumptions about environmental processes, professional verdict and different value judgments expressed by various stakeholders during consultations. Determination of the significance of the potential impacts was based on the three broad categories. These are: i) Legal, the importance of environmental conservation is acknowledged in existing policies, laws and plans; ii) Public, segment of the public recognize the importance of environmental conservation. This recognition takes place in the form of support and sometime conflict and opposition; and iii) Technical, the importance of an environmental resource is based on the scientific knowledge of the critical resource characteristics.

6.2. Potential Environmental Impacts

6.2.1. Potential positive impacts of the proposed project

There are a number of positive benefits associated with the proposed project. They include the following:

- Improvement in Public Health Conditions by reduction in waterborne diseases and vector transmitted diseases by eliminating water logging during rainy/wet seasons.
- Provision of employment opportunities during both construction and operation stages of the project
- Environmental conservation and management due to elimination of storm water drains pollution from solid waste disposal
- Improved environmental aesthetics and cleaner air due to reduced odour from the polluted waterlogged area/ road surface

6.2.2. Potential negative impacts associated with the SWD construction activities

Under the JTFRP, the component of the proposed construction of new storm water drainage system in Bonpora-Padshahibagh Area of Zone 1 in Srinagar consists of construction of new storm water drainage network in Padshahibagh, Nowgam, and Bonpora areas including pumping stations (MPS/IPS). Impact assessment has been conducted for the proposed subproject.

The expected environmental impacts on various components of environment due to proposed storm water drainage system including construction of two pumping stations (MPS/IPS) can be assessed in terms of i) physical environment ii) biological environment, and iii) socioeconomic environment. For proper impact assessment of significance and magnitude of environmental impacts due to pre-construction, construction and operation & maintenance of the proposed storm water drainage system, the impacts are analyzed for each environmental parameter. An assessment is made both for adverse and positive impacts in following section.

The environmental, biological and socioeconomic environment impacts can be direct as well as indirect. Scientific techniques and methodologies based on mathematical modelling are also available for studying impacts of various project activities of proposed storm water drainage on environmental parameters.

The next step is prediction of impacts which is an important component in environmental impact assessment process and for preparation of environmental management plan. Various techniques and methodologies are used for predicting anticipated impacts due to proposed project activities for the storm water drainage system. Selecting suitable mitigated measures in terms of sites, technology, machinery and operations can minimize the major possible adverse environmental impacts due to the proposed storm water drainage system.

The following environmental components have been studied to identify the possible environmental impacts due to the proposed storm water drainage system:-

- Air Environment
- Water Environment
- Noise Environment
- Land Environment
- Biological Environment
- Health and Safety
- Socio-Economic Environment

The main procedural steps of environmental impact assessment can be summarized as follows:

This involves identification of the major project activities, environmental attributes, the impacts of the activities on the environmental attributes and formulation of ‘activity-impact’ matrix. The impact rating assessment matrix is presented below in **Table 6.1.**

Table 6.1: Impact Rating Assessment Matrix

Impact		Criteria
Nature of impact	Beneficial	Positive
	Adverse	Negative
Duration of impact	Short term	Impacts shall be confined to a stipulated time
	Long term	Impacts shall be continued till the end of life cycle of the project
Impacted Area	Localized	Impacts shall be confined within the project influence area
	Regional	Impacts shall be continued beyond within the project influence area

The impact of the proposed "Storm Water Drainage system" has been assessed on each environmental attribute. The pre-construction, construction and operation & maintenance stages have been considered to identify and evaluate the possible impacts due to the proposed subproject. The matrix method has been chosen to list the potential impacts of the proposed construction activities for proposed storm water drainage system and pumping stations. The activities have been arranged in columns and the environmental attributes in the rows of the matrix.

6.3. Activities and Impacts Due to Proposed Construction of Storm Water Drainage System/ Pumping Stations in Bonpora-Padshahibagh during Pre-construction, Construction and Operation Stages

The construction of proposed storm water drainage system & two pumping stations in Bonpora-Padshahibagh area of Zone -1 of Srinagar City may involve the following activities during pre-construction, construction and operation Stages of the project:

Pre-construction Stage

- Clearing and levelling the site.
- Utility Shifting Identification
- Traffic Management Planning
- Identification of Labour camp

Construction Stage

- Excavation of existing roads for laying of drainage pipes
- Transportation of materials to the Bonpora-Padshahibagh-SWD site
- Construction of Manholes throughout the drainage network in Bonpora-Padshahibagh Area
- Construction of the structures to house the Pumps
- Protection of Scheduled Trees and other indigenous trees, if any
- Workers camp
- Piping and Electrical Works- Pumping Stations

Operation Stage

- Operation of pumps at Bonpora-Padshahibagh SW Drainage
- Maintenance of pumping stations
- Monitoring of waste water quality to be pumped and receiving water body
- Strategy for pumping of waste water into receiving water body and to ensure compliance of discharge standards.

6.4. Prediction of Impacts

This involves prediction of the nature, magnitude and significance of the impacts. It also includes analysis of the possibilities and/or probabilities of occurrences of the impacts. The matrix establishes 'Cause-effect' relationship between the activities and the environmental factors responsible for them as shown in **Table 6.2** and **Table 6.3** with respect to activities during construction and operation stages of Storm Water Drainage System in Bonpora-Padshahibagh, respectively.

Table 6.2: Impact Prediction Matrix during Pre-construction and Construction Stage

Activities	Environmental Attributes						
	Air	Noise	Water	Land & Soil	Vegetation	Employment	Aesthetics
Site Clearing	✓	✓	✓	✓	✓	✓	✓
Excavation	✓	✓	✓	✓	✓	✓	✓
Construction of Civil Works	✓	✓	✓	✓	✓	✓	✓
Transportation of Construction Materials	✓	✓	✓				✓
Commissioning of Pumping Stations		✓	✓	✓		✓	✓
Employment						✓	

Table 6.3: Impact Prediction Matrix During Operation Phase

Activities	Environmental Attribute						
	Air	Noise	Water	Land & Soil	Vegetation	Employment	Aesthetics
Operation of SWD/ pumping Stations			✓	✓		✓	✓
Maintenance of pumping stations	✓	✓	✓	✓		✓	
Monitoring of Water and Waste Water of Receiving Water Body & Pumping Station Discharge			✓			✓	

6.5. Impact on Air Quality

During Construction stage

Transportation of construction material, excavation of trenches for laying of drainage pipes/ main holes, local traffic movement inside colony roads and restoration works will generate a particulate matter/ dust during the construction of the new storm water drainage system. However, the suspended particulate matter in ambient air as a result of construction activities may be relatively coarse and will be settled within a short distance of the construction site. Therefore, the impact will be restricted within the close proximity of the site. Minor vehicular traffic emissions from construction machinery like excavators and vehicles carrying construction materials are also expected. Small amount of dust emissions are also anticipated from the batch mix plant/ stone crusher plant for concrete and restoration works. All these impacts are temporary, time specific, limited to construction area and reversible in nature.

During Operation stage

During operation of storm water drainage system including its pumping station, there will be no air pollution emission sources. No emission will be generated during the operations of electrical pumps as well. Therefore, no impact is anticipated on ambient air quality during operation stage of storm water drainage system in Bonpora-Padshahibagh area. However use of diesel Gen Sets in absence of the electricity may generate minor emissions.

6.6. Climatology and Meteorology

The pre-construction, construction and operation stage of storm water drainage system and a pumping stations will have no impact on climatology and meteorology of the area

6.7. Impact on Water Quality

During Pre-construction and Construction Stages

During the pre-construction and construction stages, small quantities of wastes will be generated from clearing and grubbing activity at proposed pumping station sites. The construction stage may result in minor soil erosion from the site of pumping stations, as ground vegetation of 5 Willows/Poplar, 1 Mulberry) will be cleared at MPS site and excavation will be carried for foundation of structure and pumps. Run off from the construction site during a first few precipitation may cause some increase in the quantity of suspended solids and turbidity in the runoff in Padshahibagh nallah . However, this impact will be of temporary in nature and may last as soon as excavated soil established and construction debris are disposed off properly. Small quantity of sewage will be generated from labour camp, which will disposed through septic tanks.

It is highly [13]*recommended that "No house hold connections should be linked with the proposed Storm Water Drainage system in Bonpora-Padshahibagh area* and the *"Pure Concept of Storm Water Drainage System" will be maintained by the implementing agency, PMU, Consultants and the Contractor".*

In this context, it is observed that number of existing drainage systems in Srinagar and adjoining areas of the subproject are connected with the household waste water connections resulting into conversion of storm water drainage into sewer drainage and disposed off directly into receiving water body causing odour nuisance and contamination of water bodies. This mixed waste water comprise of high oxygen demanding (BOD) waste, surfactants, higher nutrients (nitrate-phosphates), suspended solids and prevailing anoxic condition result into sulphate precipitation which leads to the formation of *Hydrogen Sulphide* (which is a obnoxious H_2S gas/ odour in drainage network, sumps & outfall discharge channel). This has a long-term impact in a given community along with sensitive receptors like schools, religious places, residents etc due to the bad engineering practices and decision making.

One of the common problem with the SWD system is suspended solids from surface runoffs during peak storm events and dry weather flow. Suspended solids are typically the pollutant of concern, primarily because solids tend to settle down. For this purpose, DWS should be designed in such a way to arrest suspended solids in order to check the flow of sediments into a receiving water body.

During Operation Stage

During the operation stage, collected storm water from the drainage network will be discharged into the receiving water body of Padshahibagh Nallah.

6.8. Impact on Soil

During Pre-construction Stage

During the pre-construction stage, stocking/ storage of fuel barrels/lubricants/ oils/ machinery/ equipment's may result into contamination of soil of the site and ancillary locations and runoff during rain fall/ precipitation, if these are not collected and disposed in environmental sound manner.

During Construction Stage

The construction of the Storm Water Drainage and Pumping Stations may result generation of construction wastes such as, excavated material/ muck during laying of drainage pipes

[13] This environmental assessment report is prepared based on the ground truth survey, data review, EMSF 2015 (JTFRP), WB guidelines, national/ state laws and suggestions/ recommendations provided in here are based on Concept of Storm Water Drainage Design (that is collection of rain/ snow water and it run-off only)/ DWS and are correlated with the present environmental study & outcome.

and foundation works of Pumping Stations, metal cutting, electrical wire cutting, etc; which may contaminate soil at the site, if not disposed suitably. However, the extent of contamination will not be significant. Small quantity of solid wastes will be generated from labour camp. These wastes will not normally contaminate ground water. Their impact on soil and surface water will be restricted to the construction period in small area around the construction site.

During Operation Stage

During operation stage of Storm Water Drainage, no waste will be generated in routine operation. However, at an average of 0.8 kg/day municipal solid wastes will be generated from the pumping stations by the operators. Sludge may also be generated during the occasional cleaning of SWD manholes/ sumps for maintenance of pumps and will require to be disposed suitably.

6.9. Impact on Noise Levels

During pre-construction Stage

During the pre-construction stage, some noise may be generated for short duration during site establishment and ancillary site activities like material stocking, labour camp setup, etc.

During Construction Stage

During the construction stage of storm water drainage system and a pumping station in Bonpora-Padshahibagh area of zone-1, noise may be generated from site activities like excavation of trenches for pipe laying and foundation works at pumping stations, steel bar cutting, hammering, vehicles bringing construction materials to the site, erection of pumps, etc., Anticipated noise levels from various construction activities are as given below in Table 6.4;

Table 6.4: Anticipated Noise Levels from Various Sources

S. No.	Source	Anticipated Noise Levels
1.	Excavation	70 dB(A)
2.	Metal Cutting	80 dB(A)
3.	Hammering	80 dB(A)
4.	Erection of Equipment's	75 dB(A)
5.	Vehicles Movement	65 dB(A)

Generation of noise levels from above sources will be intermittent in the nature, localized and for short duration only.

6.9.1. Modelling for Noise Emissions from Construction Site

For dispersion modelling of noise, standard mathematical model for sound wave propagation have been used. The sound pressure level generated by noise sources decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure level from the source is expected due to atmospheric effect or its interaction with objects in the transmission path.

For hemispherical sound wave propagation through homogeneous loss free medium, one can be estimated noise levels at various locations due to different sources using model based on first principles, as per the following equation:

For hemispherical sound wave propagation through homogenous loss of free medium, noise levels at various locations can be calculated due to different sources using model based on the first principles as per the following equation:

$$L_{p2} = L_{p1} - 20 \log(r_2) - 8$$

Where: L_{p2} and L_{p1} - Sound Pressure Level (SPLs) at points located at source and at distances of r_2 from the source respectively in dB (A).

The combined effect of all the sources then can be determined at various locations by the following equation.

$$Lp\ (total) = 10\ Log\ (10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} \ldots\ldots\ldots\ldots\ldots)$$

Where Lp_1, LP_2, LP_3 are noise pressure levels at a point due to different sources.

The resultant maximum noise level from site is calculated as 84 dB (A). Assuming no environmental attenuation factors, noise modelling has been done which shows that noise level at different distance from the site has been shown in **Table 6.5;**

Table 6.5: Noise Level at Various Distances

Noise Levels (dB (A))	Distance from Source (m)
80	9.6
75	10.8
70	13.0
65	16.9
55	36.2

Graphical presentation of noise attenuation during construction site is shown in **Figure 6.2** below;

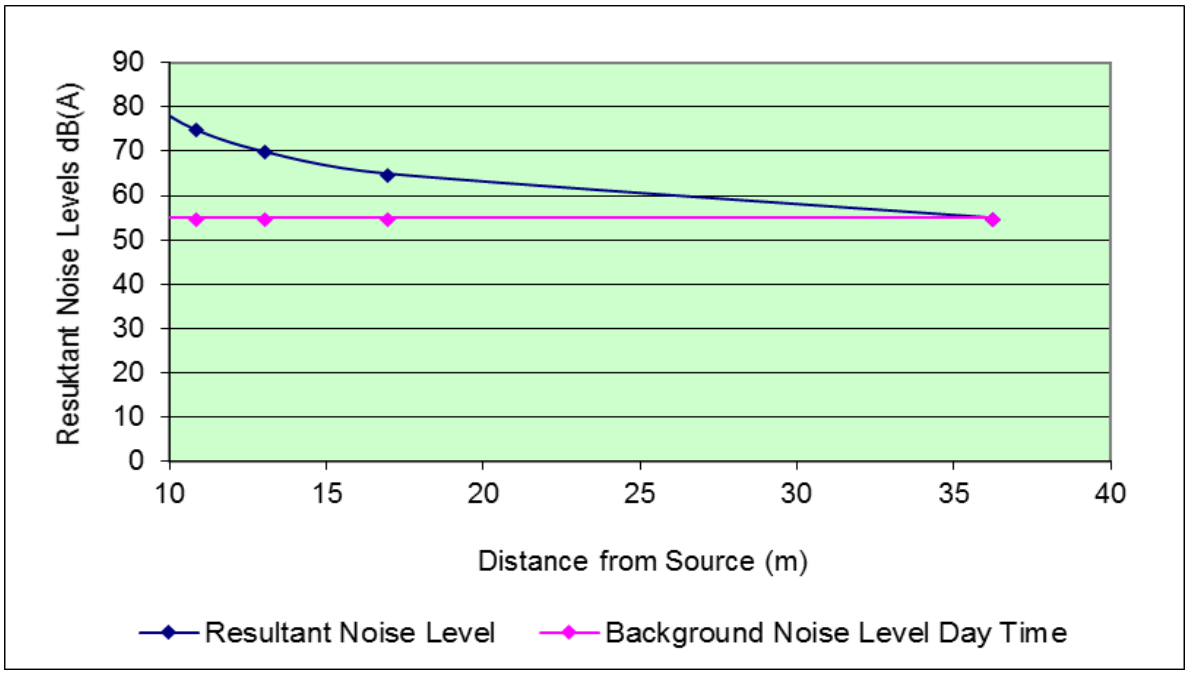


Figure 6.2: Attenuation of Noise Level During Construction Stage

The above noise modelling results show that the noise levels will remain below acceptable level within short distance at different locations of the drainage construction works and a inside pumping station. Further, the resultant noise level will mingle with the background noise level (assumed to be 55 dB (A) at 36.2 m during day time. The above noise levels are without mitigative measures. With the mitigative measures, the noise levels will be further restricted within very short distance from the pumping stations. Therefore, no significant impact is anticipated on noise levels during construction stage of the proposed storm water drainage system and a pumping station in Bonpora-Padshahibagh area.

During Operation Stage

No regular noise generation is expected due to the operation of storm water drainage system, however pumping stations which will be operated by electricity and generate very less noise (submersible type), which will blend with background noise level within pumping station. In absence of electricity salient Gen sets will be used.

6.10. Impact on Terrestrial Ecology

During Pre-construction and Construction Stages

Since the construction of storm water drainage system involves laying of drainage pipes of different dia. within the existing road at an average depth of 2.2 meter (70% of drainage network in Bonpora-Padshahibagh colonies). Based on the drainage alignment and ground truth survey/ inspection, no trees are coming or positioned within the existing road or

drainage alignment. However, 5 Poplar/ Willow trees and 1 Small Mulberry Tree are envisaged to be removed for the major pumping station (MPS) site. In Padshahibagh area at Ch 2+500 (LHS), one Chinar tree is located close to alignment of main drainage alignment. Systematic mitigation measures during excavation of trenches have been developed for efficient protection (esp. root and trunk protection) of Chinar tree which is captured comprehensively in EMP. Therefore, no significant impact on terrestrial ecology is anticipated due to proposed construction of storm water drainage and its pumping station.

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During Operation Stage

During operation stage of storm water drainage and its pumping stations, proposed plantation of Pine trees will be carried out in the periphery of pumping stations. This will provided the better aesthetics of pumping station sites and a sound barrier/ buffer zone.

6.11. Health and Safety Impacts

Vehicular traffic to the proposed sites is expected to increase especially during delivery of raw materials. This may cause an increase in the number of safety issues like dust generation, accidents, etc. The construction works will expose workers to occupational risks due to handling of heavy machinery, construction noise, electromechanical works etc. Construction activities of clearing, materials delivery, trench excavation and concrete mixing and construction traffic, will generate a lot of dust especially during the dry seasons and this may affect workers. Construction camp may be a source of both liquid and solid wastes. If these wastes are not well disposed, these sites may become breeding grounds for disease causing pests such as mosquitoes and rodents. At the concrete mixing plant the exposure of human skin to cement may lead to damage of the skin. Improper handling of solid wastes produced during electromechanical and civil works, such as spoil from excavations, scrap metal, resin, mortar, wood, paper, masonry chips and left over food stuff present a public nuisance due to littering or odour due to rotting.

6.12. Risk of Accidents at Work Sites

For any construction activity, mishaps or accidents can't be ruled out, and may occur due to failure to implement the regular use of Personal Protective Equipment's (PPE's) by workers on site and members of the public illegally accessing the work sites. Accidents may result in injuries or even death of workers or members of the public. This impact applies to all settlements under this assessment

This can be properly mitigated by the following measures;

- It will be mandatory that the "Construction Workers" and the "Supervising Team" to be provided with Personal Protective Equipment including gloves, gum boots, overalls and helmets. Use of protective gears to be enforced by the PIU/PMU.
- Contractor to provide an efficient EHS Plan prior to the commencement of works to be approved by the PIU.

- Campsite to be fenced off and Security Guards provided to restrict access to members of the public. Each work site to be barricaded to restrict the direct access in order to avoid any mishap or accident.
- Completely stocked standard “First Aid Kits” to be provided at construction Sites, Camps and in designated Ambulance Vehicle.
- Appropriate washroom/ablution facilities to be provided at the Camps and Work Sites and cleanliness maintained
- Segregate/Barricade the site and no unauthorized access should be allowed to the local communities during the construction for their safety and health

6.13. Occupational Safety

During pre-construction, construction and operation stages of the storm water drainage system in Bonpora-Padshahibagh area, the occupational health and safety of workers need attention.

During Construction Stage

During construction stage, occupational health and safety may be affected by the following reasons:

- Safety risks/ accidents during vehicular traffic movement
- Exposure to dust during excavation
- Excavation of trenches
- Handling of heavy drainage pipes
- Electrical hazards by loose electrical wiring
- Exposure to noise levels during hammering and metal cutting.
- Handling of heavy load (like submersible pumps, etc)
- Injuries to the workers during construction operation

To enhance the occupational health and safety during construction stage, the following measures like Proper Shoring of Trenches, Water sprinkling to avoid dust emission, use of suitable PPEs, electrical safety to be maintained as per regulations, induction training to worker to enhance safety at work place, first aid facilities, etc. will be provided.

During Operation Stage

During operation stage, workers may be directly or indirectly exposed due to following hazards:

- Electrical hazardous during operation of pumps,
- Fire due to electrical short circuit,
- Cleaning/ Handling of sumps and submersible pumps during maintenance
- Handling of sludge containing coli form and other pathogen.

- During cleaning of Man Holes

6.14. Service Delivery Impacts

The construction storm water drainage will cause disruption of services such as water supply, electricity, sanitation and transportation within the construction area. Excavation of trenches for the storm water drains may cut the water pipes and telecommunication lines (OFC). Excavation of trenches will necessitate digging up of roads and pavement. This will cause disruption of transport and other services.

This can be properly mitigated by the following measures;

- Setting up signage to warn or inform the drivers and other road users of the ongoing and type of construction activities.
- During pre-construction stage, identification and mapping of utilities alignment to chalk out the execution of the works with minimum disruption of services..
- Mobilization of professional utility crew vehicle (plumber, electrician etc) for priority based restoration of essential services during construction activities.
- Diversion routes signage where internal colony or main roads need to be closed.
- Access/ Right of entry of residents should be facilitated by installing appropriate temporary bridges over the trenches and lateral access as well.
- The contractor should communicate any intended disruption of services in advance especially water supply, electricity, and transport. This can be done by informing commuters through local community heads, announcement from the mosques etc.

6.15. Demographic, Land Use and Socio-Economic Environment

6.15.1. Demographic

During pre-construction and construction stages of storm water drainage system and a pumping stations in Bonpora-Padshahi Bagh Area, the total requirement of manpower for subproject will be about 60-70 workers on daily basis. During operation stage, maximum four operators will be required for operation of pumping stations (MPS/IPS). Therefore, large scale immigration will not take place for the proposed storm water drainage system and the impact on demography of the area will be insignificant.

6.15.2. Land Use

The construction of storm water drainage system and a pumping station in Bonpora-Padshahibagh Area of Zone-1 in Srinagar will have no impact on land use of the study area, as drainage pipes will be laid on already existing roads only. However, a patch of land measuring 995 m^2 at Bonpora-Padshahibagh is required for the construction of pumping station. Revenue papers of the above land are provided by SMC from Department of

Revenue, Govt. of Jammu & Kashmir. As per revenue records it is a community land and community is ready to donate the said piece of land.

6.15.3. Socio-economic

Economic Impacts

The construction and operation stages of storm water drainage system and a construction of pumping stations will have some beneficial impact due to increase in incomes as local skilled , semiskilled and unskilled persons will gain some direct and indirect employment. However, in view of the small manpower and support facility requirements, the beneficial impacts due to the construction of storm water drainage and pumping stations are likely to be marginal.

Social Impacts

Since the immigration of work force during construction and operation of the storm water drainage system is likely to be very small, the impact on facilities and cultural aspects are expected to be insignificant and contractor will engage mostly local labours.

7. ANALYSIS OF ALTERNATIVES

7.1. Analysis of Project Alternatives

This section analyses the project alternatives in terms of site, technology and waste management options.

7.2. No Project Alternative

The No Project option in reverence to the proposed project of storm water drainage system in Bonpora-Padshahibagh implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to people within the proposed sub project area and other citizens. These areas will continue to have frequent flooding, submergence, continuous water logging and pollution as sewerage continue to mix with the stagnant or water logged area which will lead negative health scenario and socially distressed life. The No Project Option is the least preferred from the socio-economic and environmental perspective due to the following factors:

- Development of efficient storm water drainage system infrastructural facilities (roads and associated infrastructure) will not be undertaken.
- From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people of Bonpora, Nowgam and Padshahibagh areas of Srinagar. Bonpora-Padshahibagh is being long suffered from the continuous water logging/ submergence and floods which lead to distressed life pattern as such people came on roads to protest against lack of drainage and bad road conditions resulting from water logging.
- No project option will have negative health impact as water logging of Bonpora, Padshahibagh and Nowgam, which are low lying areas result in mixing waste water and sewerage and gives rise to water borne diseases due to the contaminated and polluted water
- Discouragement for investors and loaners
- No employment opportunities will be created who will work in the project area.

Based on this assessment “No Project Option” is not preferred alternative.

7.3. Analysis of Alternative Technological Alternatives

The proposed project of storm water drainage system will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security, environmental and aesthetic requirements. One of the important components of SWD system is efficient pumping stations which can function even during peak floods. At both Pumping Stations, the proposed pumping equipment’s being of submersible type would not get damaged due to floods etc, besides beings efficient and almost noiseless. The proposed

pumping units being installed in the pumping stations shall be of the full capacity for the storm water drainage load thus no inundation of the proposed sub project area would take place. Moreover, the proposed electrical equipments would be place and installed above the now established HFL's per 2014 floods, thus would not get affected due to any kind of flood etc. The proposed D.G. Set are also being installed above the now established HFL and being of silent type with acoustic enclosure and complying with the latest CPCB norms and having the capacity for the full motor load operation.

7.4. Alternatives for Disposal of Storm Water from Pumping Station at Padshahibagh Nallah and design criteria consideration.

The concept and purpose of storm water drainage system and its pumping station is to collect the storm water from the low lying water logged areas through efficient drainage network system and its safe disposal into nearest receiving water body, respectively. Since the nearest water body is Padshahibagh Nallah within the catchment area of the Bonpora-Padshahibagh and no other water body is located near the area. Since pure concept of storm water drainage system is conceived which is based on runoff of wet and dry weather flow and the entity of waste water entering into closed SWD system is minimum. The collected storm water contains suspended solids during runoff and BOD/nutrient load will be minimum which will further minimized during discharge into Nallah.

7.5. Alternatives for Restoration of Roads.

The proposed storm water drainage system will involve excavation of trenches in existing road surfaces for the laying of drainage pipes (RCC NP3 type) and constructing man holes. The restoration of partially damaged and fully damaged roads due to construction of storm water drainage system including finishing, retaining the connectivity disrupted in and around the construction area. The affected areas by way of restored roads will benefit by the restored access to market and other localities and better riding surface. Restoration of roads will also serve as supply/rescue lines in the event of disaster.

For the restoration of road works, the road-works will be made using locally sourced materials that meet the required national and international standards. The alternative technologies available include the conventional concrete roads, prefabricated concrete panels, or even temporary structures. These may not be desirable from a cost and durability perspective. The technology to be adopted will be the most economical and one sensitive to the environment.

7.6. Solid Waste Management Alternatives

Solid wastes will be generated from the proposed storm water drainage project during construction and operational stages. An integrated solid waste management system is endorsed during the construction stage. Initially, the contractor will give priority to reduction at

source of the materials. This option will demand a solid waste management awareness program in the management and the staff. Recycling and reuse options of the waste will be the second alternative in priority. This will call for a source segregation program to be put in place. Finally, the contractor with the assistance from PIU will need to establish agreement with Srinagar Municipal Corporation (SMC), Govt. of J&K to ensure regular waste removal and disposal in an environmentally-friendly manner. Since a dedicated system is already established by the SMC in Srinagar City for effective solid waste management and daily household collection system. In this connection a dedicated SMC vehicle shall put in place and engaged for regular solid waste removal from the site. This is the most practical and feasible option for solid waste management considering the delineated options.

During operation stage a small amount of solid waste generation is expected from the SWD pumping stations of proposed sub project area and at an average of 0.8 kg per day and systematic cleaning and removal (through mechanical means only) of sludge from the collection chambers and man holes.

7.7. The Proposed Project Alternative

The project alternative as proposed in this report was considered the most appropriate. Implementing the project will ensure that the project aim and development objectives are realized as briefed below. The main aim of the Component 3 of JTFRP is “to strengthen and reinforce existing weak and vulnerable flood control infrastructure and related investments for improvement and increased resilience”. One of the SWD project taken up under this component is “Construction of storm water drainage system in Bonpora-Padshahibagh area of Zone-1 in Srinagar” with the project objective is to provide better sanitation facility thereby promoting sustainable environment and health scenario and which will also augment preparedness for flood disasters. In addition, the drainage systems will contribute to the goals and vision of the Smart City Mission of India in which Srinagar city is one of the selected cities.

8. PUBLIC CONSULTATION

8.1. Objective of Consultation and Location

Public consultation was conducted in accordance with the World Bank guidelines and ESMF of JTFRP protocol which is the pre-requisite for the screening and assessment process. The purpose and objective of this consultation is the involvement of residents/ stakeholders and to make them cognizant about the proposed activity of the subproject. The decision/proposal was well considered and in line with the recommendations of authorities, according to which construction of SWD scheme is essentially required in Bonpora-Padshahibagh area. On 3 February, 2019 and 6 May 2019, the local residents of the Bonpora-Padshahibagh area comprised of Bonpora, Nowgam, Padshahibagh and Advent Colony etc were consulted based on the procedural guidelines of reaching public required for the preliminary baseline characteristics of environmental and social screening.

Transect Walk was also conducted along the periphery of the sub project area to collect baseline information. Consultations were undertaken with the project stakeholders to take the views and propositions about the project activities.

8.2. Issues Discussed During Public Consultation

- Proposed project of Storm Water Drainage system and the perceived information on the benefits of the subproject and environmental enhancement and issues about project and its source of assistance, its implementation/execution etc.
- Concept of Environment and Social Screening requirements and benefits thereof.
- Construction activity whether causing any type of health hazard or not? and mitigation measures thereof.
- Concept of Storm Water Drainage was discussed with the people and apprised that SWD is not designed to connect household waste water connection as this will result in environmental contamination of SWD system, receiving water body and health hazard.
- Discussion among general public and school management/ staff for sharing of information related to project, environment/ social policy of World Bank, direct and indirect impacts of construction works
- Temporary access disruption during execution stage. Any loss of business or other community property due to the proposed construction activity?
- Any impact on religious places like mosques or schools in sub-project area?
- Protection and conservation aspects of environmental attributes.
- Mechanism and operation of grievance redressal system in case of any public complaints during project execution.

8.3. Outcome and Feedback Received from the Public Consultation

Public consultation with local residents/ stakeholders was conducted involving both gender at Bonpora-Padshahibagh for the proposed Storm Water Drainage project and environmental assessment survey in Bonpora-Padshahibagh area in Zone-1. Community heads have provided the full support in assembling of the locals during the consultation process in both Bonpora ans Padshahi Bagh areas. During consultation, locals were apprized about the proposed storm water drainage project, project proponents, World Bank, safeguard policy of the Bank and its implementation. A wave of contentment among locals with smiling faces was observed throughout the consultation. People were suffering since long due to the lack of the efficient drainage system especially in Bonpora, Advent Colony, Padshahi Bagh areas which remain water logged thoughout the year. As evident during consultation and field survey/ site assessment (refer Annexure 2 & 3), number of residential houses, schools, main and link roads were seen with the waterlogged and submerged with the stagnant water in the month of May 2019. Purpose of present study "Environmental and Social Screening" was also discussed and following general suggestions were recorded;

Some of the valuable feedback was received from the consultation conducted in February and May, 2019 in proposed sub project area are summarized below;

1. The residents have ensured full cooperation and support for the successful execution of the project. They have also ensured to nominate the responsible persons of locality who will liaison with the implementing agency and the contractor for community related issues.
2. People requested to lower the road surface during drainage works/ restoration of the road by atleast 6-8 inch than the existing road surface. As such number of plinth area of properties has already been below the road surface causing moisture issues during water logging etc.
3. The residents of the Bonpora- Padshahibagh areas who are related to construction industry (both un-skilled/ skilled workers) shall be provided the opportunity with the proposed drainage works..
4. The residents requested to provide with the temporary access routes/ ramps/ bridges shall be provided during excavation activity.

9. ENVIRONMENTAL MANAGEMENT PLAN

9.1. Introduction

The Jammu & Kashmir region owing to its geographical and geo-climatic setting is a multi-hazard prone region, which experiences natural disasters like earthquakes, floods, etc. Floods and flash floods are frequent in the region. Floods generally occur in the summer when heavy rains are followed by snow melting. Flooding of the river Jhelum is the main cause of floods in the region. In September 2014, the northern region of India experienced torrential monsoon rains in the region causing major flooding and landslides. The continuous spell of rains from September 2nd to 6th, 2014, caused Jhelum and Chenab Rivers as well as many other streams/tributaries to flow above the danger mark. The Jhelum River breached its banks causing flooding in many low-lying areas in Anantnag, Srinagar and adjoining districts. Due to the unprecedented heavy rainfall, the catchment areas particularly the low laying areas were flooded for more than two weeks. Some areas in urban Srinagar stayed flooded for 28 days. Water level was as high as 27 feet in many parts of Srinagar city. The areas from the main tributaries of river Jhehlum *vis-a-vis* Brengi nallah, Vishav nallah, Lider nallah and Sundran nallah started overflowing due to the heavy rainfall causing water levels in Jhelum River to rise. Subsequently, the discharge of the river Suran was 200 thousand cusecs as against an average 50 thousand cusecs. With the excessive discharge of water, the river Suran affected the basin areas and also took a different course at various locations causing damages to the surrounding villages in the catchment area. Water level also increased in rivers of Chanab and Tawi, both of which were flowing above normal levels. Due to severe flood in Srinagar city, public service infrastructure, equipment of hospitals and education centres were also severely damaged and are still not fully operational. The project “Jhelum & Tawi Flood Recovery Project (JTFRP)” focuses on restoring critical infrastructure using international best practice of resilient infrastructure. Under the JTFRP, it is proposed to improve/re-construct the damages caused by 2014 September Floods in Srinagar city through efficient drainage system/ pumping station in areas lacking drainage system and by taking the machine floor level 1 m above HFL as recorded in 2014.

During pre-construction, construction and operation stages of Storm Water Drainage (SWD) Works and Construction of Two Pumping Stations at Bonpora-Padshahibagh- Zone-1 in Srinagar City under the JTFRP, several direct and indirect environmental impacts are anticipated. To mitigate anticipated environmental impacts during different stages of construction of storm water drainage system in Bonpora-Padshahibagh Area an implementable environmental management plan has been prepared.

9.2. Proposed Works of Storm Water Drainage in Bonpora-Padshahibagh

The proposed works of storm water drainage system of Bonpora-Padshahibagh Area of Zone-1 in Srinagar City consist of the following main works:

- Laying of storm water drainage network (pipes of different dia) in whole of Bonpora-Padshahibagh area within the existing RoW.
- Construction of Two pumping stations of required capacity with SCADA automation and with non-clog submersible pumps
- Taking the Machine floor Level of Pumping Stations 1m above HFL as recorded in 2014.

9.3. Outline of EMP and its Implementation Strategy

The Environmental Management Plan (EMP) is a guiding tool which discusses the potential environmental impacts and specific mitigation and management measures for the proposed storm water drainage system and construction of two pumping stations in Bonpora-Padshahibagh Area of Zone 1 in Srinagar City. It refers to the responsibilities ensuring commitment for implementation and means of verifying/ supervision whether the same has been implemented properly. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided in the Environmental Management Plan. As a part of the EMP, the contractors will commit to identification of the environmental and, social impacts at the individual sub-project site. In case of any future changes in the sub-project design, the EMP will need to be updated to reflect the new scope of the activities. Such revisions will be finalized in consultation with the World Bank.

The PIU will be responsible to ensure implementation of EMP by the contractors with the overall accountability resting with the JTFRP-PMU. Whereas, the TAQAC will ensure periodic quality audit/ guidance to the PIU and by imparting regular training, monitoring and ensuring that all EMP provisions and policy requirements are translated into contract and that these requirements are implemented to their full intent and extent.

Overall responsibility will be of Contractor for effective implementation of EMP and adherence to all the mitigation measures as outlined in this EMP associated with their respective activities. The Contractor will be required to comply with the provisions of the EMP.

9.4. Environmental Management Plan

The Environmental Management Plan (EMP) will guide the environmentally-sound construction of the “Storm Water Drainage in Bonpora-Padshahibagh Area” and ensure efficient lines of communication/ coordination between the PIU, Contractor, PMU and TAQAC. The EMP has been prepared for three stages of storm water drainage construction activities as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization/ Operational Stage. EMP for Storm Water Drainage System and Construction of two Pumping Stations in Bonpora-Padshahibagh Area of Zone-1 in Srinagar City has been prepared and presented in Table-9.1. Various guidelines, checklists, strip mapping plan and reporting formats for implementation of EMP are given as Annexures at the end of the EIA Report.

The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on

site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with.

Budgetary provisions for implementation of EMP shall be integrated with the bid/construction contract in the form of technical specifications and environmental performance requirements. The costs to be incurred on implementation of EMP shall be incidental to the civil works and therefore, no separate environment budget/cost will be provided to the contractor for implementation of EMP. The contractor will ensure effective implementation of EMP during pre-construction, construction and demobilization/ operation stages. EMP for operation stage will be implemented by Srinagar Municipal Corporation (SMC).

The Contractor is deemed not to have complied with the EMP if; i), within the boundaries of the project site/ ancillary sites, site extensions and haul/ access roads there is evidence of contravention of clauses and, ii) if environmental damage ensues due to negligence, the contractor fails to comply with corrective action measures or other instructions issued by the PIU / JTFRP-PMU within a specified timeframe and the Contractor fails to respond adequately to complaints from the public.

Table-9.1: Environmental Management Plan for Storm Water Drainage System and Construction of 2 Pumping Stations in Bonpora-Padshahi Bagh, Srinagar

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
I.	**Pre-Construction Stage**			
A.	**Pre-construction Activities By the Contractor**			
A-1	Regulatory Approvals	• Permission from the J&K SPCB for consent to establish (before commencement of the works) and consent for operating of pumping station (during operation stage). • Permission from Irrigation & Flood Control department • Labour license from Department of Labour. • Prior permission will be taken from line department offices of Electricity (PDD), Telecommunications (for OFC underground cables, etc), water Pipelines (PHE), etc. Utility shifting required to be undertaken by the contractor in the supervision of PIU. • Setting–up of Batching Plant, Stone Crusher Plant, HMM Plants (required during restoration works), D.G Sets- Consent to Establish and Operate Certificates required from State Pollution Control Board (SPCB) or if contractor intends to procure such material from local outsourced agencies. Contractor to submit Consent to Establish/ Operate certificates (issued by the SPCB to the plant owners)	SMC, PIU Contractor	PIU PMU PIU TAQAC
A.2	Appointment and Mobilization of Environment & Safety Officer	The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will dedicatedly work and ensure implementation of EMP including Occupational, Health and Safety issues of the stormwater drainage system/ pumping stations (IPS/MPS) in Bonpora-Padshahi Bagh area.	Contractor	PIU TAQAC
A.3	Construction Camp Locations - Selection, Design & Layout	• If a contractor decides to establish a labor camp, the siting of the camp will be as per the guidelines given in Annexure 7-Main EIA report and layout of camp will be approved by PIU. • Labour camp will not be established within 250 m from the nearest settlement to avoid conflicts and stress with the local community.	Contractor	PIU TAQAC
A.4	Arrangements for Temporary Land for Camp	The Contractor as per prevalent rules will carry out negotiations with the landowner for obtaining his consent in writing for temporary use of land for labor camp, etc.	Contractor	PIU TAQAC

A.5	Tree cutting	• Cutting off one scheduled tree (Mulberry tree) (Morus sp.) of 1.8 ft of girth class is located at the MPS site (outfall channel). Cutting of 4 small Willow trees (0.9 – 1.2 ft girth class), one Poplar (1.2 ft girth class), One Ailanthus sp (1.2 ft girth class) and 13 no's of small saplings are also required for the construction of Major pumping Station (MPS) at Padshahi Bagh. • Loss of trees will be compensated by a 1:3 ratio (i.e. for loss of 1 tree 3 trees will planted or greater including transplantation of the same trees in the periphery of the PS (Bund Side) site in consultation with the Environmental Specialist of PMU.	Contractor	PIU/ PMU TAQAC
A.6	Safeguarding of Trees	• One Chinar Tree *(Platanus orientalis)* which is a scheduled tree (protected tree of State) is located in Padshahi Bagh area and is close to the road on LHS at RD 2.5 km of Main drain. The girth class of Chinar Tree is approximately6-8 m. • This Chinar tree will be marked with horizontal reflective strips prior to the commencement of works. • During construction, the scheduled Chinar tree will be covered/ wrapped with protective green mesh fiber cloth around the base tree trunk area by 6 feet in height. • No stockpiling of any construction will be allowed around or close to the Chinar tree. • Make-shift steel barricading will be provided around the existing Chinar tree in an active work zone where excavation takes place. • Any other trees within the area near the construction site will be marked with same horizontal reflective strips and green mesh as per the above measures. • To take sufficient care to define the root protection zone and minimize root loss especially to Chinar Tree. [14]From the perspective of the Chinar tree growth, pavement profile designs without a compacted subgrade and gravel base are preferable as these resulted in greater root abundance from 10-20 cm soil depth. Porous pavements are even more advantageous than impervious pavements given this profile design as they resulted in greater root biomass, as well as enhanced above-ground growth of Chinar. • No concreting shall be allowed around the Chinar tree and all excavation activities shall be done only in consultation with the Environmental Specialist of PMU.	Contractor	PMU, PIU TAQAC

[14] J. Morgenroth, "Root Growth Response of Platanus orientalis to Porous Pavements, Aboriculture & Urban Forestry 37 (2):March 2011

A.7	Construction Vehicles, Equipment and Machinery	• All vehicles and equipment to be procured for construction of stormwater drainage works will conform to the relevant Bureau of Indian Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 1988 will be strictly adhered to. • The silent/quiet equipment like DG set as per regulations will be used at the construction site or labor camp. • The contractor will maintain records of Pollution Under Control (PUC) certificates for all vehicles used during the contract period, which will be produced to PIU for Monitoring whenever required.	Contractor	PIU, TAQAC
A.8	Material Management-Sourcing	• Contractors shall prepare a source statement indicating the sources of all materials (including sands, natural gravels (GSB), crushed stone, asphalt (required during the restoration of roads), etc, and submit these to the PIU for approval prior to commencement of work. As part of quality control, sources of all materials shall be informed to the PIU for approval for on-going works. • Where possible, a signed document from the supplier of natural materials shall be obtained confirming that they have been obtained in a sustainable manner and in compliance with relevant legislation. • Where materials are borrowed (mined), proof must be provided of authorization to utilize these materials from the landowner/material rights owner and the Department of Geology and Mining.		PIU, TAQAC
A.9	Labour Requirement	The contractor preferably will use unskilled/semiskilled labor from the local area to give the maximum benefit to the local community.	Contractor	PIU TAQAC

A.10	Traffic Management Plan	• The construction of the Storm Water Drainage (SWD) system is located in Nowgam Bonpora and Padshahi bagh area. The laying of drainage pipes and construction of manholes will lead to disruption of traffic movement within the internal roads of the area. • The Storm Water Drainage system in Bonpora- Padshahi Bagh area has a total drainage network length of 12 km. The existing road is a link road connecting the Nowgam and adjoining areas with the Lasjan, Jawahar Nagar, Rajbagh, etc., therefore, it is essential that before start of the construction works, the contractor will prepare site-specific traffic management plan in consultation with PIU to transport construction materials, excavation activities, laying of drainage pipes/ manhole construction, etc. Community heads of the local should be taken into confidence in order to streamline pedestrian and vehicular movement within the Bonpora-Padshahi Bagh area. • Contractor to ensure construction works like excavation for laying of drainage pipes and manhole to be constructed on priority basis in winter period (Dec-March period when schools in Srinagar usually remains closed for the winter vacation) in order to avoid any such hindrances in normal functioning of the school. Contractor to incorporate the above measures in the traffic management plan • The contractor will make an effort to transport materials to the site in non-peak hours or in the night time. Contractor to follow timing schedule as per SMC protocol i.e., 8:00 pm to 8:00 am.	Contractor	PIU TAQAC

A-11	Utility Shifting & Accessibility	• Construction of stormwater drainage in Bonpora Nowgam- Padshahi bagh will involve excavation activities of trenches for laying of drainage pipes (RCC-NP3) and construction of main holes, which may impact existing utilities and cause disruption in services and inconvenience to the community. All the drainage works will be carried out following the center alignment of the existing road • Existing underground utilities include PHE- water supply pipelines (main/ household/religious places, school connections), telecommunication lines like Optical Fiber Cables (OFC), PDD electric poles and transformers (distribution type) poles above ground may also get disrupted, etc. • Before commencement of works, a joint field inspection will be conducted by the Contractor, TAQAC, PIU along with the concerned line departments of PHE, PDD, Telecommunication/ private agencies to map out the alignments, to check if any utility is being impacted due to construction works such as water pipelines, underground telecommunication lines, PDD electric poles/ transformers etc. • Checking for accommodating utilities crossing the drains- raising, lowering or re-location if required • Get maps/ alignments of the underground infrastructure from the relevant institutions/ line departments • Contractor to mobilize experienced Utility Crew (Plumber, Electrician, etc) and Utility vehicle for repair/ restoration on immediate basis for any damage caused to utilities like PHE-Water Pipelines, telephone line, etc. in coordination with concerned line departments, during the execution of construction works. • Contractor in coordination with PIU to sensitize the workers (especially JCB operator/ supervisor) carrying out excavations so that they exercise caution to minimize the chances of underground utility damage. • Prior permission will be taken from regional offices of Electricity, Telecommunications, Waterworks, etc by PIU during excavation activity • Any Utility shall be relocated at the earliest, in case of damage and the services shall be restored within the shortest time. • Any common property resource, if removed due to the construction activity shall be restored/ relocated at the earliest with the consent of the immediate local community using it.		

A-12	[15]Stockyard/ Storage of Construction Material and Establishing Equipment Lay-down Area	• Contractor in consultation with PIU shall identify the site for temporary use of land for construction sites /storage of construction materials including pipes etc. These sites shall not cause an inconvenience to the local population/traffic movement. These locations shall be approved by the PIU. • Selection of location for material storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent land uses, general on-site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary. • Protect material stockpiles from storm water erosion (e.g. by excavating a cut-off ditch around stockpiles to keep away storm water). • Enclosed storage for fuel with non- permeable flooring. • The contractor shall cover material stockpiles with tarpaulin or other materials. Avoid stockpiling material near water bodies. • Proper cover and stacking of loose construction material will be ensured during the construction of outfall structures at the construction site to prevent surface runoff and [16]contamination of receiving water bodies. • Storage areas shall be secure so as to minimize the risk of crime. They shall also be safe from access by children/animals etc. • It is very important that the proximity of residents, businesses, schools, etc is taken into account when deciding on storage areas for hazardous substances or materials. Residents living adjacent to the construction site must be notified of the existence of the hazardous storage area • Staff dealing with these materials/substances must be aware of their potential impacts and follow the appropriate safety measures. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training. Necessary training and awareness programs shall be carried out to make aware the contractor and its staff aware of the hazardous nature of substances.	Contractor	PIU, TAQAC

[15] These storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully

[16] The most expected source of watercourse contamination is excavated soil or loose material being washed into water body during construction of drainage works

A-13	Information Dissemination and Communication Activities	• Prior to construction activity, information dissemination will be undertaken by TAQAC, PMU and the PIU at the project site. The wider dissemination of information to the public will be undertaken by PMU through the disclosure of EIA / EMP reports on the website of PMU-JTFRP. • The project site of Bonpora-Padshahi Bagh, which is the direct impact zone, information boards will be displayed to disseminate the project details with a network map by the contractor. These information boards will be of standard size as per applicable codes and will be designed and put up in such a way that the public can easily read it from a distance. • Information boards will also be set up at the sites of construction camps and labor camps and stockyard site. These information boards will also mention the availability of a complaint register with Environment & Safety Officer (ESO) of the Contractor.	PMU Contractor	PMU, PIU TAQAC PIU
A-14	Environmental Monitoring-Baseline Data	Ambient air quality, noise levels, and water quality monitoring on a quarterly basis as per environmental monitoring plan and in accordance with instruction of Environmental Specialist of PMU.	Environmental Monitoring Laboratory of JTFRP-PMU through TAQAC	PMU
B.	**Construction Stage**			
B.1	**Site Clearance & Levelling**			
B.1.1	Clearing and Levelling	• The Pumping Station site at Padshahi Bagh is located close to the bund side of Padshahi bagh Nallah and its outfall channel across the existing bund. The embankment measures should be pre-defined around the outfall channel of Padshahi Bagh Nallah. This measure will check the silt/ earth spillover. • Minimum shrubs and ground flora will be removed from the periphery of the pumping station site. • The vegetation which include 1 Mulberry tree, 4 small Willow trees, 1 poplar tree, 1 Ailanthus tree, 13 saplings of Willows and shrubs/ grass at MPS site will be cleared and shall be replanted/ transplanted at periphery of bund side (Padshahi Bagh Nallah) of MPS outfall discharge channel in consultation with PIU/ PMU and TAQAC.	Contractor	PIU TAQAC

B.2	**Procurement of Construction Materials**			
B.2.1	Procurement for Aggregate and other construction materials	• The contractor will procure aggregate and other construction materials for concrete/reinforcement works for laying of drainage pipes, manholes, foundations and structures of pump house from authorized suppliers only. • The contractor will also work-out a road network to transport aggregate and other construction materials to the project site in synchronization with active works and report to PIU, which will be inspected before approval.	Contractor	PIU TAQAC
B.2.2	Transporting Construction Materials	• All vehicles delivering fine materials like aggregate, cement, earth, sand, etc, to the site will be covered by Tarpaulin to avoid spillage of materials. • Existing road used by vehicles of the contractor or any of his subcontractors or suppliers of materials will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Most of the material transportation shall take place from the Lasjan-Padshahi Bagh road near bridge at Rd 2+500. As such most of the material sourcing like stone crusher plants, WMM, HMM, Batching plants, etc shall be procured from the Lasjan which is known for the construction material hub. • The contractor will make an effort to transport materials to the site in non-peak hours or in the night time.	Contractor	PIU TAQAC
B.3	**Construction Work**			

B.3.1	Labour Camp Site	• The project information board will be displayed at the labor campsite. • Electrical cables and wires will be properly arranged with proper electrical safety. Loose electrical connections will not be allowed at the labor camp. • Red danger sign with bone & skull will be displayed as per The Electrical Rules at three stage motors, electrical panels and electrical machines, DG sets, etc. • Housekeeping at the labor camp will be maintained properly. Daily sweeping and cleaning will be done at the labor camp. • HIV Aids awareness posters will be displayed at the campsite. • Solid waste generated at the campsite will be collected in covered waste bins. Then, it will be segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealers. Biodegradable (food waste, paper, etc) solid waste will be disposed in compost pit. Non-biodegradable inert wastes will be sent to the landfill site of Srinagar Municipal Corporation (SMC). • Proper drinking water, sanitation, canteen facilities will be provided to workers at the labor camp.	Contractor	PIU, TAQAC
B.3.2	Safeguarding of Trees	• One Chinar Tree *(Platanus orientalis)* which is a scheduled tree (protective tree of State) is located in the Padshahi Bagh area and is close to the edge of the road on LHS at RD 2.5 km of Main drain. The drainage is proposed from the central alignment of the existing road. • As captured in the pre-construction stage same mitigation measures to be followed during this stage of the construction as follows; o The Chinar tree should be marked (horizontal strip) with safe reflective strips prior to the commencement of works. o The chinar tree in the construction zone will be covered/ wrapped with protective green mesh fiber cloth around the base tree trunk area by 6 feet in height. o No stockpiling of any construction will be allowed around or close to Chinar tree o Make-shift steel barricading should be provided around Chinar trees in active work zone excavation takes place.	Contractor	PIU TAQAC

B.3.3	Pedestrian and Vehicular Traffic Movement Management	• Wherever the entry and exit to houses/ establishments are affected due to construction activities of excavation of existing roads for laying of drainage pipes, an alternate temporary arrangement for crossing over shall be provided. • Detailed traffic control plans will be prepared and submitted to the PIU for approval, one week prior to commencement of works. • The traffic control plans shall contain details of temporary diversion, details of arrangements for construction (road stretches, timing, and stages). • Provide the construction itinerary in advance so that the potentially affected population can use alternative routes and start early to get to their destinations on time. • Erect warning signs of ongoing works. • Access of residents should be facilitated by installing appropriate temporary bridges/ solid racks over the trenches. Entry should be bridge type as lateral access along with the longitudinal access to be provided along the trench. • Suitable fluorescent (reflective) warning signs should be placed at near construction locations and should be visible at night. • Alternative access ways should be communicated to the community by way of announcement (through loudspeakers) in mosques or local FM Radios/ local newspaper can be utilized for the public information. • Install signage, barricading, fencing as required and include safety measures for transport of materials/equipment, which shall be limited to certain times, and arrangements for flagmen at intersection.	Contractor	PIU TAQAC

B.3.4	Excavation for laying of Drainage Pipes, Foundations for pumping stations (IPS/MPS) at Bonpora Nowgam and Padshahi Bagh	• During excavation for laying of concrete (RCC) drainage pipes and foundation work for pumping station (and its allied structures) at IPS site Bonpora and MPS site at Padshahi Bagh, necessary safety measures will be taken by the contractor as defined below; o At the excavation site, warning signboards will be displayed in vernacular language and English. o The entry of general public/unauthorized person will be restricted. o Excavation of 1.5 meters deep or greater requires a side protection (Close Timbering and step cutting) unless the excavation is made entirely in stable rock. To ensure all the excavation activity in Bonpora Nowgam- Padshahi Bagh network to be opened and executed only under the strict supervision of PIU. Contractor to follow strict protocol during excavation near sensitive receptors like schools, religious places (mosques), near graveyards etc. o Safe access and egress will be required including ladders, steps, ramps, or other safe means of exit of workers in excavated depth of 4 feet (1.22 meters) or deeper. o Excavated earth will be collected and disposed of in pre-identified site with the approval of PIU. o To ensure the elimination of excavation hazards, excavation will be carried in the presence of a competent person. o Suitable barricading will be provided around the excavation site. o Suitable personal protective equipment will be provided to the workers.	Contractor	PIU TAQAC
B 3.5	Safe Disposal of Excavated Earth	• The excess excavated earth from drains will be collected and disposed of in pre-identified site with the approval of PIU. • The excavated earth/ silt may be utilized by the locals for their use in filling purposes like lawn/ garden raising etc. For this purpose, the locals have to get written consent from the PIU. • All vehicles delivering material to the site shall be covered to avoid material spillage. • During excavation greater than 1.5 meters., protection (timber support) along the excavated drains are mandatory in order to avoid collapsing which may trigger the damage to the boundary walls (brick type). In case of damage, the contractor will inform the PIU immediately in order to ascertain the damages and reconstruction of the same	Contractor	PIU TAQAC

B.3.6	Handling of Cement Bags	• Cement bags will be stored and emptied in a covered area to control fugitive dust emissions. • While handling and emptying cement bags, workers will wear masks, hand gloves, and protective goggles. • The manual transferring of cement bags from one place to another place will not be allowed. For this purpose, the trolley will be used.	Contractor	PIU TAQAC
B.3.7	Reinforcement with steel for foundations, pillars and roofs of structures for pumping station at Bonpora Nowgam and Padshahi Bagh	• Manual cutting of steel bars for reinforcement will be discouraged. • Only skilled workers will be deployed by the contractor for steel bar bending and rebaring reinforced structures. • Correct hand and power tools will be used to tie and cut steel bars. • Workers engaged in steel bar bending and reinforcement will be provided helmet, suitably strong and flexible leather gloves, and safety shoes. • Workers will take extra caution and attention when walking on steel bar mattes and areas that contain exposed steel bars. • First aid facilities will be provided at the site to provide first aid in case of cuts or injuries to workers. After providing first aid, an injured worker will be taken to the hospital for further treatment.	Contractor	PIU TAQAC
B.3.8	Machinery works and concreting for foundations, pillars and roofs of structures for pumping station at Bonpora Nowgam and Padshahi Bagh)	• Workers will be given induction training for machinery and concreting works. • Workers engaged in concrete pouring will wear alkali-resistant gloves, cover the body with long sleeves and full-length pants, waterproof gumboots and eye protection. • Safety barricading will be provided around the concrete pouring site. • Proper access will be provided to workers to engage in concrete pouring. • After concrete pouring, workers should be instructed to wash skin with soap and eyes with fresh water.	Contractor	PIU TAQAC

B.3.9	Safety Measures at Pumping Stations (Bonpora Nowgam and Padshahi Bagh)	• Before starting the erection of pumps, the work area will be cleaned and will be kept free of any debris that might get in way of walking and handling of pumps, piping and electrical cable for erection. • Manual handling of heavy pumps will be discouraged. • For handling of heavy pumps, suitable lifting tools and tackles will be used. • Before use lifting tools and tackles to be used will be thoroughly checked. • Workers engaged in the erection of pumps will essentially use personal protective equipment (PPE), helmet, safety shoes, hand gloves, etc. • The right tools will be used for the right job during erection. No substitutions will be allowed for tools to avoid injury to workers. • Damaged fasteners or malfunctioned tools will not be allowed at the site. • During erection work, it will be ensured that loose electrical cables are not lying on the floor. • All metal cuttings, electrical wire pieces, etc will be collected daily and disposed of in an environmentally sound manner. • If welding will be used in the erection of pumps, proper eye and face protection shield will be used by welder for welding safety varies depending on the particular task being performed. • First Aid Box will be kept ready for all the time at the erection site. • During painting of piping with pumps the following safety measures will be ensured like common precautions including good ventilation and protection against fire will be ensured, painting on piping will be carried in such a way spillage on the ground is negligible, workers will be provided mask and hand gloves while carrying painting on piping, paint residue left in containers will be stored properly and disposed in environmentally sound manner.	Contractor	PIU TAQAC

B.3.10	Sensitive Receptors- Impact Management	• The identified sensitive receptors located along the main drainage corridor are 3 schools at Rd 0+070 LHS (Advent Private School in Bonpora Nowgam), Rd 0+450 RHS (Iqra Private School, Bonpora), at Rd 3+195 RHS (Kids Campus Private School in Padshahi Bagh); Mosques Rd 0+040 on LHS, Rd 0+490 on LHS, at Rd 1+430 on RHS and RD 2+530 (Masjid Khalid Bin Waleed-Padshahi Bagh) on RHS; Graveyards are also located at Rd 0+100 (on both sides) and in general residential houses. Following measures to be implemented during the construction activity; o The construction operations in these areas should be limited to the time period from 7:30 am to 6:00 pm. o Contractor to ensure construction works like excavation for laying of drainage pipes and manhole to be constructed on priority basis in winter period (Dec-March period when schools in Srinagar usually remains closed for the winter vacation) in order to avoid any such hindrances in normal functioning of the school. During excavation works near mosques, safe access ramps/ bridges to be provided along with lateral access in order to avoid any hindrance. Contractor to incorporate the above measures in the traffic management plan. o Periodic maintenance and calibration of construction equipment/ vehicles to meet applicable CPCB emission standards. o Noise barriers shall be installed during the construction stage to protect the school from the noise from construction activities. o Adequate barricading and safety measures to protect dust pollution and noise impacts on sensitive receptors like schools and religious places etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction. o Provision of enclosing generators and concrete mixers at site.	Contractor	PIU, TAQAC
B.3.11	Electrical Safety at Pumping Station (Bonpora Nowgam-Padshahi Bagh)	• BIS mark control panel will be provided at the pumping station. • It will be ensured that there is no loose connection, exposed wires and open conduit at the pump stations. • Electrical cables will be laid in cable trays with cable identification tags. • Double earthing will be provided to all three-stage motors and electrical panels as per specification IS: 3043/5039. At three-stage motors and panels and DG sets, danger sign with Red Colour bone and skull sign will be conspicuously displayed. • BIS marked electric shockproof rubber mat will be to the electrical panels. • SOP for starting and stopping of pumps will be displayed.	Contractor	PIU, TAQAC

B.3.12	Occupational Health and Safety of Workers	• The contractor will follow the OHS plan in Annex VI, including provisions for emergency response and night time work • All workers will be provided with required personal protective equipment • Provision of all workers with requisite personal protective equipment will be made;		
B.4	**Pollution**			
B.4.1	**Water Pollution**			
B.4.1.1	Water Pollution from construction material	• No workers/ staff are permitted to use water from near water bodies for the purposes of bathing, washing of clothing or for any construction or related activities. • The contractor will arrange collection, storing and disposal of excavated earth & construction wastes to the pre-identified disposal site approved by the PIU. As such no excavated/ construction will be allowed to stockpile near water bodies like Padshahi Bagh Nallah near MPS site or any other water body near the project area. • All oil spills, petroleum wastes, and paint sludge will be disposed of in accordance with J&K State Pollution Control Board (JKSPCB) guidelines.	Contractor	PIU , TAQAC
B.4.1.2	Waste Water from Labour Camp	• Wastewater generated from the sanitary facilities of labor camp will be treated in septic tank followed by soak pit. • No untreated raw wastewater will be discharged into drain/ water bodies • Workers will not be allowed for open defecation. Proper toilets fitted with septic tank and soak pit will be provided for workers at camp and construction sites.	Contractor	PIU , TAQAC
B.4.2	**Air Pollution**			

B.4.2.1	Dust Pollution	• The contractor will take every precaution to reduce the level of dust from the Storm Water Drainage (SWD) construction site and construction of new pumping stations at Bonpora and Padshahi Bagh. • The contractor will procure the construction machinery, which conforms to the pollution control norms specified by the MoEF&CC/CPCB/JKSPCB. • The excavated earth /construction materials will be stored properly so that it does not generate fugitive emissions. • Regular maintenance of vehicles to be used for material transportation and equipment will be carried and vehicular pollution checks should be made mandatory. • LPG will be used as a fuel source for cooking food in labor camp instead of fuelwood. The kitchen area should be well ventilated equipped with the standard exhaust fan. At labor camp, persons/ cook dealing with the LPG gas stoves/ cylinders should be well sensitized for the operating procedures and the importance of maintaining ventilation. Sensitization to be provided by the ESO of the Contractor. • Mask and other PPE should be provided as a mandatory effort to the construction workers. • While painting of piping, standard masks shall be used by workers. The following safety measures will be ensured like common precautions including good ventilation and protection against fire will be ensured, painting on piping will be carried in such a way spillage on the ground is negligible, workers will be provided mask and hand gloves while carrying painting on piping, paint residue left in containers will be stored properly and disposed in environmentally sound manner. • The location of the proposed dewatering station's outfall disposal pipe should be well away from the school and pumping station should be designed in accordance with environmental standards and odor control shall be maintained.	Contractor	PIU TAQAC

B.4.2.2	Emission from Construction Vehicles, Equipment and Machinery	• The contractor will ensure that all vehicles, equipment, and machinery used for construction works are regularly maintained and conform that pollution emission levels and comply with the requirements of CPCB and/Motor Vehicles Rules. The contractor will submit Pollution Under Control (PUC) certificates for all vehicles for the project. • DG set will be provided with chimney of adequate height as per CPCB guidelines (Height of stack in meter = Height of the building + 0.2 √KVA).	Contractor	PIU TAQAC
B.4.3	**Noise Pollution**			
B.4.3.1	Noise Levels from Construction Vehicles and Equipment's	The contractor will confirm the following: • All construction equipment used in excavation, concreting, etc, will strictly conform to the MoEF&CC/CPCB/JKSPCB noise standards. • All vehicles and equipment used in construction works will be fitted with exhaust silencers/mufflers. • Maintenance and servicing of all construction vehicles and machinery will be done regularly. • Only acoustic enclosures fitted DG sets will be allowed at the construction site and labor camp. • The erection of the new pump station will be such that noise generation is minimal.	Contractor	PIU TAQAC
B.5	**Personal Safety**			

B.5.1	Personal Safety Measures for Labours and Staff	The contractor will take necessary measures for the personal safety of workers: • Protective safety shoes, gumboots, hand gloves, protective goggles, etc (as required) will be provided to the workers employed in excavation, steel rebaring, concrete works, erection of pump station, etc. • Welder's protective eye-shields will be provided to workers who are engaged in welding works. • Earplugs will be provided to the workers exposed to high noise levels. • Safety vests will be used by workers when on a construction site. • The contractor will comply with all the precautions as required for ensuring the safety of the workmen as far as those are applicable to this contract. • The contractor will make sure that during the construction work all relevant provisions of Building and other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996 are adhered to. • The Contractor will not employ any person below the age of 14 years for any work.	Contractor	PIU TAQAC
B.5.2	Emergency Management	• Emergency numbers will be displayed at the construction sites and campsite, • First boxes will be made available at the construction site and campsite, • Fire extinguishers for petroleum oil fire and electrical fire will be made available at pumping station, construction site, and campsite. • Designated vehicles, which can be used as an ambulance will be available at the construction site all the time.	Contractor	PIU TAQAC
B.5.3	Risk Force Measure	• The contractor will make required arrangements so that in case of any mishap during, operation of machinery/ construction vehicles, dismantling, excavation, concrete pouring, and erection of pumps, all necessary steps can be taken for prompt first aid treatment. • Construction Safety Plan for stormwater drainage system and construction of new pumping stations (IPS/MPS) at Bonpora Nowgam and Padshahi Bagh to be prepared by the contractor and will identify necessary actions in the event of an emergency.	Contractor	PIU TAQAC

B.5.4	First Aid Facility	The contractor will arrange for : • A readily available first aid unit including an adequate supply of sterilized dressing materials, burn ointment and appliances as per the state Factories Rules will be maintained all the time by the contractor. • The availability of first aid trained persons will be ensured at the project site during the construction stage. • The availability of suitable transport will be ensured at all times to take the injured or sick person(s) to the hospital.	Contractor	PIU TAQAC
B.6	**Labour Camp and Project Site Management**			
B.6.1	Accommodation for Laborers	• The contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. • The location, layout and basic facility provision of each labor camp will be submitted to the Environmental Expert of PIU prior to their construction. • The construction will commence only upon the written approval of the Environmental Expert of PIU. • The contractor will maintain necessary living accommodation, toilets, bathrooms and ancillary facilities in a functional and hygienic manner. • Proper ventilation along with standard exhaust fans will be provided in labor accommodation rooms. • Regular cleaning and sweeping will be ensured at the labor campsite. • Systematic waste collection management at labor camp to be managed as per SWM Rules 2016.	Contractor	PIU TAQAC
B.6.2	HIV/AIDS Prevention Measures	• Necessary HIV/AIDS prevention measures will be taken at labor camp • HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer (ESO).	Contractor	PIU TAQAC

B.6.3	Potable Water for Workers	The contractor will construct and maintain labor accommodation in such a fashion that uncontaminated clean water is available for drinking, cooking, bathing, and washing. The contractor will also provide potable water facilities within the precincts of workplace/pump stations in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The contractor will also provide the following: a) Supply of sufficient quantity of potable water (as per IS) at construction site/labour camp (site at suitable and easily accessible places and regular maintenance of such facilities). b) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1 meter above the surrounding ground level. c) If water is drawn from any existing well/hand pump, which is within 30 meters proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for the drinking. Environmental Expert of PIU will be required to inspect the labor camp once in a week to ensure the compliance of the EMP.	Contractor	PIU TAQAC
B.6.4	Sanitation and Sewage System at Labour Camp	The contractor will ensure that : • The sewage system for the camp will be designed, built and operated in such a fashion that no health hazard occurs and no pollution to the air, groundwater or adjacent watercourses take place, • Separate toilets/bathrooms, as required, will be provided for men and women, marked in vernacular language, • Toilets will be provided with a septic tank followed by soak pit. • Adequate water supply will be provided in all toilets and urinals, • Night soil can be disposed of with the help of municipality or disposed of by putting a layer of it at the bottom of a permanent pit prepared for the purpose and covered with 15 cm layer of waste or refuse and then covered with a layer of earth for a fortnight.	Contractor	PIU TAQAC

B.6.5	Waste Disposal	• The contractor will provide garbage bins in the camp & construction site and ensure that these are regularly emptied and disposed of in a hygienic manner according to Solid Waste Management Plan as per Solid Waste Management Rule 2016. • The burning of wastes at the construction site and labor camp will not be allowed. • Solid waste generated at the construction site & labor camp, will be collected in covered waste bins and segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealers. Biodegradable (food waste, paper, etc) solid waste will be disposed in the compost pit.	Contractor	PIU TAQAC
B.7	**Environmental Monitoring**			
B.7.1	Environmental Monitoring- Construction Stage	• The environmental monitoring laboratory of JTFRP-PMU will carry out environmental monitoring for Ambient Air Quality, Noise levels, and Water Quality on a quarterly basis as per environmental monitoring plan and in accordance with the instruction of Environmental Specialist of PMU.	Environmental Monitoring Laboratory of JTFRP- PMU through TAQAC	PMU
C.	**Contractor's Demobilization**			
C.1	Clean-up Operations, Restoration and Rehabilitation	• The contractor will prepare a project and labor campsite restoration plan, which will be approved by the PIU/ Environmental Expert. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization from the construction site and labor camp. The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in environmental sound manner. • All disposal pits or trenches will be filled in and effectively sealed off. • Construction places including camp and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU.	Contractor	PIU TAQAC

C.2	Land Rehabilitation	• All surfaces hardened due to construction activities are to be ripped & imported materials thereon removed. • All rubbles to be removed from the site to an approved disposal site. Burying of rubble on-site is prohibited. • Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the Engineer. • All embankments are to be trimmed, shaped and replanted to the satisfaction of the PIU. • Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the PIU regarding these requirements.		
D.	**Operation Stage**			
D1 Management and Maintenance of Storm Water Drainage				
D1.1	Public Awareness-Storm Water Management on Efficient lines	The SMC with support from JTFRP-PMU would need to carry out education and awareness campaigns on efficient stormwater drainage management through periodic visit to Bonpora Nowgam- Padshahi Bagh areas by way of announcement, sharing of pamphlets, Radio/ FM programs, regarding their 'responsible' activities in relation to drainage management, and discourage solid waste dumping, disposing of wastewater in the drainage system.	SMC	PMU by rendering technical support

D1.2	Public Health	• SMC to ensure that no household wastewater connections are connected with the stormwater drainage man-holes/ network. SMC will ensure that the drains carry only the stormwater. • Drains are designed as closed/ covered in RCC type with cover on top which will curtail dumping of solid waste in drains. • The stormwater drains would need to be periodically de-silted in-order to maintain its carrying capacity. • SMC to go for periodic checking and source of waste generation and its identification, and additional bins in critical locations will be provided and frequent collection and disposal of waste will be ensured. This exercise will minimize the contamination from the leaching solid/ liquid waste into the SWD system. • All structures comprising the construction camp/ ancillary sites are to be removed from the sites to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. • PIU/ SMC to ensure that the stormwater drains are not clogged and correct operation and maintenance of drains and waste screen. • The drains will require regular inspection and maintenance with clearance of any accumulated silt or waste, and the waste screen will need regular removal of waste, the clearance interval will be shorter in the wet weather flow than in the dry weather flow. • Drains will be regularly inspected and cleaned especially prior to the rainy season. • SMC to ensure muck and silt that are removed from the drainage system will not be left alongside the drain and will be immediately disposed in the designated waste collection vehicles of SMC and subsequently ensure that it will be disposed at an approved municipal solid waste site in Srinagar	SMC	PMU
D1.4	Compensatory Plantation	• 20 trees (including 13 Willow) saplings will be compensated by 1:3 ratio (i.e. for loss of 1 tree 3 trees will be planted or greater including transplantation of the same trees/ saplings in the periphery of the MPS (Padshahi Bund Side) site in consultation with the Environmental Specialist of PMU. • Horizontal strip plantation will be carried out by 20 feet on both sides of the MPS site (bund side). Plantation of shrubs with grass (Cynodon sp.) engraining will be carried out in this section.		

D2. Maintenance of Pumping Station at Bonpora Nowgam- Padshahi Bagh SWD				
D.2.1	Operation of Pumping Stations (IPS/ MPS) at Bonpora Nowgam and Padshahi Bagh	• Standard Operating Procedure (SOP) for pump operation will be displayed at pumping stations at Bonpora Nowgam and Padshahi Bagh. • Pump stations will be maintained clean and do's and don'ts for pumping station will be displayed. • Earthing and earth resistance of the earth pits will be checked every year. • Dry Chemical (ABC) type fire extinguisher for electrical fire will be kept in the pump station. • DG set will be fitted with acoustic enclosure. • Stack height to DG set will be provided as per CBCB guidelines to vent out stack gases into the atmosphere. • Proper ventilation will be maintained in the pump station. • First Aid Box will be kept ready at the pump station. • Necessary personal protective equipment like electrical resistance hand gloves, safety shoes, helmet, mask, etc will be kept ready in the pump station. • Waste collection bin will be provided, which will be cleaned daily and collected wastes will be disposed of at designated place by Srinagar Municipal Corporation.	SMC	SMC
D.2.2	Maintenance of Pumping Station	• Predictive and preventive maintenance schedules will be prepared as per manufacturer recommendation. • Checklist will be prepared by SMC for maintenance for pumping station • During maintenance, necessary personal protective equipment will be used by workers.	SMC	SMC
D.2.3	Monitoring of sewage to be pumped	• SMC will ensure the monthly monitoring of wastewater to be pumped by pump stations. The monitoring parameters will be in line with discharge standards of CPCB *i.e.* Temperature, pH, Turbidity, Total Suspended Solid (TSS), T. Alkalinity, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil & Grease (O&G), Fecal Coliform, Total Nitrogen, and Total Phosphate. The records of environmental monitoring will be maintained.	SMC	SMC

D.2.4	Pumping strategy for wastewater into Padshahi Bagh Nallah	Wastewater at pumping stations has considerable variation in flow rates, concentration of pollutants and characteristics during various segments of a day. Usually, in morning and evening hours flow rates and concentration of water pollutants remain high. The incessant pumping of wastewater in Padshahi Bagh Nallah has the possibility that the concentration of pollutants in wastewater at pumping might be exceeding discharge standards. Therefore, it is suggested that based on hourly wastewater monitoring, SMC should ensure equalization of wastewater of drain to bring down the concentration of water pollutants like BOD below the discharge standards before discharge into the spill channel. It is highly recommended that SMC to ensure that [17]" No household connections should be linked/ connected with the Storm Water Drainage system at both locations of Bonpora and Padshahi Bagh and the "Pure Concept of Storm Water Drainage System" will be maintained by the SMC". In this context, it is observed that the number of existing drainage systems in Srinagar and adjoining areas, are connected with the household wastewater connections resulting in conversion of stormwater drainage into sewer drainage and disposed of directly into receiving water body causing odor nuisance and contamination of water bodies. This mixed wastewater comprises of high oxygen demanding (BOD) waste, surfactants, higher nutrients (nitrate-phosphates), suspended solids and prevailing anoxic condition result into sulfate precipitation which leads to the formation of *Hydrogen Sulphide* (which is an obnoxious H_2S gas/odor in drainage network, sumps & outfall discharge channel). This has a long-term impact in a given community along with sensitive receptors like schools, religious places, residents, etc due to the bad engineering practices and decision making. One of the common problems with the SWD system is suspended solids from surface runoffs during peak storm events and dry weather flow. Suspended solids are typically the pollutant of concern, primarily because solids tend to settle down. For this purpose, DWS should be designed in such a way to arrest suspended solids in order to check the flow of sediments into a receiving water body of Padshahibagh Nallah.	SMC	SMC

[17] This report is being prepared based on the storm water drainage design parameters, ground truth survey, data review, EMSF 2015 (JTFRP) WB guidelines and national/ state laws and suggestions/ recommendations provided in here are based on Concept of Storm Water Drainage Design (that is collection of rain/ snow water and its run-off only)/ pumping station and are correlated with the present environmental study & outcome.

9.5. Clause for Non-conformity to Environmental Management Plan (EMP) - Protection of the Environment

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Health, Safety & Environment (HSE) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value. If the lapse is not rectified within one month after withholding the payment, **the amount withheld shall be forfeited.**

9.6. Environmental Monitoring Plan (EMP)

The monitoring plan consists of performance indicators, reporting formats and necessary budgetary provisions. The contractors monitoring plan should be in accordance with the baseline environmental monitoring, locations provided in the environmental assessment report.

The monitoring plan has the following objectives:

- To ensure effective implementation of EMP
- To evaluate the performance of mitigation measures proposed in the EMP
- To comply with all applicable environmental, safety, labour and local legislation
- To ensure that public opinions and obligations are taken into account and respected to the required satisfaction level
- To modify the mitigation measures or implementing additional measures, if required

The monitoring requirement for the different environmental components have been prepared and is presented in Table 9.2 below;

Table 9.2: Environmental Monitoring Plan (EMP) of Storm Water Drainage in Bonpora-Padshahibagh Area of Zone 1, Srinagar

S. No.	Monitoring Type	Parameter	Frequency	Responsibility	Location for Monitoring
A. Pre-Construction Stage					
1	Legislation, Permits and Agreements	All clearance/ consents/ NOC required from different departments and Environmental aspects shall be ensured and made available before start of work.	Pre-Construction Stage requirement (Before Construction)	Implementation: Contractor Supervision: Monitoring: PIU, TAQAC	Project Area
2	Safeguarding of Trees	1 number of Chinar Tree *(Platinus orientalis)* is located close to the existing pavement (Protective Measures defined in EMP).	Before Construction	Implementation: Contractor Supervision: Monitoring: PIU, TAQAC	At Padshahibagh Ch. 2+500 (LHS)
3	Tree Cutting	5 Willow/Poplar trees and 1 Mulberry tree cutting is required, it can be undertaken after necessary approval from regulatory authority. Trees shall be removed from the construction sites before commencement of construction	Before Construction	Implementation: Contractor Supervision: Monitoring: PIU, TAQAC	At Pumping Station site (MPS)-Padshahi Bagh
4	Access to site	Existing conditions, traffic rerouting, notification, project informatory boards, road signages	Before construction	Implementation: Contractor Monitoring: PIU, TAQAC	Prior to moving onto site

5	Public Information and Signage	Public informed of project activities in advance of works contractors occupying each section of work site or use of roads for movement of materials. information regarding the project, and contact of the Environmental Safety Officer (ESO) officer in case of complaints.	Before construction	Implementation: Contractor Supervision: Monitoring: PIU, TAQAC	Prior to moving onto site
6	Ambient Air Quality Monitoring Standards: NAAQS, 2009 Ambient Air Quality Standards, Air (Prevention and Control of Pollution) Act,1981	Baseline Data: Particulate Matter (PM_{10}, $PM_{2.5}$), Sulfur dioxide (SO_2), Nitrogen dioxide (NO_2)	Before commencement of the works. (1 Location)	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of [18]ES-PMU	Baseline location near sensitive receptors/ locations in Bonpora-Padshahibagh area. Near School and near religious place, residential area
7	Ambient Noise Monitoring Noise Pollution (Regulation and Control) Rules, 2000	Baseline Data- [19]Ambient noise levels in dB(A) of day time .	Before commencement of the works. (near sensitive receptor location), (1 Location)	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Baseline location near sensitive receptors/ and near religious place, residential area
8	Water Quality Monitoring Indian standards for Inland Surface Water (IS; 2296, 1982)	Baseline Data- Parameters for Surface water quality standards (IS; 2296) Temp, pH, Electrical conductivity, TSS, TDS, Alkalinity, Total Hardness, Nitrate-Nitrogen, ortho-Phosphates, BOD, COD, Sulphate, Chloride, E.Coli (As per APHA methods)	Before commencement of the works. (1 location at Padshahibagh Nallah	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Baseline location of Padshahibagh Nallah near pumping station (MPS).

[18] ES: Environmental Specialist
[19] Night time noise level monitoring is not possible due to the security reasons.

9	Construction camp	Approval of location and facilities	Before construction	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	prior to moving onto site
10	Equipment Lay-down and Storage Area	Approval of location and facilities	Before commencement of the works	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	prior to moving onto site and during site set-up
11	Materials management – sourcing	Approval of sources and suppliers	Before commencement of the works	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	prior to procurement of materials
12	Awareness of site staff	Awareness Level Training - Environment - Health and Safety	Before commencement of the works	PIU, TAQAC	during staff induction, followed by scheduled as determined
B. Construction Stage					
14	Ambient Air Quality Monitoring Standards: NAAQS, 2009 Ambient Air Quality Standards, Air (Prevention and Control of Pollution) Act,1981	Particulate Matter 10 and 2.5 (PM_{10}, $PM_{2.5}$), Sulfur dioxide (SO_2), Nitrogen dioxide (NO_2)	Six monthly at 2 locations. (Except during Monsoon period).	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Once in six months Near sensitive receptors/ locations especially downwind directions like near schools, near religious place, and, residential area
15	Ambient Noise Monitoring Noise Pollution (Regulation and Control) Rules, 2000	[20]Ambient noise levels in dB(A) of day time	Six Monthly at 2 locations at construction sites especially near Sensitive Receptors	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Near sensitive receptors/ locations especially downwind directions like near schools, near religious place, and, residential area

[20] Night time noise level monitoring is not possible in Bonpora-Padshahi Bagh areas in Srinagar due to the security reasons.

16	Water Quality Monitoring Indian standards for Inland Surface Water (IS; 2296, 1982)	Parameters for Surface water quality standards (IS; 2296) Temp, pH, Electrical conductivity, TSS, TDS, Alkalinity, Total Hardness, Nitrate-Nitrogen, ortho-Phosphates, BOD, COD, Sulphate, Chloride, E.Coli (As per APHA methods)	During construction. (2 location at Padshahibagh Nallah and River Jhelum	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Once in six months Padshahibagh Nallah near Pumping Station (MPS) and River Jhelum near confluence point
17	Soil erosion	Soil erosion management measures	Regular	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	Pumping Station sites and SWD Network
18	Surface water	Surface water management measures (protective Measures	Regular	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	Project and ancillary sites[21]
19	Conservation of Natural Environment	1 Chinar Tree at Ch. 2+500 comes close to alignment of proposed sub project (On the Footpath)	Regular	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	1 Chinar Tree at Ch. 2+500
20	Waste management procedure	Approved Disposal sites	Periodic	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	Project, site Camp and ancillary sites
21	Construction camp	Qualitative characteristics	Periodic	Implementation: Contractor Supervision/: Monitoring: PIU, TAQAC	Camp site
C. Operation Stage and O&M					

[21] Subproject sites include approved construction site, equipment lay-down and storage area, watercourses along the subproject site, open drainages

22	Air quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2	One time monitoring O&M Stage	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Near Sensitive Receptor
23	Noise quality	Noise Level in dB(A) L_{eq}	One time monitoring O&M Stage	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU	Near Sensitive Receptor
24	Efficiency of SWD System	Visual Inspection of solid waste dumping, clearing of leaf litter water logging, odour, mosquito breeding. Disposal of waste from maintenance of drainage facilities shall be conducted in accordance with national regulations for Municipal Solid Wastes (Management and Handling) Rules, 2016 & The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013 or M.S. Act 2013 Inspect drain covers, and replace if damaged Thrice a year, (compulsory before, the monsoon) ULB Throughout the drainage network	Six Monthly	SMC	Throughout SWD Network in Bonpora-Padshahibagh Area and Pumping Stations for Sludge/ Siltation

25	Water and Waste Water Quality	Temp, pH, Electrical conductivity, TSS, TDS, Alkalinity, Total Hardness, Nitrate-Nitrogen, ortho-Phosphates, BOD, COD, Sulphate, Chloride, E.Coli	One time monitoring O&M Stage	Implementation: PMU Monitoring: Environmental Monitoring Laboratory of PMU through TAQAC under supervision of ES-PMU Further, SMC- To monitor the Water and waste water quality parameters of the Bonpora-Padshahibagh Pumping Station (Outfall Channel) and Surface Water Monitoring.	Surface Water body (Padshahibagh Nallah-Upstream/ Downstream) and outfall channel of Pumping Station
26	Community Awareness campaigns	Post-project state of the drains and solid waste management. Acting on awareness through practicing non-dumping of solid waste into drains	Single at time of awareness Observation-post-project	PIU / SMC	Location to be selected by SMC

9.7. Budgetary Provision for EMP

Mitigation measures proposed in the EMP will be implemented by the Contractor and under the supervision/ monitoring by the PIU/TAQAC. The works to be undertaken by the contractor have been quantified and the quantities included in the respective BOQ items. The essentials of environmental health and safety measures to be followed by the contractor have been included in the annexures of main EIA report.

The indicative split up of capital and recurring cost for the environmental management for the project is presented in following Table-9.3;

Table 9.3: Budgetary Allocation- Indicative Cost for EMP Implementation for Storm Water Drainage (Bonpora-Padshahi Bagh)

S. No.	Component	Item	Unit	Unit Cost	Quantity	Total Cost
A.	**Pre-Construction Stage**					
1	Environmental Monitoring (Baseline Monitoring)	Ambient Air Quality	No.	7000	1	7000
		Surface Water Sample	No.	5000	2	10000
		Ground water Sample	No	7000	1	7000
		Noise Level Measurement	No.	3000	1	3000
B. Construction Stage						
2	Safeguarding of Trees	1 no. Chinar tree at Ch. 2+500	Lump sum	1000	Lump Sum	1000
3	Tree Cutting	1 Mulberry tree and 5 willow/poplar tree cutting is required, and can be undertaken after necessary approval from regulatory authority. All Trees earmarked for cutting shall be removed from the construction sites before commencement of construction	Cost included in DPR			
4	Provision of adequate drainage and bunds/ diversion dykes.	Provision of adequate drainage and bunds/ diversion dykes, including temporary arrangements to cross drains during execution to prevent soil/ raw material escape	Cost included in DPR			
5	Public Information and Signage	Public information about the project activities in advance of works. Contractors occupying each section of work site or use of roads for movement of materials. information regarding the project, and contact of the ESHS officer in case of complaints.	Cost included in DPR			
6	Environmental Monitoring on six monthly basis- (Ambient Air, Noise, Surface Water Quality and Ground Water Sample)	Ambient Air Quality	No.	7000	3	21000
		Noise Level	No.	3000	3	9000
		Water Quality (Upstream/ Downstream)	No.	5000	6	30000
		Ground Water sample	No.	7000	3	21000
7	Water	Oil Interceptors at workshop/ campsite	Lump Sum	20000	-	20000
8	Sanitation	Sanitary facilities at construction camp (Wet & Dry Type)	Lump Sum	Cost included in DPR	-	-
9	Compensatory Plantation	Re plantation of trees @ 1:3 ratio	No.	4000	16	64000

10	Landscape management/ Beautification Plan at Pumping Station (IPS)	Pine Plantation and other beautification measures by planting ornamental trees at IPS.	Lump Sum	100000	Lump sum	100000
13	Personal Protective Equipments (PPE's)	Personal Protective Equipments like vest, helmet, safety shoe, hand gloves, gumboots, earplug, Harness belt, Welding Glasses etc	Cost included in DPR			
14	Solid Waste Management	Solid Wastes collection, segregation and disposal from building construction site and camp	-		-	-
15	Hazardous Waste Disposal	Collection and disposal of used oil from maintenance of DG set and construction equipment	-	-	-	-
16	First Aid Kits	First Aid Kits at the construction site, camp and ancillary sites	Cost Included in DPR			-
17	Horizontal Seismic Force	Seismic arrester to be provided to prevent dislocation of slabs of the Pumping Station building (Bonpora-Padshahibagh)	Cost included in DPR			
C	Operation Stage					
18	Environmental Monitoring - Ambient Air, Noise and Water and waste water Quality Monitoring,	Ambient Air Quality	No.	7000	1	7000
		Noise Level	No.	3000	1	3000
		Water Quality (Upstream/ Downstream)	No.	5000	2	10000
		Waste Water Monitoring (Pumping Stations)	No.	7000	1 x 2 (Waste Water)	14000
19	Safety of Building (Pumping station at Bonpora-Padshahibagh)	Safety Signage at the construction site as per Building Construction Guidelines	Cost included in DPR			
Total Cost						327000
Contingency Cost @ 5%						**16350**
Total EMP Budget (excluding items already reflected in DPR)						**343350**

Apart from the above mentioned monitoring requirements, any major accidents/spillage during bulk transport of hazardous materials by the contractor, depending on the type of spillages / accidents, the parameters to be monitored will be decided by the engineer and should be carried out by the contractor through approved monitoring agencies and supervised by the Implementing agency.

9.8. Reporting System

The contractor will follow the reporting system for implementation of environmental management plan and environmental management indicators. The Contractor will report the PIU on corrective measures and implementation status of mitigation measures as per the environmental management plan. The EMP compliance report will comprise with the photographic evidences (with date, time and geo-references) for implemented mitigation measures in the monitoring reports.

Table 9.4: The reporting requirements for the storm water drainage in Bonpora-Padshahibagh area.

S.No	Item	Stage	Contractor
			Implementation & Reporting to PIU/PMU
1.	Setting up of construction Camp	Pre-Construction	One Time
2.	Identification of disposal locations for constructional & other wastes from SWD project	Pre-Construction	One Time
3.	Tree cutting	Pre-Construction	One Time
4.	Top Soil Preservations	Pre-Construction	One Time
5.	EMP Implementation Report	Construction	Monthly
6.	Rehabilitation of Borrow area/ quarry area, if opened	Construction	Monthly
7.	Pollution Monitoring	Construction	Quarterly- Except during spells of precipitation.
8	Cleaning and Restoration on Demobilization	On completion of construction of storm water drainage subproject	One Time

The contractor will take all reasonable steps to protect the environment on & off the project site and to avoid, minimize and mitigate impacts due to the storm water drainage work activities creating pollution to environment and other causes as a consequence of methods of operations.

9.9. Formats For Reporting

Formats for reporting/monitoring, the progress/parameters achieved will be finalized by PIU/ TAQAC in consultation with the successful bidder.

9.10. Environmental Compliance Report

The contractor shall submit a monthly progress report as per the reporting format approved by the PIU on the status of the implementation of the EMP. Environmental Compliance report will systematically contain copy of regulatory permissions/consents/clearance, geo-referenced photographs with date and time for EMP/mitigation measures implementation, environmental monitoring report, accidents report, etc.

9.11. Grievance Redressal Mechanism

The contractor will maintain register to document any verbal or written compliant received regarding storm water drainage works in Bonpora-Padshahibagh area and labour camp. The contractor will make necessary efforts to resolve such complaints. Any complaint, which

cannot be resolved at the contractor level, shall be forwarded to PIU/PMU for amicable redressal of grievance in time bound manner.

Annexure-I: Environment and Social Screening Data Sheets

Part A: General Information

1. Name of the sub-project	Construction of Storm Water Drainage Scheme in Bonpora Padshahi Bagh areas in Srinagar, J&K	
2. Type of proposed activity (tick the applicable option and provide details)		
• Road		-
• Bridge		-
• Fire Station		-
• Hospital/Health Facility		-
• Educational Institute		-
• Building for Livelihoods		-
• Flood Infrastructure Related	√	Storm Water Drainage/ 2 Pumping Stations
• Other Public Building		-.
• Any Other (Please Specify)		-
3. Location of the proposed sub-project		
• Name of the Region	Kashmir (J&K State)	
• Name of the District	Srinagar	
• Name of the Block	Amira Kadal	

• Name of the Settlement	Nowgam Bonpora and Padshahi Bagh
• Latitude	$34^0$02'11"N (Bonpora [22]IPS), $34^0$03'13"N (Padshahi Bagh [23]MPS)
• Longitude	$74^0$49'25"E (Bonpora IPS), $74^0$49'46"E (Padshahi Bagh MPS)
4a. Proposed Nature of Work (tick the applicable options)	
• Minor Repairs	-
• Major Repairs/Rehabilitation	-
• Upgrading/Major Improvement	-
• Expansion of the facility	-
• New Construction	√ Storm Water Drainage/ 2 Pumping Stations
• Any Other	-
4b. Size of the sub-project (approx. area in sq. mt/hac or length in mtr./km, as relevant)	Total Length of Drainage Network: 12.08 Km
5. Land Requirement (in hac./sq.mt.)	
• Total Requirement	520 m^2 (MPS) + 475 m^2 (IPS) = 995 m^2
• Private Land	995 m^2
• Govt. Land	No
• Forest Land	No
6. Implementing Agency Details (sub-project level)	
• Name of the Department/ Agency	Jhelum Tawi Flood Recovery Project (PMU)

[22] Intermediate Pumping Station
[23] Major Pumping Station

• Name of the contact person	Mushtaq Ahmad Shah
• Designation	Assistant Project Manager
• Contact Number	+91-9419478025
• E-mail Id	pmukashmir@gmail.com; mushtaqshah786@gmail.com
7. Screening Exercise Details	
• Date on which it was carried out	3rd February 2019 and 6th May 2019
• Name of the Person	Akhter R. Bhat
• Contact Number	+91-9419552221; 7006543364
• E-mail Id	akhter_b@hotmail.com; akhter.bhat3@gmail.com.

Part B (1): Environment Screening

Question	Yes	No	Details
1. Is the sub-project located in whole or part within 1 km of the following environmentally sensitive areas?			
a. Biosphere Reserve		No	-
b. National Park		No	-
c. Wildlife/Bird Sanctuary		No	-
d. Wildlife/Bird Reserve		No	-
e. Important Bird Areas (IBAs)		No	-
f. Habitat of migratory birds (outside protected areas)		No	-

g. Breeding/Foraging/Migratory route of Wild Animals (outside protected areas)		No	-
h. Area with threatened/rare/ endangered flora (outside protected areas)		No	-
i. Reserved/Protected Forest		No	-
j. Another category of Forest		No	-
k. Wetland		No	
l. Natural Lakes		No	
m. Rivers/Streams	Yes		River Jhelum is approximately 180 meters away from the proposed pumping station at Padshahi Bagh. A Padshahibagh nallah is also flowing at 20 meters away from the proposed pumping station which is a disposal point of proposed storm water drainage scheme.
n. Swamps/Mudflats		No	-
o. Zoological Park		No	-
p. Botanical Garden		No	
2. **Is the sub-project located in whole or part within 500 mts. of any of the following sensitive features?**			
a. World Heritage Sites		No	-
b. Archaeological monuments/ sites (under ASI's central/state list)		No	-

c. Historic Places/Monuments/ Buildings/Other Assets (not listed under ASI list but considered locally important or carry a sentimental value)		No	
d. Religious Places (regionally or locally important)		No	
e. Reservoirs/Dams		No	-
f. Canals	Yes		Flood spill channel of river Jhelum is flowing >75 meters away from the subproject tail end near Padshahi Bagh.
g. Public Water Supply Areas from Rivers/Surface Water Bodies/ Ground Water Sources		No	-
3. What is the High Flood Level in the sub-project area?	3-5 m		
4. Is any scheduled/protected tree-like Chinar, Mulberry or Deodar likely to be affected/ cut due to the project?	Yes		1 Mulberry tree of girth size 1.8 ft is to be cut for construction of MPS
5. Is the sub-project located in a landslide/heavy erosion-prone area or affected by such a problem?		No	
6. Is sub-project located in an area that faces water paucity or water quality issues?		No	

Part B (2): Result/Outcome of Environmental Screening Exercise

1.	Environment Impact Assessment Required	No
2.	Environment Clearance Required	No

3.	Forest land Clearance/Diversion Required	No
4.	Tree Cutting Permission Required	Yes (For 1 Mulberry Tree at MPS)
5.	ASI (Centre/State) Permission Required	No
6.	Permission from ULB/Local Body/Department Required	Yes • Permission for Construction of Drainage and Dewatering Station will be required from Srinagar Municipal Corporation (SMC). • Consent to Establish/ Operate 2 Pumping Stations from SPCB
7.	Any other clearance/permission required	Yes For construction/ operation of the site and procurement of aggregate material from crusher units/ quarry sites/ borrow areas/ construction vehicles involved following consents/ permission are required; ▪ Consent to Establish (CTE) and Consent to Operate (CTO) from SPCB for the crusher units. ▪ Consent to establish/ operate Pumping station / DG Sets from the SPCB. ▪ PUC's and other fitness certificates of equipment's etc. are required on site. ▪ Construction material will be procured only from permitted sites and licensed /authorized quarries/ borrow sites approved by the Geology & Mining Department for which contractors have to produce royalty receipts.

Part C (1): Social Screening

1. Does the sub-project activity require acquisition of land?

Yes		No	√
Give the following details:	Private Land (sq mts/hac.)		-
	Govt. Land (sq mts/hac.)		-
	Forest Land (sq mts/hac.)		-
	Other Land (sq mts/hac.)		995 m^2 (Shamilat Deh Land)
2. Does the proposed sub-project activity result in demolition/removal of existing structures?			
Yes		No	√
If so, give the following details:			
• Number of public structures/buildings		-	
• Number of common property resources (such as religious/cultural/ drinking water/wells/etc.)		-	
• Number of private structures (located on private or public land)		-	
3. Does the proposed project activity result in loss of crops/trees?			
Yes	√ (5 Willow/poplar & 1 Mulberry Tree)	No	
4. Does the proposed Project activity result in loss of direct livelihood/ employment?			
Yes		No	√
5. Does the proposed activity result in loss of community forest/pastures on which nearby residents/local population are dependent?			
Yes		No	√
If yes, give the details of the extent of the area to be lost (in acres/hac).		-	
6. Does the proposed Project activity affect scheduled tribe/caste communities?			

Yes		No	√

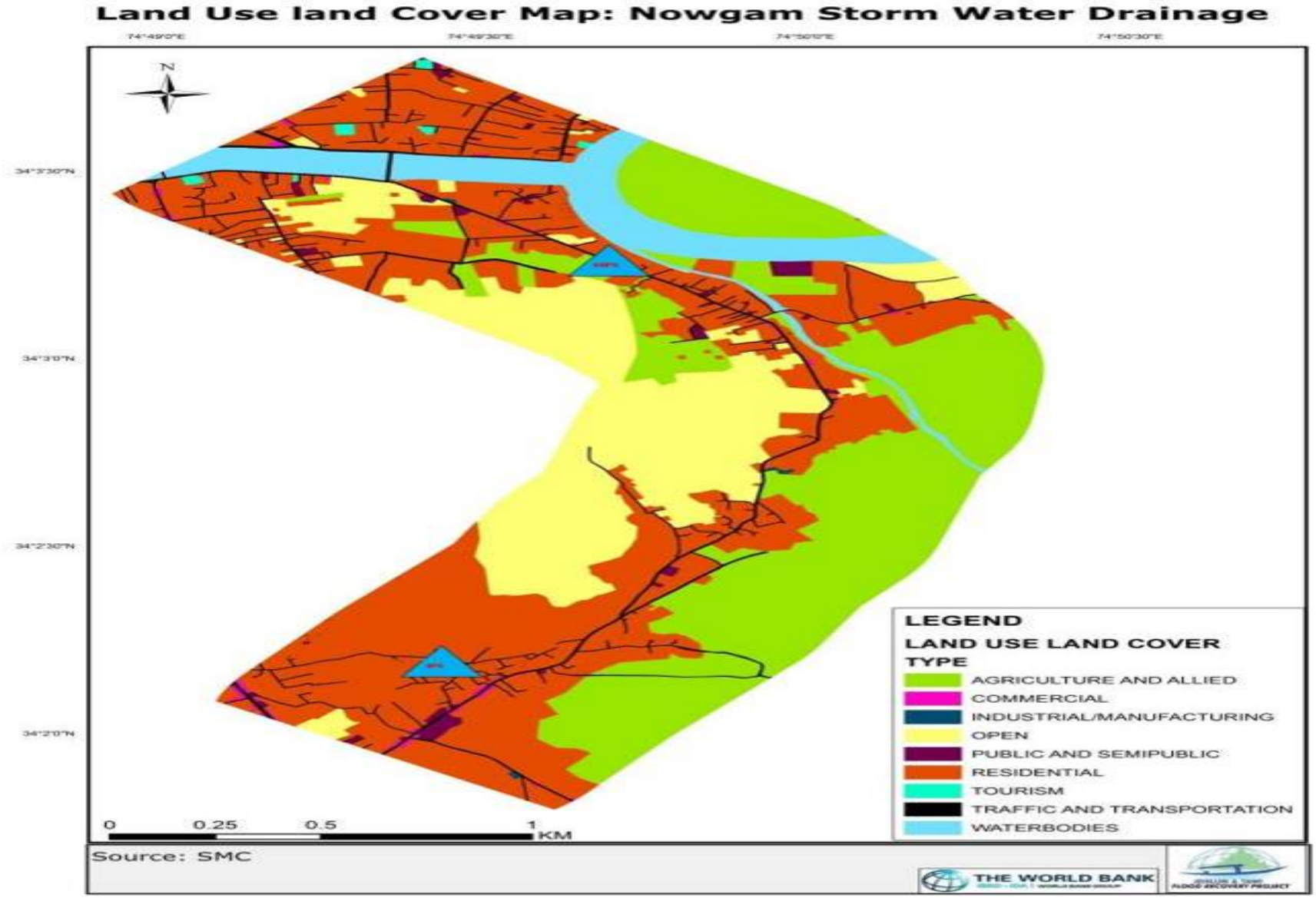
Part C (2): Result/Outcome of Social Screening Exercise

S. No.	Result/Outcome	Outcome
1.	Answer to all the questions is 'No' and only forest land is being acquired	No SIA/RAP required
2.	Answer to any question is 'Yes' and the sub-project does not affect more than 200 people (i.e. either complete or partial loss of assets and/or livelihood)	No ARAP is required
3.	Answer to any question is 'Yes' and the sub-project affects more than 200 people *(i.e. either complete or partial loss of assets and/or livelihood)*	No SIA/RAP Required

Outcome:

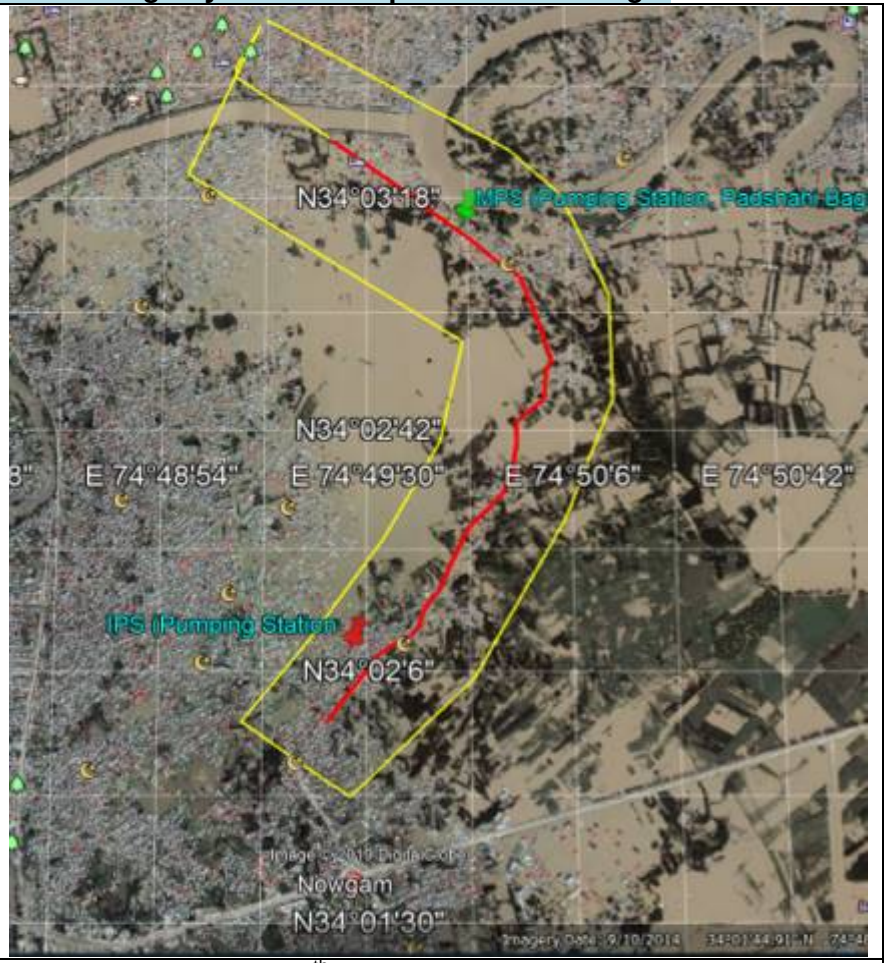
The subproject does not required detailed Social Study as no land acquisition or structure removal is involved, however preparation of Environment & Social Management Plan is required.

ANNEXURE-II: GIS Map of Proposed Storm Water Drainage in Bonpora-Padshahibagh Area in Srinagar City



ANNEXURE-III: Google Map of the proposed subproject site of Storm Water Drainage System in Bonpora-Padshahibagh.

Google Earth Imagery (dated: 10th April 2019), showing SWD with MPS/IPS locations and Landuse/ Land Pattern features.



Google Flood Imagery (10th September 2014) showing proposed subproject of SWD Nowgam-Padshahi Bagh areas completely inundated during floods.

Source: Google Earth Map

ANNEXURE-IV: Photographs showing Existing Condition of Nowgam Bonpora/ Padshahi Bagh Area of Proposed Subproject.

During transect walk with the community heads and the affected residents to address the sad picture of persistent submergence/ waterlogging and health hazard due to the lack of basic amenity of SWD Drainage system.






Submergence/ waterlogging of houses, lawns, roads is common scene during site visit. It was a difficult scene to explain or express in words, the amount of misery residents are facing daily especially school going children, old and sick and living with the contaminated environment.

Site photos of Padshahi Bagh showing waterlogging and water supply pipelines passing through stagnant water

Major Pumping Station (MPS) site with geo-coordinates $34^0$03'13" N (Lat) $74^0$49'46" E (Long) at Padshahi Bagh

Intermediate Pumping Station (IPS) with geo-coordinates $34^0$02'11" N (Lat) $74^0$49'25"E (Long) at Bonpora.

Existing waterlogging issues in the Padshahi Bagh area. Chinar tree/ mosque at Ch 2+500

ANNEXURE-V: Public Consultation/ Meeting Photographs of Bonpora-Padshahi Bagh Area of Proposed Storm Water Drainage Scheme

Involvement of woman folk during in-house consultation held in Bonpora, Advent Colony, Ahmadabad Colony, Padshahi Bagh areas. Their grievances were recorded pertaining to daily suffering due to the lack of drainage system in these areas.






During Public Consultation with the residents of the Bonpora, Advent Colony, Ahmadabad Colony, Padshahi bagh areas, etc. The response of people was appreciable in the assembling of people and was very concerned about the lack of drainage system resulting in frequent submergence and health hazards especially for the children and old and sick people.






At Padshahi Bagh and Bonpora areas and all other photos of consultation shows the positive response of local residents (both gender) in assembling of huge number of people which shows their concern present suffering of persistent waterlogging/ submergence/odor problems due to the lack of essential drainage system.

ANNEXURE VI: Guidelines For Siting, Management And Redevelopment of Labour Camp

A. Overview

Labour camp include accommodation for workers/labourers along with other basic amenities such as kitchen, potable water supply, sanitation (toilets, bathrooms, washing areas and water supply for such needs), first aid room as well as garbage collection and disposal facility. The guidelines outlined here aims to facilitate the contractor in implementing the measures in the EMP there by reducing the impact on the environment.

B. Criteria for Locating the Site

To the extent possible, fertile lands shall be avoided for locating camp site.

C. Finalization of Selected Site

After identification of the site, the Contractor should fill up the prescribed reporting format provided in EMP as annexure and submit the same for approval to the Environmental Expert of PIU. The selected site shall be approved by Environmental Expert of PIU, after considering the compliance. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the Environmental Expert of PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be restored at his own cost. After obtaining a written approval from the Environmental Expert of PIU for the selected site, the Contractor has to enter into an agreement with the landowner to obtain his/her consent before commencing any operation/activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.

D. Designing And Setting Up of Labour Camp

The following facilities should be provided in a labour camp to ensure safe, clean and hygienic accommodation for the workers.

(i) **Site preparation**: The site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. Fencing should be constructed all around the camp to prevent the trespassing of humans and animals. The approved layout plan should be strictly adhered to while setting up the camp.

(ii) **Accommodation**: Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. The height of the worker's and labour accommodation shall not be less than 3m from floor level to the lowest part of the roof. The camp shall be floored with concrete, shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of one sqm per head or as per the relevant regulation, whichever is higher. Fire and electrical safety pre-cautions shall be adhered to. Cooking, sanitation and washing areas shall be provided separately. The contractor will maintain necessary living accommodation and ancillary facilities (including provision of clean fuel to prevent damage to forests and to prevent fuel wood cutting and burning by labour) in functional and hygienic manner. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals.

(iii) **Drinking Water**: The Contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. All potable water storage facilities will be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary, water purifier unit shall be installed for providing potable water.

(iv) **Sanitation Facilities**: Adequate nos. of toilets shall be provided separately for males and females (depending on their strength), with markings for identification in vernacular language. All such facilities must have adequate water supply with proper drainage and disposal facility. They shall be maintained, cleaned and disinfected daily using proper disinfectants. Location and design of soak pit should be in such a way that it doesn't pollute the ground water. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Portable toilets may be brought to use at construction site and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. In the main camp, no night soil or sewerage shall be disposed of at any place other than the septic tanks constructed at the site. All these facilities shall be inspected on a weekly basis to check the hygiene standards.

(v) **Waste Disposal**: The Contractor should provide garbage bins in the camp and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. Separate bins shall be provided for biodegradable and non-biodegradable wastes. The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.

(vi) **Day Crèche Facility**: At construction site, provision of a day crèche shall be made so as to enable women to leave behind their children while going to work. At least one attendant shall be provided to take care of the children at the crèche. At construction site where 20 or more women are employed, there shall be at least one shelter for use of children under the age of 6 years belonging to such women.

Shelters shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Such areas shall be safely barricaded (no sharp sheets or barbed wires that may injure a child) from rest of the camp for the safety of children. Shelters shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision to keep the place clean. The size of a crèche may vary according to the number of children on a camp site.

(vii) **Mess and Kitchen Facilities**: The Contractor shall adhere to the sanitary/hygiene requirements of local medical, health and municipal authorities at all times. Adoption of such precautions as may be necessary to prevent soil and water pollution at the site while operating mess or kitchen facilities.

(viii) First Aid Facilities: At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and fire fighting equipments as detailed out in EMP should be made available in the camp and provided to the staff / workers.

(ix) Health Care Facilities: Health problems of the workers should be taken care of by providing basic health care facilities. If there is no hospital or clinic, which can be accessed in half an hour's time, then a temporary health center should be set up for the construction camp. The health centre should have at least a doctor and a nurse, duty staff, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should carryout quarterly awareness programme of HIV – AIDS with the help of AIDS control society as well as about community living and hygiene practices in day to day living. Posters should be exhibited in the health care clinic.

E. Operation of Labour Camp

Throughout the functioning period of the camp, hygienic environment must be ensured by (i) provision of safe drinking water, (ii) proper maintenance of toilets including daily cleaning and disinfection using proper disinfectants, (iii) regular cleaning of drains by removing the silt and solid waste, (if any) and (iv) appropriate waste management practices. While it is of utmost importance to ensure that fire-fighting equipments like fire extinguishers are in working condition, it should also be monitored that construction workers use the personal protective equipments provided to them and they are replaced when necessary. All these facilities should be inspected on a weekly basis to achieve the desired levels of safety and hygiene standards.

F. Preparation of Labour Camp Management And Re-development Plan

After the site for the labour camp has been finalized and approved by Environmental Expert of PIU, the Contractor should prepare a labour camp management and redevelopment plan to be submitted to PIU for approval prior to setting up of the camp and it should comprise the following details:

Section–1: Details of site: Copy of approved site identification report along with location plan, showing the site, its survey no., access road, project stretch, distance form the project stretch, surrounding features and land use like residences, water bodies etc., photograph of the site showing the topography and other existing features.

Section-2: Site preparation: Activities that should be undertaken for preparing the site based on EMP and this guideline.

Section-3: Arrangements/ facilities within the camp: List of facilities to be provided along with its details like area, no of people to be accommodated and a layout plan showing the plan of the site with all the facilities planned like quarters, labour camp, mess, common facilities, toilet facilities, etc.

Section-4: Mitigation measures that should be undertaken as per the EMP and this guideline while setting up of the camp and operation of the camp should be separately listed out here.

Sectoin-5: Other details: Any other relevant detail like list of awareness camp to be provided to workers, details of information dissemination etc. should be included.

Section 6: Re-development plan, which should indicate following points: (i) List of structures to be demolished and list of the clean-up activities that needs to be undertaken, (ii) Proposed use of the land in the post construction stage, if it is a public property, (iii) Presence of existing facilities that could be put in use by the land owner if it is a leased out private land or by the community in case of a public property.

Section-7: Annexure-(a) Working drawings: Electrical plan showing the electrical network planned for the site, location of generators, master switch boards etc. and plumbing drawing showing the network of water supply lines, water tank, drainage facilities etc. (b) Copy of permissions obtained from local governing body / community etc. as applicable, (c) Copy of agreement entered with site owner, in case of leased out site.

All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The labour camp management plan should be submitted to the Environmental Expert of PIU for a written approval before any physical work is undertaken on a particular site. The Environmental Expert of PIU will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the Contractor who shall incorporate it in the management plan. Contractor shall be responsible for satisfactory and timely implementation of these EMP requirements.

G. Re-development of The Labour Camp

The Contractor should clear all temporary structures; dispose all building debris, garbage, night soils and any other waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and the Environmental Expert of PIU.

These activities should be completed by the Contractor prior to demobilization. Once the Contractor finishes his job, he needs to obtain a certificate from the owner, stating that the site has been re-developed to his/her satisfaction and in tune with the agreement. Then following documents needs to be submitted to the Environmental Expert of PIU by the

- Copy of approved site identification report
- Photographs of the concerned site 'before' and 'after' setting up the camp.
- Certificate from the owner stating his/her satisfaction about status of re-development of the site.

Environmental Expert of PIU shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the 'works completion' certificate is issued/recommended. The PIU shall ensure through site inspection that the Contractor. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be. Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor.

ANNEXURE-VII: Guidelines to Ensure Worker's Safety During Construction

In order to ensure worker's safety while undertaking various operations/stages of construction many safety measures needs to be followed, which are listed down below:

A. Pumping Stations and Labour Camp

- Install perimeter fencing.
- Ensure good visibility and safe access at site entrances.
- Provide adequate warning signs at the entrance and exit, as necessary.
- Provide adequate space/area for loading and unloading, storage of materials, equipment and machineries.
- Display emergency procedure and statutory notices at conspicuous locations.
- Provide areas for collecting garbage and other waste material, and also arrange for their regular/periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities.
- Provide defined access roads and movement areas within the site.
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers. Provide and enforce use of PPE at pumping stations.

B. House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water.
- Keep all walkways and circulation areas clear and unobstructed at all times.
- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these are immediately collected.
- Use metal bins for collection of oily and greasy rags.
- Do not leave tools on the floor or in any location where they can be easily dislodged.
- Keep windows and light fittings clean.
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions.
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people.
- Store all flammable materials like HSD in appropriate container with proper cover and labels – as required for various products.
- Display 'no smoking' signs in areas with high risks of fire, (*eg.* near fuelling areas, diesel/oils/lubricant/paint storage area, hessians, rubber, wood and plastic etc.) in and around working area.

C. Safety During Excavation

- During excavation of foundations, necessary safety measures will be taken by the contractor.
- Excavation of 1.5 meters deep or greater require a sides protection unless the excavation is made entirely in stable rock
- Safe access and egress will be require including ladders, steps, ramps, or other safe means of exit of workers in excavated depth of 4 feet (1.22 meters) or deeper
- Excavated earth will be collected and disposed in pre-identified site with the approval of PIU.
- To ensure elimination of excavation hazards, excavation will be carried in the presence of competent person.
- Suitable barricading will be provided

D. Handling of Cement Bags

- Cement bags will be stored and emptied in covered area to control fugitive dust emissions.
- While handling and empting cement bags, workers will wear mask and goggle and hand gloves.
- Manual transferring of cement bags from one place to another place will not be allowed. For this purpose, trolley will be used.

E. Steel Bars Reinforcement for Foundation and Roof

- Manual cutting of steel bars for reinforcement will be discouraged
- Only skilled workers will be deployed by the contractor for steel bar bending and rebaring reinforced structures.
- Correct hand and power tools will be used to tie and cut steel bars.
- Workers engaged in steel bar bending and reinforcement will be provided helmet, suitably strong and flexible leather gloves and safety shoes.
- Workers will take extra caution and attention when walking on steel bar mattes and areas that contain exposed steel bar.
- First aid facilities will be provided at the site to provide first aid incase of cuts or injuries to workers. After providing first aid, injured worker will be taken to hospital for further treatment.

F. Operation of Trucks And Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Enlist help of another worker before reversing the vehicle.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.

- Carryout periodic servicing as per the manufacturer's requirements. All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

G. Manual Handling and Lifting

- Avoid manual handling of heavy materials.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control/supervise/guide movement of equipments and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects.
- Loading and unloading from vehicles shall be under strict supervision.

H. Electrical Hazards

- Statutory warning leaflets/posters are to be distributed/displayed by the Contractor in the vicinity of work site for the benefit of all workers, officers and supervisors as well as the public, indicating the do's and don'ts and warning related to electrical hazards associated with operations to be executed/in progress.
- All wires shall be treated as live wires.
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
- Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines.
- Inform technical person/s for required maintenance.
- Never use damaged wires for electrical connection.

I. Use And Storage of Flammable Gas

- Store filled gas/LPG cylinder in a secure area – mark this as a no smoking area.
- Transport, store, use and secure cylinders in upright position.
- Ensure proper ventilation at the ground level in locations where LPG is in use.
- Avoid physical damage to the cylinders.

- Never weld near the cylinder.
- Store empty cylinders secured and upright.
- Make sure that the cylinder is closed immediately after use.
- Investigate immediately if there is the smell of LPG or gas.
- Never use destenched gas/LPG on site.
- Make sure that there is no other unrelated fire in the vicinity of the cylinder.

J. Gas Welding

The welders and welding unit should follow all the basic principles of welding for safety and security:

- Use face shield to protect the eyes.
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots/gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.
- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glair moving outside it.
- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case Acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas connection lines up to the welder should be sufficiently insulated and protected from sharp edges and sharp objects. These shall not come into contact with hot metal.
- Do not use gas cylinders for supporting work or as rollers.
- While using LPG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedures have to be followed for safety and security of men and materials.

K. Fire Safety Practices

- Store flammable material in proper areas having adequate fire protection systems.

- Display sufficient warning signs.
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.
- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Display escape route maps prominently on each side.
- Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically.

L. Noise Hazards And its Control

- Plan camp lay-out in a manner that ensures barriers/buffers between residential/ office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors/ear plugs to prevent excess noise affecting the workmen.
- Reduce noise at source by: use of improved equipments; regular and proper maintenance of the machinery as per the manufacturer's manual; by replacing rickety and noisy equipments and machineries. Screening locations with noise absorbing material; making changes in the process/equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipments with fasteners.
- Appoint a competent person to: carryout a detailed noise assessment of the site; designate ear protection zone/s; give training/instructions on the necessary precautionary measures to be observed by site personnel including using suitable type of ear protection equipments.

M. Personal Protective Equipment

General

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.
- The Contractor's Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipments are in good condition.

- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean.
- PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.

Head Protection

- Hard hats are compulsory for all workers, supervisors and managers/officials while working and/or inspecting a work site.
- Hard hat areas shall be demarcated clearly.

Hearing Protection

- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently. Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive. Use earmuffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.

Respiratory (Protective) Equipment

- Wear suitable mask for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, etc.
- Provide training to all persons using the masks/respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use.
- Store respirators properly when not in use.

Safety Footwear

- Wear suitable footwear for work
- Use safety footwear on site or in other dangerous areas.
- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.

- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
- Keep shoelace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding, bending steel bars, cutting and manual handling of materials and equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

N. First Aid

- Provide first aid boxes at every work site in a cool and shaded place.
- Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.
- Display the list of persons along with their contact numbers who are trained on providing first aid.
- Ensure that every first aid box is marked "First Aid" in English and in local language.
- Check for expiry dates and replace the contents, as necessary.
- Maintain a register on health records including injuries/accidents.

O. Reporting of Accident and Investigations

- Any accident at the site will be reported.
- Carryout the investigation as quickly as possible.
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one/limited source of evidence.
- Check all the log books, stock registers, issue registers, movement registers on site
- After completion of the investigation/enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipments and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

ANNEXURE-VIII: Reporting Format for the Camp Site

A	Project Details			
1.	Name of project		Date of reporting	
2.	Name and address of the Contractor			
3.	Contract date and duration			
B	**Site Details**			
1.	Place Name		Landmark	
2.	Area of site		Current land use	
3.	Ownership of the land	Owned / leased	Survey no.	
4.	If leased / rented, name, address and contact details of owner			
5.	Distance from SWD/ Pumping Station			
6.	Distance from Water Body, Forest (if any)			
7.	Distance from the Populated Area			
8.	No of trees with girth> 0.3m on the site			
9.	No of trees to be cut			
10.	Is top soil conservation required (Yes/ No)			
List of enclosures:	(a) Location map			
	(b) Layout plan			
	(c) Photographs of the site			
	(d) List of machinery, equipments and vehicles to be used			
	(e) List of schools and hospitals with in 200 m distance from the boundary of the camp			
C. Submission Details	Submitted by (Environment & Safety Officer of Contractor)		**Approved / Rejected by (Environmental Officer of PIU)**	
Signature & date				
Name				
Designation				
Remarks by Environmental Expert of PIU				

* All distances are to be measured from the boundary of the site.
Note: Contractor has to fill and submit this format to the Environmental Expert of PIU upon identification of labour camp site. Subsequently, the Environmental Expert of PIU has to visit the site and approve / reject the site with reasons. The Environmental Expert of PIU has to give a copy of this format to the contractor after his approval / rejection with remarks. On approval of a site, the Contractor has to prepare the Management and Redevelopment Plan for this site as per the Guidelines given in EMP and submit to Environmental Expert of PIU for approval.

SWD: Storm Water Drainage

ANNEXURE-IX: Format For Register of Complaints (Grievance) and it's Reporting

A	Project Details	Information		
1.	Name of project			
2.	Name and address of the Contractor			
3.	Contract date and duration			
B	Details of Complaint Received		Site Name	
Sl. No.	Date of Complaint	Name and address of person with contact details	Complaint	Action taken with date **Signature of ESO of Contractor**
1				
2				
3				

A register in this format shall be maintained at each site office of the contractor. This same format shall be used to compile and report the details of complaints received at all site to the Environmental Expert of PIU along with the Monthly Report of the Contractor. The Environmental Expert of PIU has to give instruction to the Contractor, if any further action has to be taken on any complaint.

ANNEXURE -X: Checklist For Monitoring of Labour Camp Management

A	**Project Details**		**Date of Monitoring:**	
1.	Name of project.			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Name of Labour Camp			
B	Monitoring Details			
Sl. No.	**Environmental Management Measures**	**Environmental Expert's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	Remarks
1.	Whether the camp are floored with concrete?			
2.	Are all the first aid facilities provided in the camp?			
3.	Whether the camp is located in such a way that there are no residences, public institutions or biosensitive area with in a radius of 500 m from the camp?			
4.	Whether the vehicle movement in and out of the camp is in a controlled manner?			
5.	Whether LPG for cooking is provided?			
6.	Whether safe drinking water is provided?			
7.	Whether all the drains and channels are covered?			
8.	Whether a green belt is provided along the periphery of camp?			
9.	Whether day care centres are provided with in the camp?			
10.	Whether sanitation facilities are provided separately for male and female?			
11.	Whether separate garbage bins are provided to collect the garbage?			
12.	Whether septic tanks with soak pits are provided?			
13.	Whether the location of soak pit is in such a away that it does not pollute the ground water?			
14.	Whether a qualified safety officer is appointed for ensuring safety?			

15.	Whether proper fencing of the camp is done?			
16.	Whether the workers are well aware of cleanliness, hygiene, community livings, AIDS etc.?			
17.	Whether all applicable clearances are obtained and valid till date?			

Signature of Environment and Safety Officer (ESO) of the Contractor with date **Signature of Environmental Expert of PIU with date**

Note: The Environmental Expert of PIU has to use this format to monitor the implementation of Environmental Management Measures for each Labour Camp Quarterly. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESO of the Contractor. Environmental Expert of PIU has to attach this format to the Quarterly Report, with details of corrective action taken by the Contractor**.**

ANNEXURE-XI: Check List For Monitoring of Redevelopment of Labour Camp Site

A	**Project Details**	**Date of Monitoring:**		
1.	Name of project			
2.	Name and address of the Contractor			
3.	Contract date and duration			
4.	Name of Labour Camp			
B	**Monitoring Details**			
Sl. No.	**Environmental Management Measures**	**Environmental Expert's observation (Yes / No / Not Applicable)**	**Corrective Actions Proposed**	Remarks
1.	Are all the temporary structures cleared as per the list in the redevelopment plan?			
2.	Are all building debris, garbage, night soils and POL waste disposed off safely?			
3.	Are all disposal pits or trenches filled, disinfected and effectively sealed off?			
4.	Are the facilities that could be put to re-use maintained well?			
5.	Are all the spills within the camp site effectively disposed off from the site?			
6.	All the area within the camp site is leveled and spread over with stored top soil.			
7.	Has the residual top soil been utilized effectively?			
8.	Has the entire camp area been made clean and tidy without disturbing the adjacent lands?			
9.	Are the 'before' and 'after' scenarios of the site documented through photographs and submitted to PIU?			
10.	Are the conditions mentioned by the owner in the agreement adhered to?			
11	If not, mention the details of the conditions that are not adhered to and further steps to be taken.			
12.	Can 'works completion' certificate be issued to this			

	site?			

Signature of Environment and Safety Officer (ESO) of the Contractor with date

Signature of Environmental Expert of PIU with date

Note: The Environmental Expert of PIU has to use this format to monitor the implementation of Environmental Management Measures for the redevelopment of each Labour Camp Site as and when it is closed. Corrective actions with specific timeframe should be proposed for each Environmental Management Measure, which is not implemented satisfactorily. A copy of the filled up format should be given to the ESO of the Contractor. Environmental Expert of PIU has to attach this format to the Quarterly Report, with details of corrective action taken by the Contractor.

ANNEXURE-XII: Reporting Format for Occupational Health And Safety Measures

A	Project Details	Date of Reporting:	
1.	Name of project.		
2.	Name and address of the Contractor		
3.	Contract date and duration		
B	Implementation Status of Health and Safety Measures		
Sl. No.	**Health and Safety Measures**	**Implementation Status (Yes / No)**	**Remarks**
1	Appointment of qualified Environment and Safety Officer		
2	Approval for Construction Safety Management Plan by the Environmental Expert of PIU.		
3	Provision for flags and warning lights for potential hazards		
4	Provision of adequate staging, form work and access (ladders with handrail) for works at a height of more than 3.0 m		
5	Provision of adequate shoring / bracing / barricading / lighting for all deep excavations of more than 3.0 m depth.		
6	Provision for sufficient lighting especially for night time work		
7	Construction Workers safety – Provision of personnel protective equipment's		
	A. Helmets		
	B. Safety Shoe		
	C. Gumboot		
	D. Dust masks		
	E. Hand Gloves		
	F. Safety Belts		
	G. Reflective Jackets		
	H. Earplugs for labour		
8	Workers engaged in welding work shall be provided with welder protective shields		
9	All vehicles are provided with reverse horns.		
10	All scaffolds, ladders and other safety devices shall be maintained in as safe and sound condition		
11	Regular health checkup for labour/ Contractor's personnel		

12	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camp.		
13	Provision for insurance coverage to the workers		
C.	Submission Details		

	Submitted by (Environment & Safety Officer of Contractor)	Approved by (Environmental Officer of PIU)
Signature & date		
Name		
Designation		

Remarks by Environmental Expert of PIU

Note: Contractor has to fill and submit this format to the Environmental Expert of PIU along with the Monthly Report. The Environmental Expert of PIU has to visit the site and verify the details. Further mitigation measures, if required, can be suggested by the Environmental Expert of PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE-XIII: Format For Register of Accidents and It's Reporting

A	Project Details	Date of Reporting:
1.	Name of project	
2.	Name and address of the Contractor	
3.	Contract date and duration	
B	**Details of Accident and People Involved in Accident**	
	Name of site where accident happened	
	Name and address of people involved in the accident	
	Whether Contractor's personnel or General public	
	Details of Injury	
	Details of treatment given	
	Details of compensation given	

C	**Type of Accident (√)**			
	Fall of person from a height			**Explosion**
	Slip, trip or fall on same level			**Fire**
	Struck against fixed objects			**Contact with hot or corrosive substance**
	Struck by flying or falling objects			**Contact with poisonous gas or toxic substances.**
	Struck by moving objects			**Contact with poisonous gas or toxic substances**
	Struck / caught by cable			**Hand tool accident**
	Stepping on hail etc.			**Vehicle / Mobile plant accident**
	Handling without machinery			**Machinery operation accident**
	Crushing / burying			**Other (please specify)**
	Drowning or asphyxiation			
D	**Agent Involved in Accident (√)**			
	Machinery			**Stair edge**
	Portable power appliance			**Excavation**
	Vehicle or associated equipment /machinery			**Ladder**
	Material being handled, used or stored			**Scaffolding**
	Gas, vapor, dust, fume or oxygen			**Construction formwork, shuttering and false work.**
	Hand tools			**Electricity supply cable, wiring switchboard and associated equipment**
	Floor edge			**Nail or chipping**
	Floor opening			**Other (Please specify)**
	Left shaft			
E	**Unsafe Action Relevant to the Accident (√)**			
	Operating without authority			**Failure to use proper footwear**
	Failure to secure objects			**Failure to use eye protector**
	Making safety devices inoperative			**Failure to use respirator**
	Working on moving or dangerous equipment			**Failure to use proper clothing**

	Using un-safety equipment			**Failure to use warn others or given proper signals**
	Adopting unsafe position or posture			**Horseplay**
	Operating or working at unsafe speed			**No unsafe action**
	Unsafe loading, Placing, mixing et			**Others (please specify)**
	Failure to use helmet			
F	**Lack of Safety Measures Relevant to the Accident (√)**			
	No protective gear			**Unsafe layout of job, etc.**
	Defective protective gear			**Unsafe process of job methods**
	Improper dress / footwear			**Poor housekeeping**
	Improper guarding			**Lack of warning system**
	Improper ventilation			**Defective tool, machinery or materials**
	Improper illumination			**No unsafe condition**
	Improper procedure			**Others (please specify)**
G	**Personal Factor Relevant to the Accident (√)**			
	Incorrect attitude /motive			**No unsafe personal factor.**
	Unsafe act by another person			**Other (please specify)**
H	**Details of Corrective and Preventive action taken**			
1				
2				
3				
4				
I	**Submission Details**			

	Submitted by (Environment & Safety Officer of Contractor)	**Approved by (Environmental Officer of PIU)**
Signature & date		
Name		
Designation		
Remarks by Environmental Expert of PIU		

Note: Contractor has to fill this format as and when an accident happens and submit to the PIU along with the Monthly Report. The Environmental Expert of PIU has to visit the site and verify the details. Additional safety measures, if required, can be suggested by the PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE-XIV: Reporting Format For Environmental Pollution Monitoring

A	Project Details			Date of Reporting:		
1.	Name of project					
2.	Name and address of the Contractor					
3.	Contract date and duration					
B	**Environmental Monitoring Details**					
Sl. No	**Details of Monitoring Location**	**Period of Monitoring**	**Details of values exceeding the relevant standards**	**Reasons for pollution**	**Details of Corrective actions taken**	Remarks
a.	**Ambient Air Monitoring**					
1.						
2.						
b.	**Water Monitoring**					
1.						
2.						
c.	**Noise Monitoring***					
1.						
2.						
C	**Submission Details**					

	Submitted by (Environment & Safety Officer of Contractor)	Approved by (Environmental Officer of PIU)
Signature & date		
Name		
Designation		
Remarks by PIU		

* Noise monitoring at the site will be done by the *PIU*, using the Noise Meter. The PIU has to give the monitoring results to the Contractor for corrective actions, if any, required and including in this report.
Note: The Contractor has to conduct Environmental Monitoring through a NABL approved Laboratory as per the Environmental Monitoring Plan given in the EMP, fill this format and submit to the PIU along with the Monthly Report, if monitoring was due in that month. A copy of the monitoring report given by the Laboratory has to be attached to this format. The PIU has to visit the site and verify the details. Additional mitigation measures, if required, can be suggested by the PIU. The Environmental Expert of PIU has to give back a copy of this format to the contractor after his approval with remarks.

ANNEXURE XV: Showing distribution of drainage areas in Bonpora-Padshahibagh in Srinagar

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
1	3	C-1	0.41	4136.00	0.41	0.07	0.03	0.02	0.12
2	3	C-2	0.07	718.00	0.07	0.01	0.01	0.00	0.02
3	5	C-3	0.01	56.00	0.49	0.09	0.03	0.02	0.15
4	5	C-4	0.95	9527.00	0.95	0.17	0.07	0.05	0.29
5	6	C-5	0.09	853.00	1.53	0.28	0.11	0.08	0.46
6	8	C-6	0.11	1051.00	1.63	0.29	0.11	0.08	0.49
7	8	C-7	1.28	12805.00	1.28	0.23	0.09	0.06	0.38
8	11	C-8	0.03	296.00	2.94	0.53	0.21	0.15	0.88
9	10	C-9	0.69	6894.00	0.69	0.12	0.05	0.03	0.21
10	11	C-10	0.18	1804.00	0.87	0.16	0.06	0.04	0.26
11	15	C-11	0.78	7756.00	4.59	0.83	0.32	0.23	1.38
12	13	C-12	0.69	6894.00	0.69	0.12	0.05	0.03	0.21
13	14	C-13	0.79	7857.00	1.48	0.27	0.10	0.07	0.44
14	15	C-14	0.27	2670.00	1.74	0.31	0.12	0.09	0.52
15	17	C-15	0.16	1597.00	6.49	1.17	0.45	0.32	1.95
16	17	C-16	0.28	2787.00	0.28	0.05	0.02	0.01	0.08
17	19	C-17	0.08	759.00	6.85	1.23	0.48	0.34	2.05
18	19	C-18	0.58	5826.00	0.58	0.10	0.04	0.03	0.17
19	22	C-19	0.29	2935.00	7.72	1.39	0.54	0.39	2.32
20	21	C-20	0.18	1823.00	0.18	0.03	0.01	0.01	0.05
21	22	C-21	0.32	3188.00	0.50	0.09	0.04	0.03	0.15
22	46	C-22	0.65	6543.00	8.88	1.60	0.62	0.44	2.66
23	27	C-23	0.39	3928.00	0.39	0.07	0.03	0.02	0.12
24	25	C-24	0.13	1313.00	0.13	0.02	0.01	0.01	0.04
25	26	C-25	0.50	4967.00	0.63	0.11	0.04	0.03	0.19
26	27	C-26	0.43	4288.00	1.06	0.19	0.07	0.05	0.32

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
27	35	C-27	0.01	122.00	1.46	0.26	0.10	0.07	0.44
28	30	C-28	0.28	2786.00	0.28	0.05	0.02	0.01	0.08
29	30	C-29	0.42	4245.00	0.42	0.08	0.03	0.02	0.13
30	32	C-30	0.38	3769.00	1.08	0.19	0.08	0.05	0.32
31	32	C-31	0.14	1362.00	0.14	0.02	0.01	0.01	0.04
32	34	C-32	0.00	16.00	1.22	0.22	0.09	0.06	0.37
33	34	C-33	0.19	1919.00	0.19	0.03	0.01	0.01	0.06
34	35	C-34	0.06	598.00	1.47	0.26	0.10	0.07	0.44
35	38	C-35	0.04	437.00	2.98	0.54	0.21	0.15	0.89
36	37	C-36	0.05	525.00	0.05	0.01	0.00	0.00	0.02
37	38	C-37	0.05	525.00	0.11	0.02	0.01	0.01	0.03
38	46	C-38	0.18	1790.00	3.26	0.59	0.23	0.16	0.98
39	41	C-39	0.11	1062.00	0.11	0.02	0.01	0.01	0.03
40	41	C-40	0.16	1613.00	0.16	0.03	0.01	0.01	0.05
41	43	C-41	1.02	10187.00	1.29	0.23	0.09	0.06	0.39
43	44	C-42	0.23	2286.00	1.51	0.27	0.11	0.08	0.45
44	45	C-43	0.51	5061.00	2.02	0.36	0.14	0.10	0.61
45	46	C-44	1.01	10126.00	3.03	0.55	0.21	0.15	0.91
46	50		0.00	0.00	15.17	2.73	1.06	0.76	4.55
47	48	C-45	0.30	2989.00	0.30	0.05	0.02	0.01	0.09
48	49	C-46	0.13	1269.00	0.43	0.08	0.03	0.02	0.13
49	50	C-47	0.51	5149.00	0.94	0.17	0.07	0.05	0.28
50	IPS-1		1.01	10126.00	17.12	3.08	1.20	0.86	5.14
IPS-1	59		0.00	0.00	17.12				
51	52	C-48	0.51	5077.00	0.51	0.09	0.04	0.03	0.15
52	53	C-49	0.58	5786.00	1.09	0.20	0.08	0.05	0.33
53	54	C-50	0.64	6406.00	1.73	0.31	0.12	0.09	0.52
54	55	C-51	0.61	6128.00	2.34	0.42	0.16	0.12	0.70

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
55A	55	C-52	0.20	1967.00	0.20	0.04	0.01	0.01	0.06
55	56	C-53	0.56	5650.00	3.10	0.56	0.22	0.16	0.93
56	57	C-54	0.41	4063.00	3.51	0.63	0.25	0.18	1.05
57	58	C-55	0.07	746.00	3.58	0.64	0.25	0.18	1.07
58	59	C-56	0.11	1138.00	3.70	0.67	0.26	0.18	1.11
59	60	C-57	0.34	3416.00	21.16	3.81	1.48	1.06	6.35
60	61	C-58	0.25	2502.00	21.41	3.85	1.50	1.07	6.42
61	62	C-59	0.57	5664.00	21.98	3.96	1.54	1.10	6.59
62	63	C-60	0.49	4927.00	22.47	4.04	1.57	1.12	6.74
63	64	C-61	0.43	4329.00	22.90	4.12	1.60	1.15	6.87
64	65	C-62	0.60	6031.00	23.51	4.23	1.65	1.18	7.05
65	66	C-63	0.66	6622.00	24.17	4.35	1.69	1.21	7.25
66	67	C-64	0.25	2488.00	24.42	4.40	1.71	1.22	7.33
67	68	C-65	0.21	2062.00	24.62	4.43	1.72	1.23	7.39
68	69	C-66	0.48	4776.00	25.10	4.52	1.76	1.26	7.53
69	70	C-67	0.80	7962.00	25.90	4.66	1.81	1.29	7.77
70	71	C-68	0.63	6269.00	26.52	4.77	1.86	1.33	7.96
71A	71	A - 1	0.19	1910.00	0.19	0.03	0.01	0.01	0.06
71	72	C-69	0.53	5282.00	27.24	4.90	1.91	1.36	8.17
72	73	C-70	0.60	6036.00	27.85	5.01	1.95	1.39	8.35
73	74	C-71	0.44	4422.00	28.29	5.09	1.98	1.41	8.49
74	75	C-72	0.62	6244.00	28.91	5.20	2.02	1.45	8.67
75A	75	A - 2	0.56	5566.00	0.56	0.10	0.04	0.03	0.17
75	76	C-73	0.50	4965.00	29.97	5.39	2.10	1.50	8.99
76	77	C-74	0.11	1148.00	30.08	5.41	2.11	1.50	9.02
77A	77	A - 3	0.17	1737.00	0.17	0.03	0.01	0.01	0.05
77	78	C-75	0.22	2185.00	30.47	5.49	2.13	1.52	9.14
78	79	C-76	0.17	1660.00	30.64	5.52	2.14	1.53	9.19

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
79A	79	A - 4	0.83	8323.00	0.83	0.15	0.06	0.04	0.25
79	80	C-77	0.01	60.00	31.48	5.67	2.20	1.57	9.44
223A	223	A - 5	4.05	40535.00	4.05	0.73	0.28	0.20	1.22
223	226	C-78A	2.52	25175.00	6.57	1.18	0.46	0.33	1.97
224	226	C-78B	1.88	18828.00	1.88	0.34	0.13	0.09	0.56
225	226	C-78C	0.29	2912.00	0.29	0.05	0.02	0.01	0.09
226	80	C-78D	1.30	13005.00	10.05	1.81	0.70	0.50	3.01
80	81	C-78	0.28	2811.00	41.80	7.52	2.93	2.09	12.54
81A	81	A - 6	1.06	10579.00	1.06	0.19	0.07	0.05	0.32
81	82	C-79	0.41	4145.00	43.28	7.79	3.03	2.16	12.98
82A	82	A - 7	0.93	9273.00	0.93	0.17	0.06	0.05	0.28
82	83	C-80	0.36	3555.00	44.56	8.02	3.12	2.23	13.37
83A	83	A - 8	0.81	8136.00	0.81	0.15	0.06	0.04	0.24
83B	83	A - 14	3.07	30724.00	3.07	0.55	0.22	0.15	0.92
83	84	C-81	0.28	2757.00	48.72	8.77	3.41	2.44	14.62
84A	84	A - 9	3.03	30319.00	3.03	0.55	0.21	0.15	0.91
84	85	C-82	0.21	2059.00	51.96	9.35	3.64	2.60	15.59
85A	85	A - 10	3.03	30319.00	3.03	0.55	0.21	0.15	0.91
85B	85	A - 15	0.85	8494.00	0.85	0.15	0.06	0.04	0.25
85	86	C-83	0.16	1646.00	56.01	10.08	3.92	2.80	16.80
86A	86	A - 11	3.79	37919.00	3.79	0.68	0.27	0.19	1.14
86B	86	A - 16	1.03	10295.00	1.03	0.19	0.07	0.05	0.31
86	87	C-84	0.17	1735.00	61.00	10.98	4.27	3.05	18.30
87A	87	A - 12	1.51	15070.00	1.51	0.27	0.11	0.08	0.45
87	88	C-85	0.14	1422.00	62.65	11.28	4.39	3.13	18.79
88	89	C-86	0.27	2662.00	62.92	11.32	4.40	3.15	18.87
89A	89	A - 17	1.05	10507.00	1.05	0.19	0.07	0.05	0.32
89	90	C-87	0.57	5708.00	64.54	11.62	4.52	3.23	19.36

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
90	91	C-88	0.32	3157.00	64.85	11.67	4.54	3.24	19.46
91A	91	A - 13	1.27	12691.00	1.27	0.23	0.09	0.06	0.38
91	92	C-89	0.69	6876.00	66.81	12.03	4.68	3.34	20.04
92	93	C-89A	0.52	5191.00	67.33	12.12	4.71	3.37	20.20
93A	93	A - 18	3.28	32758.00	3.28	0.59	0.23	0.16	0.98
93	94	C-90	0.61	6117.00	71.22	12.82	4.99	3.56	21.36
94	95	C-91	0.30	3006.00	71.52	12.87	5.01	3.58	21.45
95	96	C-92	0.23	2329.00	71.75	12.91	5.02	3.59	21.52
96	97	C-93	0.42	4177.00	72.17	12.99	5.05	3.61	21.65
97	98	C-94	0.38	3838.00	72.55	13.06	5.08	3.63	21.77
98	99	C-95	0.44	4371.00	72.99	13.14	5.11	3.65	21.90
99	100	C-96	0.38	3769.00	73.36	13.21	5.14	3.67	22.01
100A	100	A - 19	3.37	33664.00	3.37	0.61	0.24	0.17	1.01
100	101	C-97	0.25	2529.00	76.98	13.86	5.39	3.85	23.10
101	104	C-98	0.13	1281.00	77.11	13.88	5.40	3.86	23.13
102	103	C-99	0.52	5186.00	0.52	0.09	0.04	0.03	0.16
103	104	C-100	0.12	1171.00	0.64	0.11	0.04	0.03	0.19
104	106	C-101	0.06	623.00	77.81	14.01	5.45	3.89	23.34
105	106	C-102	0.06	583.00	0.06	0.01	0.00	0.00	0.02
106	109	C-103	0.08	783.00	77.95	14.03	5.46	3.90	23.38
107	108	C-104	0.25	2505.00	0.25	0.05	0.02	0.01	0.08
108	109	C-105	0.09	936.00	0.34	0.06	0.02	0.02	0.10
109	111	C-106	0.03	256.00	78.32	14.10	5.48	3.92	23.49
110	111	C-107	0.32	3190.00	0.32	0.06	0.02	0.02	0.10
111	113	C-108	0.03	269.00	78.66	14.16	5.51	3.93	23.60
112	113	C-109	0.25	2540.00	0.25	0.05	0.02	0.01	0.08
113	125	C-110	0.14	1397.00	79.06	14.23	5.53	3.95	23.72
114	125	C-111	0.14	1409.00	0.14	0.03	0.01	0.01	0.04

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
115	117	C-112	1.07	10704.00	1.07	0.19	0.07	0.05	0.32
116	117	C-113	1.72	17185.00	1.72	0.31	0.12	0.09	0.52
117	119	C-114	0.18	1840.00	2.97	0.54	0.21	0.15	0.89
118	119	C-115	0.23	2341.00	0.23	0.04	0.02	0.01	0.07
119	121	C-116	0.09	898.00	3.30	0.59	0.23	0.16	0.99
120	121	C-117	0.13	1335.00	0.13	0.02	0.01	0.01	0.04
121	122	C-118	0.12	1202.00	3.55	0.64	0.25	0.18	1.07
122	123	C-119	0.08	842.00	3.63	0.65	0.25	0.18	1.09
123	124	C-120	0.06	566.00	3.69	0.66	0.26	0.18	1.11
124	125	C-121	0.26	2576.00	3.95	0.71	0.28	0.20	1.18
125	128	C-122	0.03	326.00	83.18	14.97	5.82	4.16	24.95
126	127	C-123	0.12	1223.00	0.12	0.02	0.01	0.01	0.04
127	128	C-124	0.15	1483.00	0.27	0.05	0.02	0.01	0.08
128	130	C-124A	0.02	245.00	83.47	15.03	5.84	4.17	25.04
129	130	C-124B	0.08	790.00	0.08	0.01	0.01	0.00	0.02
130	132	C-125	0.03	329.00	83.59	15.05	5.85	4.18	25.08
131	132	C-126	0.06	605.00	0.06	0.01	0.00	0.00	0.02
132	134	C-127	0.04	436.00	83.69	15.06	5.86	4.18	25.11
133	134	C-128	0.13	1330.00	0.13	0.02	0.01	0.01	0.04
134	135	C-129	0.15	1530.00	83.98	15.12	5.88	4.20	25.19
135	139	C-130	0.18	1832.00	84.16	15.15	5.89	4.21	25.25
136	138	C-131	0.33	3349.00	0.33	0.06	0.02	0.02	0.10
137	138	C-132	0.15	1472.00	0.15	0.03	0.01	0.01	0.04
138	139	C-133	0.06	606.00	0.54	0.10	0.04	0.03	0.16
139	140	C-134	0.28	2807.00	84.98	15.30	5.95	4.25	25.49
140	220	C-135	0.12	1208.00	85.10	15.32	5.96	4.26	25.53
141A	141	A - 20	2.48	24803.00	2.48	0.45	0.17	0.12	0.74
141	142	C-136	0.18	1810.00	2.66	0.48	0.19	0.13	0.80

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
142	144	C-137	0.04	426.00	2.70	0.49	0.19	0.14	0.81
143A	143	A - 21	2.29	22867.00	2.29	0.41	0.16	0.11	0.69
143	144	C-138	0.12	1213.00	2.41	0.43	0.17	0.12	0.72
144	220	C-139	0.05	491.00	5.16	0.93	0.36	0.26	1.55
145	146	C-140	0.14	1388.00	0.14	0.02	0.01	0.01	0.04
146	147	C-141	0.14	1422.00	0.28	0.05	0.02	0.01	0.08
147	148	C-142	0.14	1441.00	0.43	0.08	0.03	0.02	0.13
148	148A	C-143	0.23	2266.00	0.65	0.12	0.05	0.03	0.20
148A	152	C-144	0.35	3494.00	1.00	0.18	0.07	0.05	0.30
149	152	C-145	0.62	6153.00	0.62	0.11	0.04	0.03	0.18
150	151	C-146	0.56	5612.00	0.56	0.10	0.04	0.03	0.17
151	152	C-147	0.28	2846.00	0.85	0.15	0.06	0.04	0.25
152	153	C-148	0.26	2611.00	2.72	0.49	0.19	0.14	0.82
153	154	C-149	0.57	5714.00	3.29	0.59	0.23	0.16	0.99
154	155	C-150	0.72	7181.00	4.01	0.72	0.28	0.20	1.20
155	159	C-151	0.98	9840.00	5.00	0.90	0.35	0.25	1.50
156	158	C-152	0.27	2668.00	0.27	0.05	0.02	0.01	0.08
157	158	C-153	0.17	1699.00	0.17	0.03	0.01	0.01	0.05
158	159	C-154	0.21	2057.00	0.64	0.12	0.04	0.03	0.19
159	172	C-155	0.03	271.00	5.67	1.02	0.40	0.28	1.70
160	162	C-156	0.28	2775.00	0.28	0.05	0.02	0.01	0.08
161	162	C-157	0.27	2671.00	0.27	0.05	0.02	0.01	0.08
162	165	C-158	0.02	245.00	0.57	0.10	0.04	0.03	0.17
163	165	C-159	0.40	3963.00	0.40	0.07	0.03	0.02	0.12
164	165	C-160	0.29	2862.00	0.29	0.05	0.02	0.01	0.09
165	166	C-161	0.70	7028.00	1.95	0.35	0.14	0.10	0.59
166	171	C-162	0.70	7028.00	2.66	0.48	0.19	0.13	0.80
167	169	C-163	0.08	784.00	0.08	0.01	0.01	0.00	0.02

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
168	169	C-164	0.24	2437.00	0.24	0.04	0.02	0.01	0.07
169	171	C-165	0.31	3099.00	0.63	0.11	0.04	0.03	0.19
170	171	C-166	0.07	661.00	0.07	0.01	0.00	0.00	0.02
171	172	C-167	0.72	7197.00	4.07	0.73	0.29	0.20	1.22
172	173	C-168	0.34	3447.00	10.09	1.82	0.71	0.50	3.03
173	175	C-169	0.33	3289.00	10.41	1.87	0.73	0.52	3.12
174	175	C-170	0.54	5355.00	0.54	0.10	0.04	0.03	0.16
175	176	C-171	0.65	6522.00	11.60	2.09	0.81	0.58	3.48
176	177	C-172	0.40	3960.00	12.00	2.16	0.84	0.60	3.60
177	179	C-173	0.45	4522.00	12.45	2.24	0.87	0.62	3.74
178	179	C-174	0.10	1031.00	0.10	0.02	0.01	0.01	0.03
179	220	C-174A	0.03	277.00	12.58	2.26	0.88	0.63	3.77
180	182	C-175	0.63	6315.00	0.63	0.11	0.04	0.03	0.19
181	182	C-176	1.21	12148.00	1.21	0.22	0.09	0.06	0.36
182	184	C-177	0.10	1024.00	1.95	0.35	0.14	0.10	0.58
183	184	C-178	0.46	4551.00	0.46	0.08	0.03	0.02	0.14
184	186	C-179	0.15	1531.00	2.56	0.46	0.18	0.13	0.77
185	186	C-180	0.27	2659.00	0.27	0.05	0.02	0.01	0.08
186	188	C-181	0.09	946.00	2.92	0.53	0.20	0.15	0.88
187	188	C-182	0.39	3930.00	0.39	0.07	0.03	0.02	0.12
188	189	C-183	0.23	2256.00	3.54	0.64	0.25	0.18	1.06
189	191	C-184	0.28	2831.00	3.82	0.69	0.27	0.19	1.15
190	191	C-185	0.23	2348.00	0.23	0.04	0.02	0.01	0.07
191	193	C-186	0.39	3855.00	4.44	0.80	0.31	0.22	1.33
192	193	C-187	0.29	2928.00	0.29	0.05	0.02	0.01	0.09
193	195	C-188	0.20	1990.00	4.93	0.89	0.35	0.25	1.48
194	195	C-189	0.23	2297.00	0.23	0.04	0.02	0.01	0.07
195	198	C-190	0.24	2378.00	5.40	0.97	0.38	0.27	1.62

Name of the Drain section		Name of Catchment	Drainage Area (in Hect.)	Drainage Area (in Sqm.)	Cumulative Area (in Hect.)	Residential Area of Total area (A1) 40% with 45% Imperviousness (A1)	Commercial Area of Total area (A2) 10% with 70% Imperviousness (A2)	Parks and undeveloped area of total area (A3) 50% with 10% Imperviousness	Weighted Average Imperviousness Area of total Area (A1+A2+A3)
Head	Tail								
1	2	3	4	5	6	7	8	9	10
196	197	C-191	0.59	5902.00	0.59	0.11	0.04	0.03	0.18
197	198	C-192	0.30	3018.00	0.89	0.16	0.06	0.04	0.27
198	201	C-193	0.25	2467.00	6.54	1.18	0.46	0.33	1.96
199	200	C-194	0.23	2288.00	0.23	0.04	0.02	0.01	0.07
200	201	C-195	0.19	1873.00	0.42	0.07	0.03	0.02	0.12
201	212	C-196	0.08	820.00	7.04	1.27	0.49	0.35	2.11
202	212	C-197	0.59	5946.00	0.59	0.11	0.04	0.03	0.18
203	204	C-198	1.15	11483.00	1.15	0.21	0.08	0.06	0.34
204	206	C-199	0.16	1570.00	1.31	0.23	0.09	0.07	0.39
205	206	C-200	0.68	6806.00	0.68	0.12	0.05	0.03	0.20
206	207	C-201	0.15	1474.00	2.13	0.38	0.15	0.11	0.64
207	209	C-202	1.50	15022.00	3.64	0.65	0.25	0.18	1.09
208	209	C-203	0.10	1048.00	0.10	0.02	0.01	0.01	0.03
209	211	C-204	0.03	275.00	3.77	0.68	0.26	0.19	1.13
210	211	C-205	0.20	2030.00	0.20	0.04	0.01	0.01	0.06
211	212	C-206	0.23	2333.00	4.20	0.76	0.29	0.21	1.26
212	214	C-207	1.24	12364.00	13.07	2.35	0.91	0.65	3.92
213	214	C-208	0.51	5097.00	0.51	0.09	0.04	0.03	0.15
214	216	C-209	0.47	4658.00	14.05	2.53	0.98	0.70	4.21
215	216	C-210	0.34	3441.00	0.34	0.06	0.02	0.02	0.10
216	218	C-211	0.73	7260.00	15.12	2.72	1.06	0.76	4.53
217	218	C-212	0.21	2090.00	0.21	0.04	0.01	0.01	0.06
218A	218	A-22	1.91	19093.00	1.91	0.34	0.13	0.10	0.57
218	219	C-213	0.60	5981.00	17.83	3.21	1.25	0.89	5.35
219	220	C-214	0.15	1483.00	17.98	3.24	1.26	0.90	5.39
220	221		0.00	0.00	120.83	21.75	8.46	6.04	36.25
221	222	C-215	0.05	536.00	120.88	21.76	8.46	6.04	36.26
222	MPS		0.00	0.00	120.88	21.76	8.46	6.04	36.26