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Final Report - Updated Environment Management Framework

Environment & Social Assessment Studies for
PRWSS II Program

January 2015
(Revised)

State Programme Management Cell

Mott MacDonald

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Executive Summary

The Government of Punjab (GoP) has prioritized RWSS as a key area of its development agenda. Over the past few years, significant capital allocations to the RWSS sector (about US $ 50 to $ 55 million annually or 2.5% of the total outlay) have been made, which indicates the high priority accorded to the sector. Government of India too supports the RWSS sector reforms and provides significant financial assistance to Punjab through its centrally sponsored programs such as NRDWP, TSC and NBA now SBM (Swachh Bharat Mission). More than 83% of the villages currently receive a basic service level of 40 lpcd water through public water schemes. Another 15% villages have piped water supply schemes but with service level less than 40 lpcd and the remaining 1-2% villages do not have access to any public water system. Water quality in about 35% of villages is affected by fluoride, salinity, iron, heavy metals, pesticides or uranium. About 75% households have latrines and 90% of the household members use it on regular basis. Drainage facility is available in 95% habitations. Sewerage systems are also being implemented in 98 villages on pilot basis. Despite these efforts, several issues related to Water supply and Sanitation are on hand to be tackled.

Earlier DWSS (Department of Water Supply & Sanitation) was providing new schemes with limited or no participation of the end users in decision making or service management. Thus, those institutional, operational and financing arrangements presented constraints and challenges in achieving service improvements or ensuring long term sustainability. With high O&M costs and low O&M cost recovery from the users, the water supply systems were becoming unsustainable. As a result, in the year 2006, GoP thought of taking a step ahead under good governance initiatives to involve the community in capital cost sharing, planning, construction and operation & maintenance of the RWSS infrastructure. Since the sector needed significant improvements in the quality of rural water and sanitation service delivery requiring both additional investments and reforms, the RWSS program was taken up with the support of World Bank by adopting Sector Wide Approach (SWAp).

Now, GoP intends to scale up and consolidate the gains of the first project and progressively raise the water supply and community sanitation service standards and also raise the coverage of high standards by seeking The World Bank assistance for the PRWSS II project with estimated cost of INR 2200 crores. The PRWSS II Program will be implemented in the rural areas of all the 22 districts of Punjab State. Selection of villages in the project will be made by adopting a self- selection process, a pre-requisite of demand-responsive development. In this background, GoP intends to undertake Environmental and Social Assessment Studies for PRWSS II project.

Key Objectives of Environmental Assessment

To conduct Environmental Analysis (EA) with a view to identify the critical environmental concerns in the RWSS sector and address them as an integral part of project design.

The following specific objectives would contribute to the above stated key objective:

- Identify and assess the environmental issues related to the water supply, sanitation and sewerage, surface and ground water pollution etc.
- To assess existing status of environment in the state and identify threats and issues

- Identification of environmental issues associated with implementation of individual RWSS schemes and developing environmental codes of practices that need to be followed during various stages of the prospective project.
- Identifying generic environmental issues which are beyond the scope if individual RWSS schemes, but related to the sector and recommend remedial measures to address the issues as part of the project,
- Updation of Environmental Management Framework including environmental management, monitoring plans, and environmental codes of practices to adequately address the issues and enhancement of the positive environmental impacts of various tasks and activities under the proposed project.
- Environmental Management Framework including well-defined performance indicators for addressing the identified issues, and strategy for implementation of various activities / tasks under the proposed project to achieve sustainable sources for water supply and environmental sanitation benefits

M/s. Mott MacDonald Pvt. Ltd. has been assigned the Environmental Assessment (EA) study, with a mandate to identify the critical environmental concerns in the RWSS sector related to single village and multi village schemes involving water treatment plants, sanitation facilities and sewerage schemes including sewage treatment plants and to put forth a mechanism to address these issues, by preparing Updated Environmental Management Framework (EMF).

The proposed 2nd RWSS project is to provide good water quality and better sanitation facilities in the rural areas of 22 districts of the Punjab. For the identified environmental impacts for the project, environmental monitoring and supervision will be undertaken based on the key environmental issues associated with such type of work.

The assignment will provide the client with clear understanding of the prevailing and expected environmental issues and their probable causes, which have to be considered while preparing and implementing the RWSS schemes. Environmental Codes of Practices will be prepared, which need to be followed during various stages such as planning, design, construction and operation and maintenance of the proposed RWSS schemes.

The Updated Environmental Management Framework (EMF) will provide the client, with well-defined performance indicators for addressing the identified issues, through various activities/task under the proposed project, and strategy for its implementation to achieve sustainable sources for water supply and sanitation benefits within the proposed project districts.

Existing EMFs

A Sector Environment Assessment (SEA) including preparation of Environmental Management Framework (EMF) was carried out by Feedback Venture Group in 2006 for the proposed water supply schemes to be executed under PRWSSP. Key environmental issues identified during the study are Water Availability, Water quality (Canal water and Ground water), and Environmental Sanitation.

Subsequently, in 2010, M/s. Consulting Engineers Services (India) Private Limited (CES) were appointed as consultant by the SPMC to assist in implementation of PRWSS project and to prepare an updated EMF in light of the proposed sewerage schemes. The main objective of that study was to update the key environmental issues, key elements of the EMF, development of ECoPs, Environmental screening, monitoring and evaluation and development of responsibility matrix.

Need for Updating the current Environmental Management Framework

Sector Environment Assessment (SEA) for PRWSS project was prepared by Feedback Turnkey Engineers in September 2006. The main focus of the report was water supply schemes. In 2010, Consulting Engineers Services updated the 1st EMF in the light of sewerage schemes. The present study includes updation of existing EMF on environmental issues in the context of PRWSS Project- II, including environmental sanitation and rain water harvesting techniques and its integration with water supply and sewerage schemes, proposed Institutional Arrangements, water quality monitoring, water and waste water sampling procedure, environmental concerns and management proposals, capacity building etc. In line with state policy, demand responsive approach, active involvement and participation of PRIs and beneficiary communities through all stages of the project implementation and its sustained operation and maintenance will be the key features of this EMF.

In view of the limited awareness among the community/planners/engineers on environmental management issues; there is a need to devise an EMF for the environmental sustainable development of water supply schemes and sewerage schemes with proper disposal of solid and liquid waste. This EMF will be a ready reference for GPWSC and engineers/planners to carry out environmental screening of the project interventions, impact evaluation, and adopting the mitigation measures in the design stage itself. This will further help to reduce the intensity of impacts at planning stage as well as during implementation and post implementation phase of the project.

Policy, Legal and AdministrativeFramework

The State has Rural Water Supply and Sanitation Policy (2014) in line with the national policy on water and sanitation, which emphasizes participation by the PRIs. It lays emphasis on integration of water supply and sewerage system and environmental sanitation including personal hygiene with emphasis on institutional capacity building. The State Water Policy accords high priority for providing sustainable options for drinking water and sanitation schemes underscoring the need for regular programme of monitoring and for protection of water sources.

The proposed project will address all the issues of concern as laid down in the OP 4.01 of World Bank on EA/EMF. Though there are no specific clearances required from the Ministry of Environment, GOI, all the provisions in the various Central and State Acts listed in the Chapter 2 relevant in the context of the proposed project would be incorporated during the implementation of the project.

World Bank Safeguard Policies

The below table describes the relevant safe guard policies of the World Bank and discusses their applicability to the project.

Policy	Applicability to this project
OP/BP 4.01 Environmental Assessment	**Applicable to this project.** The EMF includes a detailed description of assessment procedures for each of the activities proposed under the project.
OP/BP 4.04 Natural Habitats	Not applicable, Since schemes to be taken up under the project would not convert or degrade natural habitats.
OP 4.09 – Pest Management	Not applicable.No activity will support use of pesticides or related activity, hence policy is not triggered.
OP 4.10 / BP 4.10 – Indigenous Peoples	Not applicable to the project**.** • No indigenous people in Punjab.
OP/BP 4.36 Forestry	Applicable to the project. • Some of the schemes taken up under the Project will be located in forest areas. Assessment procedures and mitigation measures have been put into place through the EMP in accordance with the approval of the Forest Department and guidelines for compensatory afforestation. • The most important natural habitats in Punjab are in Urban areas, not in rural areas. The statehas a history of intensive agriculture for hundreds of years, and most landscapes were severely modified. There are areas which could be termed as sacred groves, but these are also areas that are not populated, and rural water supply do not come anywhere near any of these. • The forest patches which exists in the state are legal forests, although not rich in bio-diversity – but necessitates recognition of the legal forest issues and rights. • The project will –in order of priority – first try to make the current sources and supplies more efficient; then might tap some additional ground water, and as the last resort try to tap some water from the irrigation canals (where water is fully allocated already) or seepage. The project does not intent to drain any river (even if the rivers could be termed as natural habitats).
OP/BP 7.50 – Projects on International Waterways	Applicable. The proposed project falls within the exception to the riparian notification requirement under Paragraph 7(a) of OP/BP 7.50.
BP 17.5 – Disclosure of Information	Applicable; • Whenever the Bank requires an Environmental Assessment

Policy	Applicability to this project
	(EA), the proposed borrower prepares an EA report as a separate, free-standing document. The EA report is publicly available after the borrower has made the draft EA report available at a public place accessible to project affected groups and local NGOs in accordance with OP/BP 4.01.

Basis of Exception to OP 7.50:

Exception to Riparian Notification

As indicated at the outset, rural water supply, drainage and sanitation activities will be carried out in the watersheds of the Sutlej, Ravi and Beas rivers, or their tributaries, which are part of the Indus basin. With regard to ground water sources, this project will not finance any new bore wells as the state has achieved 100% water supply coverage already. All the villages in Punjab have water supply schemes. The project will result in a net reduction in 'ground water extraction' for drinking water in rural Punjab.

The project will finance activities aimed at improved efficiency and service delivery as described in the three components, including through the replacement of existing groundwater schemes with surface water supply. As shown in the table below, the state of Punjab already has an existing scheme of canals and distributaries for surface water with a total stretch of approximately 14,500 km.

Sr. No.	Name of the Canal	Length of Canal (Km)	Capacity of Canal Cusecs	Off-taking Point	Cultivable Area in Ha.
1	Sirhind Canal		12,620	Ropar Headwork	13.59 Lacs
2	Bhakra Main Line (Extension of Nangal Hydel Channel)	164	12,500	Nangal Barrage D/s of Bhakra Dam	
3	Narwana Branch	98	4500	Off-takes from Bhakra Main Line	
4	Bist Doab Canal	805	1452	Right bank of Sutlej river U/S of Ropar Headwork	1.99 Lacs
5	Upper Bari Doab Canal	3119	9000	Madhopur Head-works	5.73 Lacs
6	Rajasthan Feeder (Exclusively for Rajasthan)	149.53	18500	Harike Head-works	
7	Ferozepur Feeder	51.30	11192	Harike Head-works	

Sr. No.	Name of the Canal	Length of Canal (Km)	Capacity of Canal Cusecs	Off-taking Point	Cultivable Area in Ha.
8	Sirhind Feeder	136.50	5264	Off-takes from Ferozepur feeder	3.6 Lacs
9	Eastern Canal	8.02	3197	Hussainiwala Head-works	2.16 Lacs
10	Makhu Canal	92.8	292	Harike Head-works	20,600
11	Shah Nehar Canal	24.23	875	D/s of Pong Dam	0.33

According to Indus Treaty (1960), all the waters of eastern rivers are for the unrestricted use of India and all the waters of western rivers are for the unrestricted use of Pakistan and the discharges in the rivers shall be regularly monitored by both the countries. For the supply of drinking water from surface water source based schemes, a feasibility study is being done and under this study, only eastern rivers with their extensive canal network, which are meant for the use of India, are only considered. The proposed project takes up the schemes formulated based on the surface water sources, i.e., the eastern rivers allocated for the use of India and the canals originating from the dams on these rivers (i.e., the Sutlej, the Beas and the Ravi) only. There will not be any interference with the waters in western rivers allocated for the use of Pakistan.

On the basis of a feasibility study that was conducted in six districts by the Drinking Water Supply and Sanitation Department of Government of Punjab, 20 schemes have been formulated covering 4005 villages. These will be supplied with drinking water from surface sources primarily, the Pong dam on the Beas River as well as a number of Headworks and dams on the Sutlej River. In total, an ultimate water demand of 956.54 MLD is expected for the 4005 villages. This requirement of water works out to be approximately 0.45% of the identified surface water sources (rivers and canals), which is quite marginal and does not affect the current water requirement for irrigation or the downstream flows of the rivers. The Proposed project will consider some of the schemes conceived in the feasibility study on priority basis as per the need.

Taking into account the project's focus on improved efficiency and service delivery for already existing water supply and sanitation schemes in Punjab, it is the Team's assessment that the proposed activities will (i) not adversely change the quality or quantity of water flows to the other riparians, and (ii) will not be adversely affected by the other riparians' possible water use. Thus, the exception to the riparian notification requirement under paragraph 7(a) of OP 7.50 applies and no notification will be required.

Environmental Analysis

This covers the overview of the physical geography of the state, with special emphasis on water resources and sanitation amenities. This environmental baseline has been developed mainly on the basis of data collected through secondary sources, and has been supplemented by village level surveys of

6representative sample villages. The physical, land use pattern, agriculture status, water resources environment are presented in the Chapter 3 for the study area along with issues pertaining to the existing conditions on water supply, sanitation, health and hygiene.

This section covers:

- Physical Environment (Location, Temperature, Precipitation)
- Drainage pattern (River system and Canals)
- Hydrology (Surface water, Ground water, Wetlands)
- Disasters (Floods, Droughts, Earthquake)
- Demographic status
- Land-use pattern and Land degradation
- Forests

Baseline Environmental Status

Water Supply

Surface Water

- Punjab, the name derived from the Persian words, Punj (five) and ab (water) is a land of five rivers which formed part of Indus basin till 1947. After partition of the country, India's right of usage was restricted to only three Eastern rivers namely Satluj, Ravi and Beas.
- The main canals from Satluj are Anandpur Hydel Channel and Bhakhra Main Line (BML). BML further bifurcates into Narwana Branch and Bhakhra main branch.
- At Ropar Head-works two main canals, Sirhind canal and Bist Doab canal originate.
- At Harike Head-works, Satluj feeds water to Rajasthan feeder canal and Ferozepur feeder canal.
- The Bikaner canal originates at Hussainiwala Head works.
- Shah Nehar canal or Mukerian Hydel channel originates from Shah Nehar Barrage on Beas river.
- From Ravi river, at Madhopur Head works, Upper Bari Doab canal off-takes.
- The total stretch of canals and distributaries including minors in Punjab is approximately 14,500 km.

Ground Water

- The annual Replenishable Ground Water Resource of the State has been estimated as 22.53 bcm and Net Annual Ground Water Availability is 20.32 bcm. The Annual Ground Water Draft is 34.88 bcm and stage of Ground Water Development (percentage of abstraction over availability) is 172%.
- Based on assessment, out of 138 blocks (Total 142 blocks of which 4 blocks status is not available), 110 blocks have been categorized as 'Over-Exploited, 4 as 'Critical', 2 as 'Semi-Critical, and 22 as 'Safe'.
- The district wise stage of ground water development (i.e. Ratio of Annual Ground Water Draft and Net Annual Ground Water Availability) varies from 69% in Sri Muktsar Sahib to 283% in Sangrur.

Surface Water Quality

- In India, the Central Pollution Control Board (CPCB) has developed a concept of designated best use. According to this, out of the several uses of water of a particular body, the use which demands highest quality is termed as designated best use.
- Surface Water Quality of Beas River when it enters Punjab state at Talwara is fairly good and starts deteriorating near Mukerian as it receives effluents and sewage from town. Also, further downstream, water quality remains same due to discharge of industrial effluents and sewage from Goindwal town and industrial complex.
- Surface Water Quality of Satluj River is being monitored by Punjab Pollution Control Board (PPCB) for various physio-chemical parameters. Water quality of river at various sampling locations indicates that its quality with respect to BoD and Total Coliform starts deteriorating once it reaches Budha Nallah.
- With regard to Surface Water Quality of Ravi River, only one sampling point on the upstream side of Madhopur Head-works in Gurdaspur district is available and results of the analysis confirm water quality as Class A (Drinking Water source without conventional treatment but after disinfection) as per designated best use classification of CPCB.
- Surface Water Quality of river Ghaggar River over its entire stretch is of D category. The BOD values are very high at Chhatbir and remain very high through-out till its tail end at Sardulgarh.

Table 1.1: Primary Water Quality Criteria for Designated Best Use - Classes

Designated Best Use	Class	Criteria
Drinking Water source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100 ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20° C, 2 mg/l or less
Outdoor Bathing (Organized)	B	• Total Coliforms Organism MPN/100 ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20° C, 3 mg/l or less
Drinking Water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100 ml shall be 5000 or less • pH between 6 and 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20° C, 3 mg/l or less
Propagation of Wild Life and Fisheries	D	• pH between 6.5 and 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia

Designated Best Use	Class	Criteria
		• Biochemical Oxygen Demand 5 days 20° C, 2 mg/l or less
Irrigation, Industrial Cooling, Control Waste Disposal	E	• pH between 6.5 and 8.5 • Electrical Conductivity at 25 C micro mhos/cm, maximum 2250 • Sodium Absorption Ratio, Maximum 26 • Boron, Max. 2 mg/l
	Below E	• Not meeting any of the A,B,C,D & E

Source: Central Pollution Control Board (CPCB)

Ground Water Quality

Based on Ministry of Drinking Water and Sanitation website as on 01/04/2014, summary of assessment is as given below:

- Iron – Amritsar, Ferozepur, Rupnagar, Gurdaspur & Hoshiarpur are worst affected.
- Fluoride – Patiala, Fatehgarh Sahib and Sangrur are mostly affected.
- Arsenic – Gurdaspur having major problem with Arsenic contamination
- Uranium –Ferozepur, Barnala and Moga are the worst affected districts.
- Nitrate – Ferozepur, Hoshiarpur, Fatehgarh Sahib and Jalandhar are the severely affected districts.
- Aluminium – Rupnagar, Pathankot, Hoshiarpur, Moga and Patiala are having major problems with Aluminium contamination.
- Lead – Patiala, Jalandhar and Ludhiana are affected.
- Selenium – Jalandhar, Ludhiana and Kapurthala are worst affected

Current Water Supply and Treatment Practices

- The existing rural water supply schemes essentially have three sources – tube well, canal and hand pumps.
- Out of total schemes of 9,302; 6,807 are tube well source based; 1,659 schemes are with India Mark II hand pumps and only 836 schemes are with canal based source.
- In tube well source based schemes, A chlorination unit/Silver Ionization plant is connected to the pumping main for disinfection of water. After chlorination, water is pumped to the overhead tank and subsequently supplied to the users through distribution network.
- In canal based schemes, water treatment is provided by filtration units followed by disinfection through chlorination and finally to the clear water sump, which is then pumped to overhead tank and subsequently to the distribution network by gravity flow.

Incidence of Water and Sanitation Related Diseases

- As per the assessment of Health Department done for the years 2008 to 2013, Jalandhar and Patiala were found to be the worst affected districts with 1,58,437 and 88,918 acute diarrhoea cases respectively.
- Jalandhar, Ludhiana and Gurdaspur were the districts having 31,477, 21,621 and 20,472 enteric fever cases respectively in last six years.
- Ludhiana, Sangrur and Moga are the worst affected districts with 1,577, 902 and 890 Hepatitis A & E cases respectively.

Sanitation Status

Toilet construction

- Moga and Ludhiana are the districts where more than 90% households are having IHHLs, whereas in Bathinda, Faridkot, Jalandhar, Patiala and Sangrur it is more than 80%.
- Amritsar is the only district where only 50% households are having IHHLs.
- As far as coverage of BPL households is concerned, special attention to be given in Amritsar, Nawansher, Kapurthala and Tarn Taran districts where less than 50% households are having IHHLs.
- In terms of APL households, IEC activities have to be taken up on regular basis in Amritsar, Barnala, Ferozepur, Hoshiarpur, Nawansher and Tarn Taran districts in view of less coverage of the section in the range of 60% to 70% households compared to other districts.
- Action to be taken to construct school toilets in the districts of Gurdaspur & SAS Nagar.
- To construct Anganwadis toilets in the districts of Amritsar, Ferozepur, Ludhiana & Sangrur.
- To construct Sanitary Complex in the districts of Barnala, Ludhiana, Mansa and Sri Muktsar Sahib.

Sewerage Schemes

According to Department of Water Supply and Sanitation and status as on November 2014, there are currently 97 sewerage schemes in 18 districts of Punjab State for which either work is in progress or they are commissioned.

Out of 97 schemes, 82 schemes are already commissioned and for remaining 15 schemes work is in progress. As far as sewer connections are concerned, people are still apprehensive in taking the connections, which observed to be the caseof involvement of cost of connection and lack of awareness.

Waste Management

- Effective solid and liquid waste management is the key to create a clean environment. Effective management of SLWM includes management of bio-degradable and non-biodegradable waste, management of all grey water generated in the village and general cleanliness of the village.
- So far, only 87 Solid and Liquid waste management programmes have been implemented across all the districts of Punjab state, with none being reported in Amritsar, Fatehgarh Sahib, Gurdaspur, Jalandhar, Kapurthala, Nawansher, Rupnagar, SAS Nagar & Tarn Taran.

Field Survey & Study

Six (6) villages were selected from the geographically spread 6 representative districts (SAS Nagar, Sangrur, Sri Muktsar Sahib, Moga, Amritsar & Hoshiarpur) for field visits. Based on the field visit observations, discussions with local officials and community and secondary data collected, the Environmental Assessment and Updated Environmental Management Framework for the project area is prepared.

As per the village level survey and discussions with villagers and Sarpanch the following are the key issues related to water supply and sanitation.

Major Findings

Water Supply Key Issues:

- Since the supply of canal water is not available all 365 days a year, required storage is to be maintained to provide regular water supply during canal closure period. Due to high turbidity in canal water, slow sand filters get clogged up frequently and require the provision of pre-treatment.
- Operation of Pumps: Insufficient power supply and regular power cuts problems within the area supplying water through piped water supply scheme.
- Safe disposal of reject water from R.O plants.
- There is a possibility that, the coverage of habitations with contaminant removal units could be affected, once the O&M responsibility of these units by the contractor ends. In those habitations, piped water supply schemes with safe and sustainable source can be a better option, if people come forward to bear the costs of O&M of the scheme.
- Use of individual submersible pumps at household level by private people in their houses could lead to over draft of ground water.
- Use of small (Tullu)pumps to draw more water from the piped water supply scheme could affect other users.

Sanitation Key Issues:

- Where the sewer lines are already constructed, people are not willing to get connected; Lack of awareness and cost of connection
- No plantation surrounding STP and space constraint for plantation.
- Improper disposal of solid and liquid wastes

Environmental Concerns and Management Proposals

In order to ensure that the environmental issues are systematically identified and addressed in the various stages of the implementation of the schemes, an updated Environmental Management Framework (EMF) has been developed for this project. The following are the project related key environmental issues and management proposals.

- **Water Supply Issues:**
  - **Water Availability / Water Quantity:** Ground water has been the major source of rural drinking water and irrigation in Punjab. Owing to large scale extraction of ground water for irrigation, combined with increasing demands in other sectors due to population and industrial growth, the aquifers are prone to be under stress and some of the sources have become either unsustainable or contaminated.
  - **Water Source Protection:** Drinking water from local drinking water utilities or an individual well comes from either ground water, streams, rivers or lakes in a watershed. Although most of the raw water requires some kind of treatment beforeits actually supplied for its intended purpose mainly for drinking, domestic or industrial use, protecting sources of water is an important part of providing safe drinking water to the public.
  - **Water Quality (Surface water & Ground water):** A major canal network of The Punjab State is relatively free of industrial or municipal discharges, and the irrigation drainage flows are seldom routed into the canal system. The water quality in the main canals is generally better than that of the river courses. The quality problems with respect to surface water sources are more acute in the locations and during the periods when the flow in the river is not sufficient to cause acceptable level of dilution of the discharge effluents.

    The shallow ground water quality in Punjab is poor owing to natural presence of salinity and pollutants at concentrations exceeding the permissible levels for drinking water use. In addition, the ground water quality may also indicate bacteriological and chemical contamination due to inadequate treatment of effluents from septic tanks or industrial discharges and disposal of sullage into stagnant pools of wastewater.
  - **Leakage from Water supply:** Water is often wasted through leaking pipes, joints, valves and fittings of water supply system either due to bad quality of material used, poor workmanship, corrosion, age of installations, or through vandalism as well. This leakage leads to reduction in supply and loss of pressure. The leakages could either be visible or invisible. In the case of invisible leaks, sections of pipeline should be isolated and search to be carried out for location of leaks. Also, the lack of maintenance of pipeline may cause leakages in long run which has negative impact on the various attributes due to water stagnation in the village roads/streets/low lying areas.
  - **Maintenance of Water Disinfection System:** The disinfection of potable water is almost universally accomplished by the use of gaseous chlorine of chlorine compounds. Other methods of disinfection are also available such as ozone, ultra-violet light, chlorine dioxide, silver ionization etc. Disinfection should be done continuously to maintain the residual chlorine in the distribution system.

- **Sanitation Issues:**
  - **Household Sanitation options and issues:** There are no provisions of sanitation facilities in 25% of the total rural households in The Punjab State. Amongst the 75% households who have access to a sanitary facility, about 94% have a toilet within their house, 4% households share a toilet with other households while about 2% households use a public toilet.

- **Septic Tanks:** All the wastewater from the home should flow to the septic tank. Even waters from the shower or washing machine can contain disease causing germs or environmental pollutants. As wastewater flows into the tank, the heavier solid materials settle to the bottom, the lighter grease and fats float to the top and liquid flows out of the tank, which untreated can cause pollution.
- **Site Selection for STP:** Site selection of a waste water treatment facility should be based on careful consideration on development patterns as well as social, environmental and engineering constraints. It is important to understand that the selection of a site for sewage treatment plant will have long lasting social, environmental and economic repercussions on the affected community and neighbourhood.
- **Effluent Disposal & Utilization:** The effluent disposal of STP and its utilization should be planned at design stage otherwise its accumulation in the nearby areas leads to un-aesthetic view and becomes a breeding ground for mosquitoes. The effluent from the STP may be discharged in the water bodies such as ponds, streams or on land provided that it meets the PPCB criteria.
- **Impact due to malfunctioning of the sewage lift pump:** Sewage pumping stations are designed to pump sewage from one place to another and are usually used for conveying raw sewage to sewage treatment plant, or conveying treated effluent to water receiving bodies. The malfunctioning of lift pumps or power failure will cause negative impact on the surroundings and environment.

Institutional Arrangements

The project envisages improving the existing institutional model on the front of environmental monitoring that enables demand driven community action. The following is a brief description of the model.

Village Level GPWSC:

GPWSC is a standing committee of the Gram Panchayat which is expected to shoulder full responsibilities for all activities including planning, implementation, operation, maintenance and management related to RWSS at the village level.

Division Level:

At Division level, there will be one environment officer, who will assist DWSS in monitoring and implementation of mitigation measures related to RWSS at village level, preparation of environmental appraisal for clearances, train GPWSC, community members and other stakeholders in implementation activities under EMF.

Circle Level:

At circle level, there will be an environment manager/environmental expert to assist DWSS in environment assessment and appraisal of RWSS schemes, monitoring activities of environment officers at division level and environment monitoring of the completed RWSS schemes.

Zone Level:

At zone level, there will be an Executive Engineer and anEnvironmental Expert, who will assist DWSS in environment assessment and appraisal of RWSS schemes, monitoring activities of environment managers at circle level, and to look after the training of environment staffs of circles and divisions.

State Level:

At the state level the DWSS(Head Office) prepares the environment policy and sets the guidelines for the EMF implementation, monitoring and evaluation. This office also liaises with other departments with regard to environment issues. The State level Officer of DWSS will be responsible for ensuring the implementation of the EMF across the state. At State level to assist State level Officer, there will be an Executive Engineer and an Environmental Specialist, who will ensure that environment management activities are in conformity with the EMF and that necessary guidance and budget is provided to implement these plans.

Table 1.2: Proposed Institution Set-up with functions

Entity	Position	Functions
State Level	Environment (Executive Engineer Cadre)	• Monitor environmental activities of the project and ensuring compliance with EMF. • Assist DWSS in Environmental monitoring of the completed RWSS schemes/auditing of 15% of completed Category I RWSS schemes, Category II water supply schemes and Category II sewerage schemes • Assist in Environmental Capacity Building
	Environmental Specialist	• Assist DWSS in Environmental assessment and appraisal of RWSS schemes • Assist DWSS in obtaining approvals from other departments • Assist DWSS in monitoring activities of Environmental staff of the department • Assists DWSS in Environmental monitoring of the completed RWSS schemes/ auditing of 15% of completed Category I RWSS schemes, Category II water supply schemes and Category II sewerage schemes • Assist DWSS in water and wastewater quality monitoring of the completed RWSS schemes • Organize state/ circle level training programs
Zone Level	One Executive Engineer and one Environmental Expert	• Assist DWSS in Environmental assessment and appraisal of RWSS schemes • Assist DWSS in monitoring activities of circle level Environmental Managers • Assist DWSS in Environmental monitoring of the

Entity	Position	Functions
		completed RWSS schemes/ auditing of 15% of completed Category I RWSS schemes, Category II water supply schemes and Category II sewerage schemes • Train Circle / Division level Environmental staffs and operational staff of DWSS in implementing/supervising environmental mitigation measures and water& wastewater quality monitoring for completed RWSS schemes
Circle Level	Environmental Manager	• Assist DWSS in Environmental assessment and appraisal of RWSS schemes • Assist DWSS in monitoring activities of division level Environmental Officers • Assists DWSS in Environmental monitoring of the completed RWSS schemes • Train Division level Environmental officers and operational staff of DWSS and GPWSCs in implementing/supervising environmental mitigation measures and water & wastewater quality monitoring for completed RWSS schemes
Division Level	Environmental Officer	• Assist DWSS in monitoring and implementation of mitigation measures at village level for RWSS schemes. • Assist DWSS in preparation of environmental appraisals for clearances. • Train GPWSCs, community members and other stakeholders at village level in implementing activities under EMF. • Propose/Report mitigation measures in case of any environmental issues encountered during execution.
Field Level / GP level	GPWSC members / SLC Community members	• Awareness on environmental mitigation measures related to water supply and sewerage schemes in the GP • Create environmental awareness among community members

Updated Environmental Management Framework

In order to ensure that the environmental issues are systematically identified and addressed in the various stages of the implementation of the schemes, an Updated Environmental Management Framework (EMF) has been developed for this project. EMF activities in the pre-planning, planning, implementation and O&M

phases of the proposed project cycle for the project sponsored schemes are given in respective tasks. The key elements of EMF are as follows:

- **Environmental Data Sheets on Water Supply and Sewerage Schemes** - The EMF requires the basic environmental data pertaining to the proposed schemes be compiled at the field data collection stage. For this purpose, a simple Environmental Data Sheet (EDS) has been formulated on water supply, sanitation/ sewerage schemes.
- **Environmental Categorization of the Schemes** - At the Detailed Scheme Report (DSR) preparation stage, the available environmental information in the EDS will be evaluated and based on the level of expected environmental and public health impacts, the proposed scheme would be classified.In case of water supply schemes, the schemes shall be classified as either Category I (environmental data sheet to be prepared) or Category II (detail environmental appraisal is required).In case of sewerage schemes, the schemes shall be classified as either Category I (environmental data sheet to be prepared) or Category II (detail environmental appraisal is required).

Categories of Water Supply Scheme

Category I (Minimal Impacts where EMP not required)	Category II (Significant Impacts where EMP required)
• Water Supply involving pumping, construction of storage tanks and piped distribution networks, with source as tube well/bore well. • Water Supply with water source requiring minimum treatment such as disinfection.	• Water Supply involving pumping, construction of storage tanks and piped distribution networks, with Surface water as a source. • Water Supply with water source requiring "Advance Treatment" for removal of arsenic, iron, fluoride, salinity, etc.
• Single Village Scheme (SVS) with either surface water or ground water source.	• Multi Village Scheme (MVS) based on either surface water or ground water source.
• Water Supply with source in shallow aquifer in safe and semi-critical zone and with source in deep aquifer located in safe zone of exploitation.	• Water Supply with source located in/very close to natural habitat/sensitive eco-systems such as National Parks, Wild Life Sanctuaries (requiring forest permission/clearance)
• No water quality issues with regard to ground water source.	• Water Supply with water source from critical aquifers/over exploited zones. Ground water based scheme, if the water quality testing for deep groundwater source indicates unacceptable levels of pesticides or heavy metals.

Categories of Sewerage Schemes

Category I (Minimal Impacts where EMP not required))	Category II (Significant Impacts where EMP required)
• Sufficient land for STP is available easily	• Advance technology is to be provided as the available area is less than the requirement.
• Location of STP is more than 200 m away from school/hospitals and residential areas	• Location of STP is less than 200 m from school/hospitals and residential areas.

Category I (Minimal Impacts where EMP not required))	Category II (Significant Impacts where EMP required)
	• Water logged area.
• No major tree cutting is involved for sewerage system and STP	• Major tree cutting is involved for sewerage system and STP. • Clearance of Forest Department is required
• No industrial/chemical effluent being discharged to the proposed sewerage system	• Industrial/chemical effluent is mixing with sewage.
• No effluent disposal problem, i.e., disposal by gravity to nearby drain or water body	• Effluent disposal problem requiring pumping for disposal.

Risk & Assumptions

The major risk factors along with some proposed management measures from the environmental point of view are given in table below, which are as follows:-

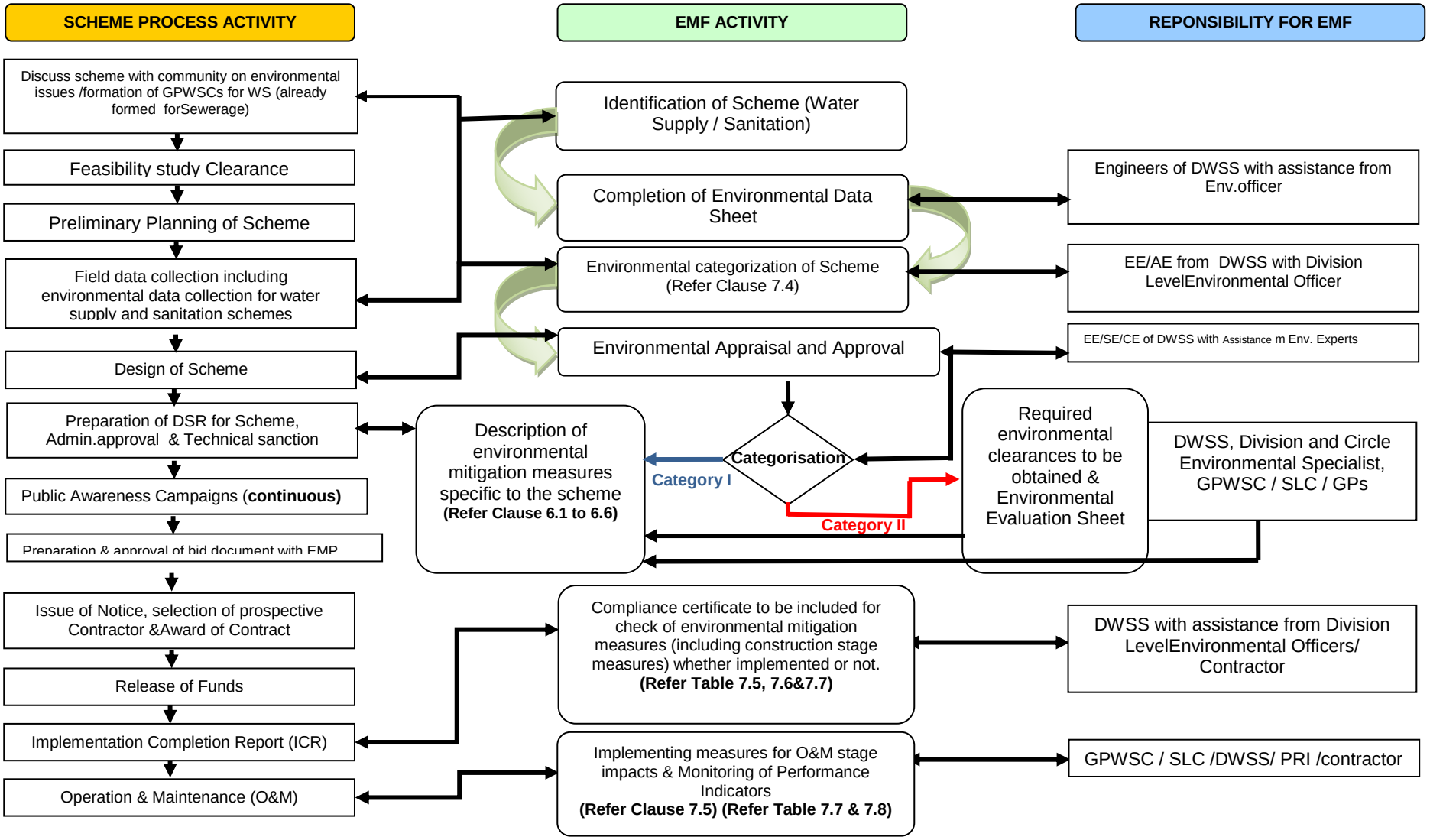
S. No	Environmental Risks	Management Proposals
1	Less yield from water sources	▪ Preventing water wastage ▪ Draw out only planned quantity ▪ Water augmentation ▪ Water harvesting ▪ Catchment area treatment ▪ Alternative sources be explored
2	Natural Calamities like Flash Floods, Droughts & Earthquakes	▪ Installation of electrical & mechanical equipment above flood level. ▪ Cordoning off the source works with protection walls (wherever possible to do so), prone to floods ▪ Establishing diversions within the flood routes in order to protect the source at the downstream.
3	Lack of awareness in the community, especially regarding water quality and environmental sanitation	▪ Intensive awareness creation program. ▪ Distribution of FTKs and ensuring its usages. ▪ Identify convenient water quality testing centres.
4	Unsuitable location for STP and layout of STP	▪ Selected site should not pollute the downstream or nearby water supply source. ▪ Proper design, construction and maintenance of STP should be ensured. ▪ Treated effluent should be discharged in to natural drain by gravity
5	Absence of Proper waste management in the community	▪ Proper training regarding use of compost and garbage pits ▪ Intensive IEC activities.

- **Environmental Appraisal and approval** - Based on the Environmental Categorization of the schemes for the proposed project, appraisals and approvals have to be obtained. With regard to land availability, as per World Bank guidelines land acquisition cost would not be financed through the World Bank, and land acquisition under this project should not be there. DWSS should ensure that the Gram Panchayat has the land required in their possession prior to conceiving a scheme.
- **Environmental Management Plan (EMP) for pre-planning, construction and O&M phase impacts** – EMP based on issues identified during the planning stage of the proposed project and necessary preventive and mitigation measures should be considered in the design. The contractor shall provide an undertaking for execution of the activities identified in the EMP. The EMP shall be initiated at the planning and design stage of project and the process shall involve addressing relevant environmental issues ranging from household to village level with appropriate detail.
- **Provision for Environmental Cost -** Provision of 2% of capital cost of water supply and sewerage schemes towards EMP is notional. If the cost of implementation of EMP is more than 2% then the actual cost to be factored in the cost of the scheme.

Approximate Provision of 2% Environmental Cost

Sr. No.	Description of Environmental Enhancement Measures	Budgetary Cost in % of Scheme	Implementations Agency
A.	**Water Supply Schemes**		
1	Provision forair, noise and water quality testing during construction / Rain water Harvesting structures	1.75%	Prospective Contractor
2	Provision of Lawns and Tree plantation in water works	0.25%	Prospective Contractor
B.	**Sewerage Schemes**		
1	Minor Repair and Cleaning of Drains	0.50%	Prospective Contractor
2	Provision forair, noise and water quality testing during construction/Rain water harvesting structures	1.00%	Prospective Contractor
3	Provision of Lawns and Tree Plantation around the STP sites	0.50%	Prospective Contractor

The following environmental frame work flow chart provides the understanding of the EMF activities to be taken up at various stages of the scheme including environmental monitoring with regard to performance indicators.


SCHEME PROCESS ACTIVITY
EMF ACTIVITY
REPONSIBILITY FOR EMF
Discuss scheme with community on environmental issues /formation of GPWSCs for WS (already formed forSewerage)
Feasibility study Clearance
Preliminary Planning of Scheme
Field data collection including environmental data collection for water supply and sanitation schemes
Design of Scheme
Preparation of DSR for Scheme, Admin.approval & Technical sanction
Public Awareness Campaigns (continuous)
Preparation & approval of bid document with EMP
Issue of Notice, selection of prospective Contractor &Award of Contract
Release of Funds
Implementation Completion Report (ICR)
Operation & Maintenance (O&M)
Identification of Scheme (Water Supply / Sanitation)
Completion of Environmental Data Sheet
Environmental categorization of Scheme (Refer Clause 7.4)
Environmental Appraisal and Approval
Description of environmental mitigation measures specific to the scheme (Refer Clause 6.1 to 6.6)
Categorisation
Category I
Category II
Required environmental clearances to be obtained & Environmental Evaluation Sheet
Compliance certificate to be included for check of environmental mitigation measures (including construction stage measures) whether implemented or not. (Refer Table 7.5, 7.6&7.7)
Implementing measures for O&M stage impacts & Monitoring of Performance Indicators (Refer Clause 7.5) (Refer Table 7.7 & 7.8)
Engineers of DWSS with assistance from Env.officer
EE/AE from DWSS with Division LevelEnvironmental Officer
EE/SE/CE of DWSS with Assistance m Env. Experts
DWSS, Division and Circle Environmental Specialist, GPWSC / SLC / GPs
DWSS with assistance from Division LevelEnvironmental Officers/ Contractor
GPWSC / SLC /DWSS/ PRI /contractor

Environmental Management Plan for Water Supply Scheme

EMP for Pre-Construction Stage Impacts – Water Supply Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Selection	• The location of treatment plant site should be at least 200 m away from the nearest settlement • The site should be isolated from the presently built-up areas or areas that have potential for future development. Large enough area for locating the plant will be helpful in maintaining the buffer area and fulfilling the needs for future expansion. • The treatment plants should not be located within flood zones.	DWSS/GPWSC /SLC		
2	Tree Cutting	• Necessary clearance for cutting of trees should be obtained by SE prior to start work from the Forest Department • A joint inspection of Forest Department officials and representative GPWSCs should be organized to identify the trees to cut for clearing the site. Trees to be cut should be clearly marked.	DWSS		
3	Establishment of Contractor's Camp and site office	• It should be located away from the residential areas/schools/hospitals/river banks/canals. • Layout of construction camps if any should be approved from GPWSCs • Construction camps, if any should have separate toilets for male and female workers, drinking water, cooking fuel and first aid facilities.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
4	Construction water	• Contractor will make his own necessary arrangement for procuring construction water – In case of community water source, Contractor should carry out consultations with GPs and obtain written permission for the utilization of water – In case of private source, Contractor should not utilize the water unless written consent is obtained from other owners of the land parcel. – In case of new bore wells, permits should be obtained as per requirements of State Ground Water Board regulations. – In case of surface water bodies, necessary permission from concerned department or administrative clearances should be obtained. • Water requirement for curing concrete should be optimized by pooling of water over concrete or covering it with gunny bags.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS
5	Disposal sites	• In consultation with GPs, disposal sites should be identified and got approved by SEin consultation with DWSS.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
					DWSS

Environmental Management Plan for Construction Stage Impacts – Water Supply Schemes

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Clearance	• No illegal tree chopping should be allowed. • Vegetation clearance activity should be closely monitored	Prospective Contractor	Once in a week	SLC/GPWSC
2	Excavation, laying and jointing of pipes	• Loose soil should be compacted properly after finishing the work • Damage to the roots should be prevented during trenching, placing, backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plan health • Excavation must be done during the lean season near water bodies, to avoid erosion and siltation of canals or other water bodies in the area. • Ensure prompt refilling of trenches and proper management and use/disposal of soil cover and wastes.	Prospective Contractor	Daily	SLC/GPWSC
3	Public Safety	• Excavated areas should be clearly demarcated • Proper barricading should be placed along the excavated trenches • Warning sign boards should be provided along the construction sites in Hindi as well as local language • Tress passing of the construction sites should not be allowed	Prospective Contractor	Twice in a month	SLC/GPWSC/ / Engineers of DWSS/ Environmental Officer
4	Access Management	• Proper access to the residents should be provided near the residential areas, schools, hospitals, and religious structures such as mosque, temples, etc.	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS
5	Storage of Construction Materials	• All construction materials should be stored in secured places • Contractor should not be allowed to store the material at construction sites for more than 1 week. • No hazardous material should be allowed to store near the construction sites.	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS
6	Construction Sites	• It should be kept free of water logging • Protective guards should be provided across the areas where workers may fall or could face an impalement hazard.	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		• Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous wastes, if any, in covered, segregated waste containers • Keep form and scrap lumber with protruding nails cleared away from work areas, passageways • No loose material should be allowed to leave unattended, and sites should be properly finished after completing the work • Good housekeeping should be maintained at construction sites			
7	Noise Pollution	• Machineries as well as equipment should be maintained properly • No high noise generating equipment which is not meeting SPCB requirements should be allowed at construction sites • Generator etc. should be properly enclosed, and proper padding should be placed below such machinery to reduce vibration. • Special care must be taken near religious structures, schools, hospitals etc. • Machineries/equipment/vehicles should meet the noise emission requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
8	Air Pollution	• Properly maintained vehicles and equipment should be used • In dusty areas, sprinkling of water should be done and especial care must be given during summer season • Construction debris should not be allowed to remain unattended at construction sites for longer time • Workers working in dusty areas such as concrete mixing equipment should use stringently nose masks. • Machineries/equipment/vehicles should meet the Air Pollution requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
9	Water Pollution	• No washing of vehicles or equipment should be permitted near the water source • Construction debris should not be disposed to the water bodies • Contractor should arrange its own water for carrying out construction activities.	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS
10	Soil Quality	• Excavated areas should be properly compacted • Loose earth should not be left unattended near the construction sites	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
11	Construction Camps	• Proper cooking fuel should be provided to the labour residing in the camps. In any case, woods should not be used for cooking. • Proper sanitation facilities should be provided in the construction camps. • Potable drinking water should be provided to the workers. • Water logging conditions should not be allowed inside the camp. • For establishing construction camps, contractor should obtain NOC from the State Pollution Control Board	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS
12	Occupational Health & Safety	• Safe access to the job sites should be provided to all workers • Passage ways, walkways, and stairways should be kept free of materials, scraps or obstructions • First Aid box should be readily available at construction sites • Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site • A vehicle should be readily available at construction site to meet emergency situation • The contractor should comply with all the precautions as required for the safety of the workmen as per the International Labour Organization as far as those applicable to this project • The contractor should strictly follow the statutory child labour act • Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the workers.	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS

Environmental Management Plan for Operation & Maintenance Stage Impacts – Water Supply Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Hand Pumps	• Routine inspections of hand pumps • Source protection + treatment for arsenic/iron/fluoride etc. • Regular cleaning and back washing of treatment units/filters in lined with hand pumps should be ensured.	Prospective Contractor / DWSS / GPWSC	Monthly	GPWSC/SLC/ Engineers of DWSS

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		• Enforce ground water act + monitor regularly ground water level			
2	Piped Water Supply Schemes	• Chlorination level of water supply to ensure minimum residual chlorine of 0.5mg/l	Prospective Contractor / Engineers of DWSS/ GPWSC	Daily	GPWSC/SLC/ Engineers of DWSS
		• Regular water quality testing		Monthly	GPWSC/SLC/ Engineers of DWSS/ Environmental Officer
		• Preventive and corrective maintenance of water distribution system including checking of leakages.		Quarterly	GPWSC/SLC/ Engineers of DWSS

Environmental Management Plan for Sewerage Scheme

EMP for Pre-Construction Stage Impacts – Sewerage Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Selection	• The location of wastewater treatment plant site should be at least 200 m away from the nearest settlement • The site should be isolated from the presently built-up areas or areas that have potential for future development. Large enough area for locating the plant will be helpful in maintaining the buffer area and fulfilling the needs for future expansion. • Enough area for local disposal of end products such as treated effluents, sludge should be available at the selected site. • The treatment plants should not be located within flood zones. • The site should be selected near a large water body or irrigable land capable of accepting the treated effluents.	DWSS/GPWSC /SLC		
2	Tree Cutting	• Necessary clearance for cutting of trees should be obtained by SE prior to start work from the Forest Department • A joint inspection of Forest Department officials and representative GPWSCs should be organized to identify the trees to cut for clearing the site. Trees to be cut should be clearly marked.	DWSS		
3	Establishment of Contractor's Camp and	• It should be located away from the residential areas/schools/hospitals/river banks/canals. • Layout of construction camps if any should be approved from GPWSCs	Prospective Contractor	One Time	SLC/GPWSC/

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
	site office	• Construction camps, if any should have separate toilets for male and female workers, drinking water, cooking fuel and first aid facilities.			Engineers of DWSS/ Environmental Officer
4	Construction water	• Contractor will make his own necessary arrangement for procuring construction water – In case of community water source, Contractor should carry out consultations with GPs and obtain written permission for the utilization of water – In case of private source, Contractor should not utilize the water unless written consent is obtained from other owners of the land parcel. – In case of new bore wells, permits should be obtained as per requirements of State Ground Water Board regulations. – In case of surface water bodies, necessary permission from concerned department or administrative clearances should be obtained. • Water requirement for curing concrete should be optimized by pooling of water over concrete or covering it with gunny bags.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS
5	Disposal sites	• In consultation with GPs, disposal sites should be identified and got approved by SE in consultation with DWSS.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS

Environmental Management Plan for Construction Stage Impacts – Sewerage Schemes

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Clearance	• No illegal tree chopping should be allowed. • Vegetation clearance activity should be closely monitored	Prospective Contractor	Once in a week	SLC/GPWSC
2	Excavation, laying and jointing of pipes	• Loose soil should be compacted properly after finishing the work • Damage to the roots should be prevented during trenching, placing, backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plan health • Excavation must be done during the lean season near water bodies, to avoid erosion and siltation of canals or other water bodies in the area. • Ensure prompt refilling of trenches and proper management and use/disposal of soil cover and wastes.	Prospective Contractor	Daily	SLC/GPWSC

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
3	Public Safety	• Excavated areas should be clearly demarcated • Proper barricading should be placed along the excavated trenches • Warning sign boards should be provided along the construction sites in Hindi as well as local language • Tress passing of the construction sites should not be allowed	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
4	Access Management	• Proper access to the residents should be provided near the residential areas, schools, hospitals, and religious structures such as mosque, temples, etc.	Prospective Contractor	Twice in a month	SLC/GPWSC/Engineers of DWSS
5	Storage of Construction Materials	• All construction materials should be stored in secured places • Contractor should not be allowed to store the material at construction sites for more than 1 week. • No hazardous material should be allowed to store near the construction sites.	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS
6	Construction Sites	• It should be kept free of water logging • Protective guards should be provided across the areas where workers may fall or could face an impalement hazard. • Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous wastes, if any, in covered, segregated waste containers • Keep form and scrap lumber with protruding nails cleared away from work areas, passageways • No loose material should be allowed to leave unattended, and sites should be properly finished after completing the work • Good housekeeping should be maintained at construction sites	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
7	Noise Pollution	• Machineries as well as equipment should be maintained properly • No high noise generating equipment which is not meeting SPCB requirements should be allowed at construction sites • Generator etc. should be properly enclosed, and proper padding should be placed below such machinery to reduce vibration. • Special care must be taken near religious structures, schools, hospitals etc. • Machineries/equipment/vehicles should meet the noise emission requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
8	Air Pollution	• Properly maintained vehicles and equipment should be used • In dusty areas, sprinkling of water should be done and especial care must be given during summer season • Construction debris should not be allowed to remain unattended at construction sites for longer time • Workers working in dusty areas such as concrete mixing equipment should use stringently nose masks. • Machineries/equipment/vehicles should meet the Air pollution requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
9	Water Pollution	• No washing of vehicles or equipment should be permitted near the water source • Construction debris should not be disposed to the water bodies • Contractor should arrange its own water for carrying out construction activities.	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
10	Soil Quality	• Excavated areas should be properly compacted • Loose earth should not be left unattended near the construction sites	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS
11	Construction Camps	• Proper cooking fuel should be provided to the labour residing in the camps. In any case, woods should not be used for cooking. • Proper sanitation facilities should be provided in the construction camps. • Potable drinking water should be provided to the workers. • Water logging conditions should not be allowed inside the camp. • For establishing construction camps, contractor should obtain NOC from the State Pollution Control Board	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
12	Occupational Health & Safety	• Safe access to the job sites should be provided to all workers • Passage ways, walkways, and stairways should be kept free of materials, scraps or obstructions • First Aid box should be readily available at construction sites • Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site • A vehicle should be readily available at construction site to meet	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		emergency situation • The contractor should comply with all the precautions as required for the safety of the workmen as per the International Labour Organization as far as those applicable to this project • The contractor should strictly follow the statutory child labour act • Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the workers.			

Environmental Management Plan for Operation & Maintenance Stage Impacts – Sewerage Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Drain/Sewer Condition Assessment	• Routine inspections of drains and sewers • Regular cleaning of interception chambers/drains (removal of blockages, debris etc.) should be ensured	Prospective Contractor / DWSS	Quarterly	SLC/GPWSC/ Engineers of DWSS
		• Leakages in sewers		Yearly	SLC/GPWSC/ Engineers of DWSS
2	Sewage Treatment Plant	• Routine maintenance of plants should be organized.	Prospective Contractor / DWSS	Twice in a month	SLC/GPWSC/ Engineers of DWSS
		• Influent & Effluent quality testing		Quarterly	SLC/GPWSC/ Engineers of DWSS/Environmental Officer
		• In case of ponds, – Its characteristic changes in colour and odour should be observed. – The ponds should be cleared of floating mats of algae at the corners and sides. – All marginal growth of weeds and vegetation should be removed. It also helps prevent mosquito breeding. – The overgrown and dead grass should be removed.		Every six months	SLC/GPWSC/ Engineers of DWSS

Environmental Data Sheet for Water Supply and Sewerage Schemes for DSR Stage

Format for Environmental Data Collection for Water Supply and Sewerage Schemes				
1. GENERAL				
1.1. Name of Village/Habitation: 1.2. Gram Panchayat 1.3. Block: 1.4. District:				
1.5. Zone (North/Central/South)				
2. BASELINE ENVIRONMENT				
2.1. Topography (Plain/Rolling/Hilly)				
2.2. Type of Soil:	☐ Alluvial	☐ Silt	☐ Silty Clay	
	☐ Sandy	☐ Sandy Clay	☐ other	
2.3. Intensity of Rainfall	☐ Low	☐ Moderate	☐ High	
2.4. Temperature:	Min: ^{0}C		Max:	
2.5. Natural Slope of the Land				
2.6. Predominant wind Direction				
2.7. Water Table (Depth Below Ground Level)	☐ Shallow (0-5m)	☐ Moderate (5-10m)		
	☐ Deep aquifer (10-20m)	☐ Very Deep (below 20m)		
2.8. Existing water body within village:	☐ River	☐ Canal	☐ Pond/Lake	
	☐ Other (Specify)			
2.8.1. If pond, current use of it. (Please give the numbers of ponds)	☐ Drinking	☐ Cattle washing	☐ Irrigation	
	☐ Sewage Disposal	☐ Others		
2.9. Water logging problem within village/villages: (Yes/No)	if yes, a. Name of area/areas: b. Area under water logging: c. Period of water logging (Annually): d. Population affected by water logging: e. Contamination of Drinking water sources from water logging:			
2.10. Minimum and Maximum width of village roads (meters)				
2.11. Existing Roads in the village are metallic/un-metallic/Brick Paved				
2.12. Current Solid Waste Disposal	☐ Combined Dust bin	☐ Door to door	☐ Drains	☐ In

Format for Environmental Data Collection for Water Supply and Sewerage Schemes				
System		collection		Streets
2.13. Local Vegetation: (Mention Species)				
3. SOCIAL ENVIRONMENT				
3.1. Population				
3.2. Number of households				
3.3. Land use pattern of village	☐ Rural	☐ Urbanized Rural		
3.4. Historical/ Religious Importance	☐ Yes	☐ No		
3.5. Major Source of Income	☐ Agriculture	☐ Business	☐ Service	
	☐ Labor	☐ Others		
3.6. Is the proposed project likely to affect any natural habitats/cultural properties? 3.6.1. If yes, whether appropriate safeguards are proposed? (Write note)				Yes / No
3.7. Is the proposed project likely to infringe on the rights of the local people, including traditional land water rights? 3.7.1. If yes, whether appropriate mitigation measures have been proposed? (Write Note)				Yes / No
4. PUBLIC HEALTH ISSUES				
4.1. Any incident of Waterborne epidemic/ disease in the recent past	☐ Yes	☐ No		
4.1.1. If Yes: Name of diseases (Waterborne)	☐ Diarrhea	☐ Gastro entities		
	☐ Typhoid	☐ Others		
4.2. Is there any vector borne disease	☐ Yes	☐ No		
4.2.1. Name of Vector borne disease	☐ Malaria	☐ Dengue	☐ Filaria	
5. WATER SUPPLY SCHEME				
5.1. Type of Scheme	Existing/New Scheme			
5.1.1. Whether the proposed water supply scheme is	☐ Single Village Scheme	☐ Multi Village Scheme		
5.1.2. If new water Supply scheme is proposed, briefly give data on the current drinking water situation				
5.1.3. Source of drinking water supply:	☐ River	☐ Lake	☐ Groundwater	
	☐ Canal	☐ Pond		
5.1.4. Water availability in lpcd				
5.1.5. Availability of Land for Intake/WTP site	☐ Panchayati Land	☐ Private land	☐ Forest land	

Format for Environmental Data Collection for Water Supply and Sewerage Schemes			
5.1.6. Has the source of water quality been assessed, if yes attach a copy of the test report.	☐ Yes	☐ No	
5.1.7. Mention the appropriate nature of the quality problem	☐ Fluoride	☐ Iron	☐ Heavy Metals
	☐ Bacteriological	☐ TDS	☐ Pesticide
	☐ Nitrate	☐ Others	☐ No Problem
5.1.8. Is there potential risk of contamination of source due to industrial contaminants, human waste discharge, solid waste dumping, use of agro chemicals (Fertilizers, pesticides etc?) 5.1.8.1. If yes, whether appropriate preventive/ corrective actions taken? (Write a note)			Yes / No
5.1.9. Does the proposed project involve provision of any bore well within 1 km of international border between India and Pakistan? 5.1.9.1. If yes, the project cannot be sanctioned.			Yes / No
5.1.10. canal source, indicate the Treatment Technology proposed.	❑ Slow Sand Filter (SSF) ❑ Package Treatment Plant	❑ Rapid Sand Filter (RSF) ❑ Any other method	
5.1.11. If groundwater, indicate Technology proposed.	❑ R O Plant ❑ Iron removal Plant	❑ De-fluoridation Plant (D F) ❑ Any other method.	
5.1.12. Has disinfection system been provided		□ Yes	□ No
5.1.12.1. If yes, type of disinfection method (Silver Ionization or Chlorinator)			
5.2. Provision Required from Generic EMF in the water supply scheme village			
5.2.1. Air, Noise and water quality testing & rain water harvesting		□ Yes	□ No
5.2.2. Lawns and Tree Plantation in Water Works		□ Yes	□ No
5.3. **Anticipated Environmental Issues and Mitigation Measures during implementation**			
5.4. Parameter	**Issue**	**Mitigation measure**	
5.4.1. Water availability			
5.4.2. Water quality			
5.4.3. Sanitation			
5.4.4. Construction			
5.4.5. Disposal of construction wastes 5.4.6.			

Format for Environmental Data Collection for Water Supply and Sewerage Schemes					
6. SEWERAGE SCHEME					
6.1. Whether Proposed Sewerage Scheme is	☐ Single Village Scheme	☐ Multi Village Scheme			
6.2. Current Sanitation Practices *	☐ Septic Tank	☐ Septic Tank with Soak Pits			
	☐ Open Defecation	☐ Bore well/ soak pit type			
	☐ Others				
6.3. Usage of toilets in terms of number and percentage					
6.4. Percentage of households having septic tanks*					
6.5. Availability of water supply in toilets					
6.6. Current Drainage Pattern*	☐ Open Drains	☐ Partially covered with Open Drains	☐ No Drainage system		
6.7. Does the wastewater from cattle sheds discharged into the open drains*	☐ Yes	☐ No			
6.8. Does the grey water and black water mix*	☐ Yes	☐ No			
6.9. Villagers feedback about current sanitation practice*	☐ Satisfied	☐ Unsatisfied			
6.10. Approximate Wastewater Quantity in mld					
6.11. Method of treatment to be Provided					
6.11.1. Whether existing Ponds will be used as STP	☐ Yes	☐ No			
6.11.2. Pond's distance from the nearest settlement (m)					
6.11.3. Whether distance from the nearest schools/primary health center/religious structure is more than 200 m.	☐ Yes	☐ No			
6.11.4. Water Quality of Pond by visual inspection	☐ Good	☐ Very bad			
6.11.5. Current use of Pond proposed for STP	☐ Cattle Wash	☐ Irrigation	☐ Sewage Disposal	☐ Aquaculture	☐ Any other
6.11.6. Is there any requirement of expansion of pond to use as a STP	☐ Yes	☐ No			
6.12. Is there sufficient land available for expansion of the pond or new STP	☐ Yes	☐ No			

Format for Environmental Data Collection for Water Supply and Sewerage Schemes			
6.12.1. If yes, current land use	☐ Agriculture	☐ Barren land	☐ Forest
6.13. Is there plantation around pond site/STP	☐ Yes	☐ No	
6.14. Environmental Features around the new STP site, i. Approximate area of land in ha. ii. Land use pattern iii. Distance from the nearest water body iv. Distance from the nearest settlement v. Accessibility of area vi. Is there stagnation of water takes place (Yes/No)		☐	
6.15. Contamination of Drinking Water Source from the Pond/STP	☐ Yes	☐ No	
6.16. Disposal of Treated Effluent	☐ Inland water body	☐ On to land for irrigation	
6.17. Is there potential risk of contamination of source of water? If yes, whatare the appropriate preventive/corrective actions taken? (write note)			

6.18. **Provision Required from Generic EMF in the Sewerage Scheme Village**		
6.18.1. Provision of Lawns and Tree Plantation at the STP Site water works premises and STP site	□ Yes	□ No
6.18.2. Provision of Rainwater harvesting	□ Yes	□ No
6.18.3. Repair and Cleaning of Drains	□ Yes	□ No
6.18.4. Air, noise and water quality testing	□ Yes	□ No
6.18.5. Need of Public Awareness on health and hygiene	□ Yes	□ No

6.19. Anticipated Environmental Issues and Mitigation Measures during implementation

Parameter	Issues	Mitigation measure
6.19.1. Site selection of STP		
6.19.2. Sewage Treatment Technology		
6.19.3. Disposal of Treated effluent		
6.19.4. Disposal of Sludge		
6.19.5. Construction Phase impacts		

Format for Environmental Data Collection for Water Supply and Sewerage Schemes		
6.19.6. Disposal of Construction debris		
7. Whether Cleaning of Pond is required	**Yes**	**No**
Signature		
JE/FE		
EO/ EM/ Sr EM/ ES/ EMS		
EE (Approval as per ES Recommendation)		
SE		

Note: * In case of multi-village scheme, please attach the data for each village separately.

Key Performance Indicators

The performance indicators for water supply schemes and sewerage schemes are identified and the frequency of its monitoring and person responsible are indicated below:

Table 1.3: Performance Indicators for various Project Interventions / Components for Water Supply Scheme

Sr. No.	Project Intervention / Component	Performance Indicators	Frequency	Monitoring Agency
1	Water Availability / Water Quantity	Access to safe drinking water supply of a minimum of 70 lpcd to the target communities.	Monthly	State level Executive Engineer in-charge of environment cell and Environment Specialist/ Environmental Officers
2	Water Quality	• Regular DWSS water quality testing	Monthly	GPWSC/SLC/Environmental Officers
		• Water Quality Surveillance	Yearly	At district laboratories by the state level Environment cell
3	Ground Water Tables	• Need to be monitored in the schemes where ground water is the source of water supply.	Yearly	Independent consultant
		•		
		•		
		•		

Table 1.4: Performance Indicators for various Project Interventions / Components for Sewerage Scheme

Sr. No.	Project Intervention / Component	Performance Indicators	Frequency	Monitoring Agency
1	Sanitation	• Increased access of household to common sewerage / sanitation system.	Half Yearly	State Environment Specialist
2	Sewer Condition Assessment	• Interception chambers / manholes / leakage in sewers etc.	Yearly	GPWSC/SLC/Environmental officers
3	Influent Characteristics	• pH, BOD, COD, TSS, SAR, EC, RSC and Faecal coliform	Quarterly	GPWSC/SLC//Environmental officers
4	Effluent Characteristics	• pH, TSS, BOD, COD, SAR, EC, RSC and Faecal coliform	Quarterly	GPWSC/SLC/Environmental officers
5	Sludge quality and compost quality	• pH, BOD, COD, Sodium, potassium, nitrogen, phosphorous, alkalinity/acidity,	Six Monthly	GPWSC/SLC/Environmental officers

Sr. No.	Project Intervention / Component	Performance Indicators	Frequency	Monitoring Agency
		and heavy metals such as Cd, Ag, Zn and Cu.		
6	Industrial waste discharge	• Checking of pre-treatment of waste and its characteristics	Monthly	GPWSC/SLC/Environmental officers
7	Sewage flow measurement	• Check for leakages, additional flows if any	Daily	Operator/GPWSC/SLC/ Environmental Officers

Training and Capacity Building

The Training and Capacity Building programs has been proposed for the project, the aiming of this is building environmental awareness and environmental management capacity in the project administration structure as well as in the intended target communities.

Sr. No.	Training	Purpose of the Training	Participants	Duration	Resource Persons/Agencies
1	Introduction to Environmental Management in Proposed RWSS project including EMF	Filling of EDS, procedural & technical aspects of Environmental Assessment To equip with knowledge and skills necessary for undertaking environmental appraisal as per the requirements of the EMF. To undertake periodic supervision of environmental performance of schemes To prepare for planning and monitoring implementation of environmental mitigation measures identified through the appraisal process. To equip with skills necessary for water quality testing using the field testing kits under the community based system for water quality monitoring and surveillance.	Field Staff – EEs. SDEs & JEs) SEs, EEs, SDEs, Environmental Experts Lab Technicians	Orientation Workshop – 1 day at circle level	Services of the experts from outside agencies such as PPCB and its affiliated Training and Research Institute, National Productivity Council (NPC) Delhi/ ESCI, Hyderabad etc., may be engaged.
2	Training on Environment Management Framework	To equip with knowledge and skills necessary for undertaking environmental assessment, appraisal, practices, water quality testing as per the requirements of the EMF	SEs, EEs, SDEs, Environmental Experts	Training Programme – 5 days	Outside agencies such as National Productivity Council (NPC) Delhi/ ESCI, Hyderabad etc.,
3	Environmental Awareness and Sensitization	To build awareness on safe drinking water, water conservation, judicious use of water sources for competing demands, environmental	Environmental Staff/ GPWSC/SLC members	One day workshop at the village level One day workshop	

Sr. No.	Training	Purpose of the Training	Participants	Duration	Resource Persons/Agencies
		sanitation and personal hygiene.		organized annually Total training programs will be about 176 for the project duration.	
4	Orientation for Water Quality monitoring for PRIs	To build awareness on water quality monitoring amongst implementation agencies.	Field Staff – EEs. SDEs & JEs) Env.Staff , GPWSC/SLC members	One day training at the circle level One day training to be organized annually.	

Environmental Codes of Practices (ECoPs)

The details of relevant ECoPs for following activities are described in the report.

- Identification of Sources of Water Supply
- Site Selection for STP
- Identification of Quarry Sites / Borrow Areas
- Selection of location for Community Toilets
- Protecting Source water supply source and Ensuring its Sustainability
- Protecting Ground Water Supply Sources and Ensuring its Sustainability
- Selection of Safe Sanitation Technique Options at individual household and community level
- Solid & Liquid Waste Management at Individual Household and Community level
- Safe Sullage Disposal and Organic Waste Management
- Rain Water Harvesting Techniques
- Management of Water Supply System
- Rehabilitation of Construction sites / Supplementary Sites
- Schemes in Forest Areas
- Water Quality Monitoring and Surveillance
- Water and Waste Water Sampling Procedure
- Construction site management/ Labour Camp
- Occupational Health &Safety

1 Introduction

1.1 Background

The primary responsibility of providing drinking water and sanitation facilities in the country rests with the state governments. The Government of India supplements the efforts of State Governments by providing Financial Assistance under the centrally sponsored National Rural Drinking Water Programme (NRDWP) and Nirmal Bharat Abhiyan (NBA)now named as SBM (Swachh Bharat Mission). The Government of India had considered and approved a proposal to bring about a package of reforms in the rural water supply & sanitation sector to address major areas of concern namely, coverage of habitations, quality problems in drinking water and sustainability of sources and systems.

The Government of Punjab (GoP) has prioritized Rural Water Supply & Sanitation (RWSS) as a key area of its development agenda. Over the past few years, significant capital allocations to the RWSS sector have been made which indicates the high priority accorded to the sector by the State Govt. The GoP intends to scale up and consolidate the gains of the first project and progressively raise the water supply and community sanitation service standards and eventually raise the coverage of high service standards (such as 24x7 water supply, 100% coverage of households by piped water connections and phasing out of public taps, resolving water quality issues in affected villages and providing sewage and sullage management systems in rural areas of the state) by seeking the support from the World Bank for the second Punjab Rural Water Supply & Sanitation (PRWSS) project. The PRWSS-II Programme will be implemented in the rural areas of all the 22 districts of the Punjab State.

Though, this kind of project is not expected to cause any adverse environment impact; however, some key environmental concerns related to this project could be:

- Water quality issues
- Surface and ground water pollution
- Sewage disposal
- Environment sanitation

To contribute to the Environment Sustainability of the proposed project, an “Environment Assessment (EA)” study is to be done according to the World Bank’s Safeguard Policies. For this purpose, State Programme Management Cell has appointed Mott MacDonald Pvt. Ltd. for preparation of “Environment Assessment and Social Assessment Report” for 22 districts of Punjab state.

1.2 Scope of the Assignment

After understanding the components for Environmental Assessment (EA) and Environmental Management Framework (EMF) required by the SPMC, the following scope has been identified:

1. Analysis of the current environmental status and issues in the study area
2. Assess the policy, codes and standards, legal and regulatory requirements relevant to RWSS programme
3. Review of existing capacity and institutional arrangements for environmental management in the programme.
4. Prepare the environmental impact matrix with mitigation measures and performance indicators.

5. Update an Environmental Management Framework for the project districts.

1.3 Need of Environment Assessment and Environmental Management Framework

In order to improve the environmental health and hygiene in rural areas, it is a necessary to provide them with proper water supply and sanitation system. The proposed water supply and sanitation project is to provide good water quality and better hygienic conditions in the rural areas of 22 districts of Punjab state. The implementation of water supply and sanitation schemes is likely to result into varying level of environmental impacts that would also require supervision and monitoring.

The assignment is intended to provide assistance to the implementers in performing their duties for smooth implementation of the project. An EMF is to be updated which will be used by the Engineers as a ready reference to screen the project interventions, impact evaluation, and adopting the mitigation measures in the design stage itself. This will help not only the GP / implementing authority but also to the engineers who are involved in the preparation of various schemes.

1.4 Objectives of Environment Assessment

1. This EA & EMF is to provide detail guidance for providing environmentally safe and sustainable Rural Water Supply & Sanitation schemes, which will be taken up by the Department of Water Supply and Sanitation (DWSS), Punjab.
2. An Environmental Assessment (EA) to be conducted which would provide insight into the environmental challenges being faced by the water supply and sanitation facilities including source sustainability, water quality management, and household sanitation issues.
3. The EA and EMF to assist in implementation of the proposed RWSS schemes, against the possible potential environmental risks and impacts in its area of influence.
4. The EA & EMF to take into account the environment, human health and safety including the country's overall policy framework, national legislation, and institutional capabilities related to the environment obligations of the state pertaining to the project activities.
5. Environment assessment outcomes and mitigation measures to be implemented to rural communities, especially the poor, with respect to up-graded levels of water supply and sanitation services.

1.5 Scope of this Report

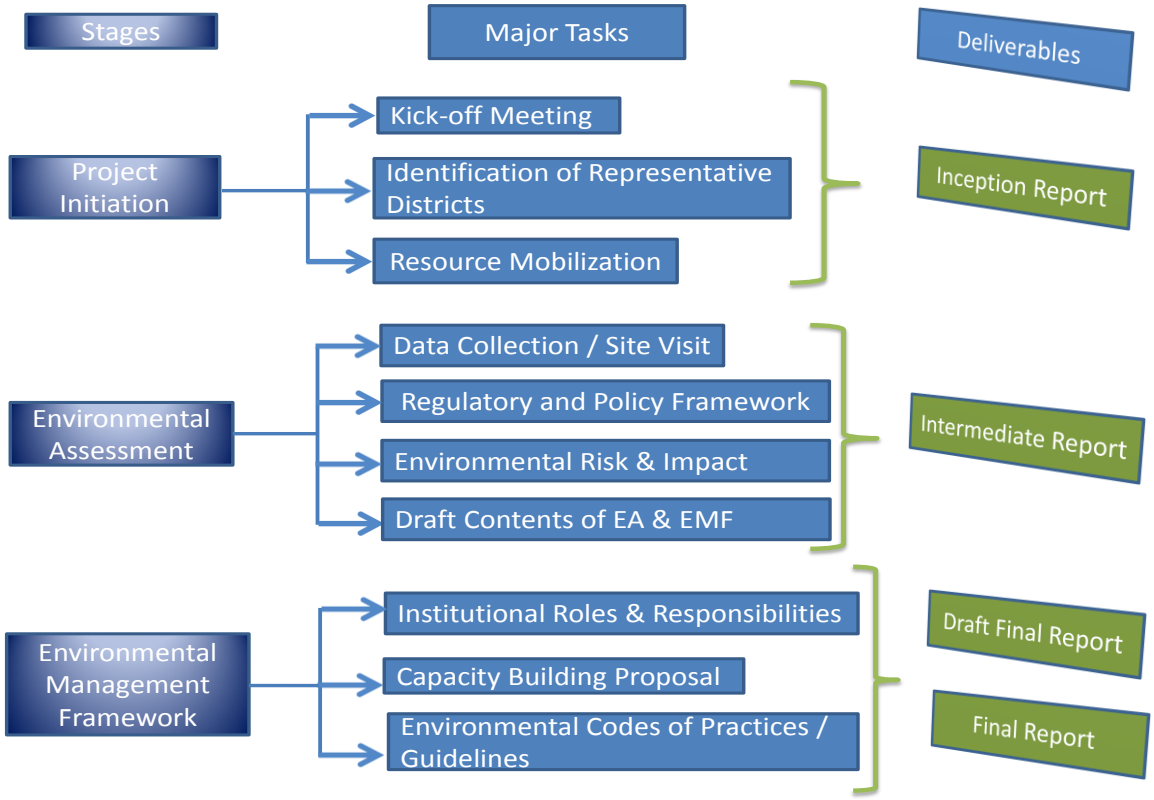
The 'Final Report – Updated Environment Management Framework' Report has been structured in the following chapters:

- Chapter 1 – Introduction; gives a brief description of the report discussing project background, objective of the project, scope of the project, need of environmental assessment and Methodology to be adopted.
- Chapter 2 – 'RWSS – Policy, Regulatory Framework, Missions and Programmes' discusses State RWSS vision, RWSS coverage in the State, relevant Laws / Acts, World Bank's safeguard policies, etc.
- Chapter 3 – 'Baseline Environmental Set' up gives existing Environmental set-up, overview of existing environmental conditions of the village and their issues, water resources, water quality, status of toilet construction, etc.

- Chapter 4 – 'Field Surveys & Study' presents Methodology of Field study, Analysis of people's perception and present status; Observations on the basis of field visit.
- Chapter 5 – Lessons Learned from the Past Project
- Chapter 6 – 'Environmental Concerns and Management Proposals' included key environmental issues & mitigation measures for water supply and sewerage schemes during pre-planning, construction and operation & maintenance phase.
- Chapter 7 – 'Environmental Management Framework' covers Objectives & key elements of EMF, Institutional Arrangement, Environmental Management Plan (EMP), Responsibility matrix, etc.
- Appendix A – Environmental Codes of Practices (ECoPs)
- Appendix B – Public Disclosure Workshop on Updated Environment Management Framework
- Appendix C – Environment Data Sheet at Preliminary Scheme Report
- Appendix D – Environment Data Sheet format for water supply and sewerage schemes for DSR stage
- Appendix E – Environment Audit Format for water supply schemes and sewerage schemes
- Appendix F – Environment Monitoring format for water supply schemes and sewerage schemes
- Appendix G – Terms of Reference for Environmental Staff
- Appendix H – Scope of Work for Environmental Audit
- Appendix I – Guidelines on Sanitary Survey for Water Supply Schemes
- Appendix J – Format for Declaration by Contractor / Consultant
- Appendix K – International Labour Organization Policy
- Appendix L – Punjab Pollution Control Board Notification

1.6 Methodology Adopted

Figure 1.1: Methodology Flow-chart for the Assignment



Source: Mott MacDonald

1.7 Progress Achieved

- Kick-off meeting with SPMC officials on 2nd September 2014
- Field visit conducted in six representative districts from 3rd September to 6th September 2014
- Inception Report submitted on 12th September 2014
- Meeting and discussion with SPMC officials on 16th& 17th September to chalk out the strategy for the assignment.
- Simultaneous Data Collection was conducted parallel to the above visits.
- Draft Table of Content for updated EMF was submitted via email on 29th September 2014.
- Intermediate Report was submitted on 1st October 2014 via email.
- Revised intermediate report submitted on12/11/2014
- Draft final report submitted on 28/10/2014.
- Revised draft final report submitted on 17/11/2014 via email.
- Presented Environment assessment and Environment management Framework in workshop organised by SPMC on 26/11/2014.
- Draft proceedings of workshop submitted on 27/11/2014 by email.

2 RWSS – Policy, Regulatory Framework, Missions and Programmes

2.1 State RWSS Vision

2.1.1 RWSS at National Context

The primary responsibility of providing drinking water facilities in the country rests with the State Governments. The Government of India supplements the efforts of State Governments by providing financial assistance under the centrally sponsored Accelerated Rural Water Supply Programme (ARWSP), now renamed as National Rural Water Drinking Programme (NRWDP). This programme has been under implementation since 1972-73. In 1986, the National Drinking Water Mission (later named as the Rajiv Gandhi National Drinking Water Mission in 1991) was launched and further in 1999, the Department of Drinking Water Supply was created and was conferred the status of Ministry in 2011.

With the 73rd and 74th Constitutional amendments, drinking water and sanitation were included in the list of subjects to be devolved to Panchayats. In 1999, Government had considered and approved a proposal to bring about a package of reforms in the rural water supply sector to address major areas of concern, namely, coverage of habitations, quality problem in drinking water and sustainability of sources and systems.

The focus of Government in the Ninth and Tenth Five Year Plan under the Rural Water Supply Programme was on coverage of habitations. Coverage in this context referred to providing water at a specific norm of 40 litres per day per capita with a source available within a walking distance of 1.6km in the plains or elevation of 100 metres in hilly areas.

The Twelfth Five Year Plan (2012-2017), Economic Targets, Volume II, targets to ensure 50 per cent of rural population has accessto 40 lpcd piped drinkingwater supply, and 50per cent *gram panchayat*s achieve Nirmal GramStatus by the end of Twelfth Five Year Plan. The Ministry has prepared a Strategic Plan for the rural drinking water sector for the period 2011 to 2022.

- To ensure that every rural person has enough safe water for drinking, cooking and other domestic needs as well as livestock throughout the year including during natural disasters
- By 2022, every rural person in the country will have access to 70 lpcd within their household premises or at a horizontal or vertical distance of not more than 50 metres from their household without barriers of social and financial discrimination.

2.1.2 Guidelines on National Rural Drinking Water Programme (NRDWP)

The Ministry of Drinking Water & Sanitation (MDWS) administers the National Rural Drinking Water Programme (NRDWP), through which the Central Government provides financial and technical support to supplement the efforts of states to provide adequate potable drinking water to the rural population. Rural drinking water supply is a state subject and has been included in the Eleventh Schedule of the Constitution among the subjects that may be entrusted to Panchayats by the states.

The NRDWP has the following objectives:

- To ensure provision of safe and adequate drinking water supply to all uncovered, partially covered and quality affected habitations in the rural areas of the country.
- To ensure that all schools and anganwadis have access to safe drinking water.
- To enable GPs/VWSCs to plan, manage, operate and maintain local water sources and water supply, to provide enabling support and environment for PRIs and local communities for this purpose.
- Enable rural communities to monitor and keep surveillance on their drinking water sources, water supply and initiate corrective action to have contaminants free water.
- Ensure equity – high priority in coverage/investment habitations with high SCs/STs and minority population.
- Promote participatory integrated water resources management with a view to ensure drinking water security – water availability, supply and consumption to be measured.
- Provide access to information through online reporting system with information in public domain to bring in transparency and informed decision making.
- Ensuring household level drinking water security through water budgeting and preparation of village water security plans.
- Consciously move away from high cost treatment technologies for tackling arsenic and fluoride contamination to development of alternative sources in respect of arsenic and alternate sources/dilution of aquifers through rainwater harvesting for tackling fluoride contamination.

The NRDWP guidelines mandate that the PRIs and the local community be involved at all stages from planning, implementation, operation and maintenance and monitoring of drinking water supply schemes. This is because drinking water security is best managed at the local level where attention is given to conservation of water, equity in distribution and usage addressed and immediate action taken for necessary repairs so that regular supply is assured.

In order to implement these processes, NRDWP proposes to establish the following structures:

2.1.2.1 Water and Sanitation Support Organization (WSSO)

In each state under the State Water and Sanitation Mission, to be staffed by consultants with expertise in IEC, HRD, Water quality, Monitoring & Evaluation (M&E), Hydrogeology, Sanitation & Hygiene.

2.1.2.2 District Water and Sanitation Mission (DWSM)

AT district level with consultants having expertise in IEC, HRD, Monitoring & Evaluation, Hydrogeology sanitation and hygiene. This will strengthen the rural water supply department and also facilitate effective convergence with related departments and schemes.

2.1.2.3 Block Resource Centre (BRC)

At the block level, for community mobilization for formation/activation of Village Water and Sanitation Committees (VWSC) and enhanced IEC activities for awareness generation, technical support and capacity building for Gram Panchayats (GPs) to enable them to fulfil their role in sustainable water supply

and sanitation, water quality monitoring and managerial aspects of operation and maintenance of the water supply systems. Each Block Resource Centre is to be staffed with one to four grass-root level workers.

2.1.3 Sector Reforms Project

Recognising that users of waters are its best managers, the Government approved grant of incentives to States for institutionalization of community participation in rural water drinking programme. Accordingly, Sector Reforms Project (SRP) were introduced in 67 selected districts in 1999 to address primarily issues and of system and source sustainability. Under the SRP, 86,769 schemes were taken up. These schemes were spread in 29,956 habitations of 65 districts in 25 states (the project did not take off in 2 districts of Sikkim). The salient features of SRP initiative were:

- Focus on village level capacity building
- Emphasis on awareness generation and training of all stakeholders
- 10% Capital cost sharing and 100% sharing of O&M cost by users
- Measures for sustained supply of water either through Rain Water Harvesting or Ground Water Recharge Schemes

Based on the experience gained, the Sector Reform Programme was expanded as the Swajaldhara Programme, under which the participation of the community in planning, implementation, operation and maintenance was a major factor.

2.1.4 Swajaldhara

On 25th December 2002, the reform initiative in the Rural Drinking Water Sector was scaled up throughout the country by launching the Swajaldhara by the Hon'able Prime Minister. Swajaldhara had two streams:

- Swajaldhara I – which will have Gram Panchayat as the lowest unit for implementing reform initiatives; and
- Swajaldhara II – which will have district as the unit for implementation.

Swajaldhara had certain fundamental reform principles as given below, which need to be adhered by the State Governments and Implementing agencies:

1. Full ownership of drinking water assets with appropriate level of Panchayat Raj institutions like single village scheme to Gram Panchayat and multi village scheme to zilla Parishad;
2. Partial Capital cost sharing either in cash or kind including labour or both, 100% responsibility of Operation & Maintenance by the users;
3. An integrated service delivery mechanism;
4. Community participation based on empowerment of villagers to ensure their full participation in the project through a decision making role.

2.1.5 Total Sanitation Campaign (TSC)

Individual health and hygiene is largely dependent on adequate availability of drinking water and proper sanitation. There is, therefore, a direct relationship between water, sanitation and health. Consumption of unsafe drinking water, improper disposal of human excreta, improper environment sanitation and lack of personal and food hygiene have been major causes of many diseases in developing country like India. It

was in this context that the Central Rural Sanitation Programme (CRSP) was launched in 1986 primary with the objective of improving the quality of life of the rural people and also to provide privacy and dignity to women. The concept of sanitation apart from disposal of human excreta includes solid and liquid waste disposal, food hygiene, personal, domestic as well as environmental hygiene. The CRSP was restructured in the 1999 to move towards a "Demand Driven" approach. This revised approach titled "Total Sanitation Campaign (TSC)" emphasises more on Information, Education and Communication (IEC), Human Resource Development, Capacity Development activities to increase awareness among the rural people and generation of demand for sanitary facilities. The main objectives of TSC are as under:

1. To bring an improvement in general quality of life in rural areas.
2. Accelerate Sanitation coverage in villages
3. Motivate communities and PRIs to promote awareness and health education.
4. Encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation.
5. Develop community managed environmental sanitation systems focusing on solid & liquid waste management.

2.1.6 Nirmal Bharat Abhiyan (NBA)

Nirmal Bharat Abhiyan is a comprehensive programme to ensure sanitation facilities in rural areas with broader goal to eradicate the practice of open defecation by 2019. NBA gives strong emphasis on Information, Education and Communication (IEC), Capacity Building and Hygiene Education for effective behaviour change with involvement of PRIs, NGOs etc. The main purpose of NBA is as given below:

1. To cover all schools and anganwadis with toilets
2. Eliminate manual scavenging
3. Eradicate the practice of open defecation
4. Clean Environment
5. Improve the general quality of life in rural areas

2.1.7 Swachh Bharat Mission

Swachh Bharat Mission (Campaign Clean India) is a national level campaign by the Government of India covering 4041 statutory towns to clean the streets, roads and infrastructure of the country. This campaign aims to accomplish the vision of 'clean India' by 2nd October 2019, 150th Birthday of Mahatma Gandhi and is expected to cost over Rs. 62,000 crores. The campaign is described as "beyond politics" and "inspired by patriotism."

The concept of Swachh Bharat is to pave access for every person to sanitation facilities including toilets, solid and liquid waste disposal systems, village cleanliness and safe and adequate drinking water supply.

2.2 Regulatory and Policy Framework

2.2.1 National Policies and Regulations

Rural water supply is a state focus under the Constitution of India. However, states are guided by policies and guidelines enunciated by Government of India. These include:

1. 73rd Constitutional Amendment
2. The National Water Policy of 2002
3. The Environment Protection Act, no. 29 of 1986
4. Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988
5. Water (Prevention and Control of Pollution) Cess Act No 36 of 1977
6. Forest (Conservation) Act No. 69 of 1980 as amended in 1988
7. The Wildlife (Protection) Act 1972 as amended in 1991
8. EIA Notification of 2006

Table 2.1: Environment Acts

The Environment (Protection) Act No. 29 of 1986	Under this act, the central government is empowered to take measures necessary to protect and improve the quality of the environment by setting standard for emissions and discharge; regulating the location of industries; management of hazardous wastes, and protection of public health and welfare.
EIA Notification of MoEF 2006	All projects listed under Schedule-I of the notification require environmental clearance from the MoEF. Water supply and sanitation projects however are not covered in the schedule.
The Municipal Solid Wastes (Management and Handling) Rules, 2000.	Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

Table 2.2: Water Acts

Water (Prevention and Control of Pollution) Act, 1974 (Central Act 6 of 1974) as amended in 1988	This act prohibits the discharge of pollutants into water bodies beyond a given standard and lays down penalties for non-compliance.
Water (Prevention and Control of Pollution) Cess Act No. 36 of 1977	This act provides for a levy and collection of a cess on water consumed by industries and local authorities. It aims at augmenting the resources of the central and state boards for prevention and control of water pollution.

Table 2.3: Environment Tribunal/Authority Act

The National Environment Appellate Authority Act, 1987	An Act to provide for the establishment of a National Environment Appellate Authority to hear appeals with respect to restriction of areas in which any industries, operations or processes or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards under the Environment (Protection) Act, 1986 and for matters connected therewith or incidental thereto.

Table 2.4: Forest and Wild Life Acts

Forest (Conservation) Act No. 69 of 1980 and amended in 1988	This act restricts the powers of the state in respect of de-reservation of forests and use of forestland for non-forest purposes.
The Wildlife (Protection) Act 1972, Amendment 1991	This act provides for protection to listed species of flora and fauna in the declared network of ecologically important protected areas such as wild life sanctuaries and national parks.
The Indian Forest Act, 1927	The Act consolidate and reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce.

2.2.1.1 73rd Constitutional Amendment

The 73rd Constitutional Amendment designates PRIs as providers of basic services to rural communities which include drinking water and sanitation.

2.2.1.2 National Water Policy 2002

The aspects of the National Water Policy that impact rural water supply systems are given below:

- Water is a scarce and precious national resource to be planned, developed and conserved as such, and on an integrated and environmentally sound basis, keeping in view the needs of the State concerned.
- Water should be made available to water scarcity areas by transfer from other areas including transfers from one river basin to another, based on a national perspective, after taking into account the requirements of the areas/ basins.
- Water resource development projects should, as far as possible, be planned and developed as multipurpose projects. Provision for drinking water should be a primary consideration.
- The study of the impact of a project, during construction and later, on human lives; settlements, occupations, economic and other aspects should be an essential component of the project planning.
- In the planning, implementation and operation of projects, the preservation of the quality of environment and the ecological balance should be a primary consideration. The adverse impact, if any, on the environment should be minimized and should be offset by adequate compensatory measures.

- There should be an integrated and multidisciplinary approach to the planning, formulation, clearance and implementation of projects, including catchment treatment and management, environmental and ecological aspects, the rehabilitation of affected people and command area development.
- Special efforts should be made to investigate and formulate projects either in or for the benefit of areas inhabited by tribal or other specially disadvantaged groups such as Scheduled Castes and Scheduled Tribes and other weaker sections of society.
- In the planning and operation of systems, water allocation priorities, drinking water should have first priority.
- There should be a close integration of water use and land use policies.

2.2.2 State Policies and Regulations

Punjab Water Supply and Sanitation Department is primarily entrusted with the responsibility of providing safe drinking water to the rural population and execution of sanitation works. Policy on Rural Drinking Water programme aims to provide every rural person with adequate water for drinking, cooking and other domestic needs on a sustainable basis.

2.2.2.1 The Punjab Irrigation and Drainage Authority Act, 1997

Main objectives of this act was - to establish the Punjab Irrigation and Drainage Authority to implement the strategy of the Government of Punjab for streamlining the Irrigation and Drainage system; to replace the existing administrative set up and procedures with more responsive, efficient and transparent arrangements; to achieve economical and effective operation and maintenance of the irrigation, drainage and flood control system, etc.

2.2.2.2 Punjab State Water Policy Draft, 2008

The state water policy envisions that available water resources should be utilized efficiently and judiciously to meet drinking water needs and irrigation requirements in a manner that also promotes its conservation and engenders community participation. It also outline the fact that the quality of surface water and ground water as well as soil shall be monitored for improvement to bring it up to the standards fixed by State Pollution Control Board.

Water Supply and Sanitation in state of Punjab is guided by the following State Acts / Laws presented in the table below:

Table 2.5: Punjab State Acts / Laws

Sr. No.	Act / Law	Scope of Act / Law
1	The Punjab Panchayati Raj Act, 1994	Greater Participation of the people and more effective implementation of rural development and Panchayati raj system
2	The Punjab State Tube Well Act, 1954	To provide for the construction improvement

Sr. No.	Act / Law	Scope of Act / Law
		and maintenance of the State Tube Wells Irrigation works in Punjab

Source: punjabrevenue.nic.in, International Environmental Law Research Centre

2.2.2.3 Punjab State Rural Water Supply & Sanitation Policy 2014

The Department of Water Supply and Sanitation (DWSS) has been implementing and managing rural drinking water supply schemes in the state. As on date, there are 8,319 single village and multi village water supply schemes in the state, majority of which are either tube well based or canal based. Further, according to 2011 census data, there is a significant change in decreasing open defecation percentage in Punjab, and sanitation coverage of approximately 70%, there are no sanitation facilities for around 30% of rural households. Those who do not have access to toilet, practice open defecation which not only results in degraded sanitation situation but also contaminates shallow ground water.

Realizing the need for institutional and investment reforms in the rural water supply and sanitation sector, Government of Punjab has reworked its rural water supply and sanitation policy to address these issues, which affect quality of service and its sustainability. Major objectives of this policy are given in the table below:

Table 2.6: Objectives of Punjab State Rural Water Supply & Sanitation Policy 2014

Sr. No.	Objectives	Key Feature of each objective
1	Water coverage	To provide 100% coverage of all households in rural areas of Punjab with at least 70 lpcd of potable water, supplied through 24x7 piped and metered individual water supply connections.
2	Sanitation coverage	To ensure that 100% of rural households have access to and use safe sanitation facilities that do not contaminate the environment, particularly ground water.
3	Hygiene	To ensure that 100% of rural households practice safe personal hygiene practices, especially hand washing at critical times, to minimize risks of water related diseases.
4	Sustainable water supply	To ensure the availability, quality and sustainability of domestic water supplies by: • Conserving existing water sources • Improving the efficiency of existing schemes • Using all possible options of water treatment as per requirement • Developing new and sustainable water sources.
5	Water regulation	To regulate the use of water, using institutional and legal means, so as to provide adequate water to all users.

Sr. No.	Objectives	Key Feature of each objective
6	Environmental sustainability	To improve the quality of life and environment through the effective and efficient management of water services.
7	User participation	To ensure effective participation of users in developing, operating and maintaining water supply services and to empower them to manage their own water supply and environmental sanitation services.
8	Institutional capacity	To improve institutional capacity and human resources of government departments to provide efficient, effective and sustainable water and sanitation services.

2.2.3 The World Bank Safeguard Policies

The below table describes the relevant safeguard policies of the World Bank, which will be applicable in this project:

Table 2.7: World Bank Safe-guard Policies

Policy	Key Features of Policy
OP 4.01 / BP 4.01 – Environment Assessment	• To ensure, Project is environmentally sound and sustainable • Project's potential environmental risks and impacts evaluation • Takes into account Natural Environment, Health & Safety, Social Aspects & global environment aspects.
OP / BP 4.04 – Natural Habitats	• Prohibits financing of projects involving "significant conversion of natural habitats unless there are no feasible alternatives." • Requires environmental cost benefit analysis. • Requires EA with mitigation measures.
OP 4.09 – Pest Management	• Pest populations are normally controlled through biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest. • Controlling pests primarily through environmental methods. Where environmental methods are not effective, the bank may finance the use of pesticides for control of disease vectors. • No activity will support use of pesticides or related activity, hence policy is not triggered.
OP 4.10 / BP 4.10 – Indigenous Peoples	• Mission of Poverty reduction and sustainable development • On the basis of the social assessment and in consultation with the affected Indigenous people's communities, prepare and "Indigenous Peoples Plan". • Applies to project that might adversely affect indigenous

Policy	Key Features of Policy
	people or when they are targeted beneficiaries
OP 4.36 / BP – Forests	• To harness the potential of forests • To protect the vital local environmental services and values of forests • Some of the schemes taken up under the Project will be located in forest areas. Assessment procedures and mitigation measures have been put into place through the EMP in accordance with the approval of the Forest Department and guidelines for compensatory afforestation. • The most important natural habitats in Punjab are in Urban areas, not in rural areas. The state has a history of intensive agriculture for hundreds of years, and most landscapes were severely modified. There are areas which could be termed as sacred groves, but these are also areas that are not populated, and rural water supply do not come anywhere near any of these. • The forest patches which exists in the state are legal forests, although not rich in bio-diversity – but necessitates recognition of the legal forest issues and rights. • The project will –in order of priority – first try to make the current sources and supplies more efficient; then might tap some additional ground water, and as the last resort try to tap some water from the irrigation canals (where water is fully allocated already) or seepage. The project does not intent to drain any river (even if the rivers could be termed as natural habitats).
OP/BP 7.50 – Projects on International Waterways	• Covers riparian waterways that form boundary between two or more states, as well as any bay, gulf, strait or channel bordered by two or more states. • Applies to dams, irrigation, flood control, navigation, water, sewerage and industrial projects. • Requires notification, agreement between states, detailed maps, and feasibility surveys. • The proposed project falls within the exception to the riparian notification requirement under Paragraph 7(a) of OP/BP 7.50.
BP 17.5 – Disclosure of Information	• Whenever the Bank requires an Environmental Assessment (EA), the proposed borrower prepares an EA report as a separate, free-standing document. The EA report is publicly available after the borrower has made the draft EA report available at a public place accessible to project affected groups and local NGOs in accordance with OP/BP 4.01 and after such EA report has been officially received by the Bank, but before the bank begins formal appraisal of the project. • If the borrower objects to disclosure of an EA report for a

Policy	Key Features of Policy
	project proposed for IDA financing, the bank discontinues project processing. • If the borrower objects to disclosure of an EA report for a project proposed for IBRD financing, the issue of further processing is submitted to the Executive Directors for consideration.

Basis of Exception to OP 7.50:

Exception to Riparian Notification

As indicated at the outset, rural water supply, drainage and sanitation activities will be carried out in the watersheds of the Sutlej, Ravi and Beas rivers, or their tributaries, which are part of the Indus basin. With regard to ground water sources, this project will not finance any new bore wells as the state has achieved 100% water supply coverage already. All the villages in Punjab have water supply schemes. The project will result in a net reduction in 'ground water extraction' for drinking water in rural Punjab.

The project will finance activities aimed at improved efficiency and service delivery as described in the three components, including through the replacement of existing groundwater schemes with surface water supply. As shown in the table below, the state of Punjab already has an existing scheme of canals and distributaries for surface water with a total stretch of approximately 14,500 km.

Sr. No.	Name of the Canal	Length of the Canal in km.	Capacity of Canal in Cusecs	Off-taking Point	Cultivable Area in Ha.
1	Sirhind Canal		12,620	Ropar Headwork	13.59 Lacs
2	Bhakra Main Line (Extension of Nangal Hydel Channel)	164	12,500	Nangal Barrage D/s of Bhakra Dam	
3	Narwana Branch	98	4500	Off-takes from Bhakra Main Line	
4	Bist Doab Canal	805	1452	Right bank of Sutlej river U/S of Ropar Headwork	1.99 Lacs
5	Upper Bari Doab Canal	3119	9000	Madhopur Head-works	5.73 Lacs
6	Rajasthan Feeder (Exclusively for Rajasthan)	149.53	18500	Harike Head-works	

Sr. No.	Name of the Canal	Length of the Canal in km.	Capacity of Canal in Cusecs	Off-taking Point	Cultivable Area in Ha.
7	Ferozepur Feeder	51.30	11192	Harike Head-works	
8	Sirhind Feeder	136.50	5264	Off-takes from Ferozepur feeder	3.6 Lacs
9	Eastern Canal	8.02	3197	Hussainiwala Head-works	2.16 Lacs
10	Makhu Canal	92.8	292	Harike Head-works	20,600
11	Shah Nehar Canal	24.23	875	D/s of Pong Dam	0.33

According to Indus Treaty (1960), all the waters of eastern rivers are for the unrestricted use of India and all the waters of western rivers are for the unrestricted use of Pakistan and the discharges in the rivers shall be regularly monitored by both the countries. For the supply of drinking water from surface water source based schemes, a feasibility study is being done and under this study, only eastern rivers with their extensive canal network, which are meant for the use of India, are only considered. The proposed project takes up the schemes formulated based on the surface water sources, i.e., the eastern rivers allocated for the use of India and the canals originating from the dams on these rivers (i.e., the Sutlej, the Beas and the Ravi) only. There will not be any interference with the waters in western rivers allocated for the use of Pakistan.

On the basis of a feasibility study that was conducted in six districts by the Drinking Water Supply and Sanitation Department of Government of Punjab, 20 schemes have been formulated covering 4005 villages. These will be supplied with drinking water from surface sources primarily, the Pong dam on the Beas River as well as a number of Headworks and dams on the Sutlej River. In total, an ultimate water demand of 956.54 MLD is expected for the 4005 villages. This requirement of water works out to be approximately 0.45% of the identified surface water sources (rivers and canals), which is quite marginal and does not affect the current water requirement for irrigation or the downstream flows of the rivers. The Proposed project will consider some of the schemes conceived in the feasibility study on priority basis as per the need.

Taking into account the project's focus on improved efficiency and service delivery for already existing water supply and sanitation schemes in Punjab, it is the Team's assessment that the proposed activities will (i) not adversely change the quality or quantity of water flows to the other riparians, and (ii) will not be adversely affected by the other riparians' possible water use. Thus, the exception to the riparian notification requirement under paragraph 7(a) of OP 7.50 applies and no notification will be required.

Table 2.8: World Bank Safeguard Policies – Applicability to this Project

Safeguard Policies triggered by the project	Yes / No
OP 4.01 / BP 4.01 – Environment Assessment	Yes
OP / BP 4.04 – Natural Habitats	No
OP 4.09 – Pest Management	No
OP 4.10 / BP 4.10 – Indigenous Peoples	No
OP 4.36 / BP – Forests	Yes
OP/BP 7.50 – Projects on International Waterways	Yes. But, the proposed project falls within the exception to the riparian notification requirement under Paragraph 7(a) of OP/BP 7.50.
BP 17.5 – Disclosure of Information	Yes

2.3 State Sector Institutions

Punjab has one nodal department for rural water supply and sanitation, while four other institutions have a converging impact on water supply and sanitation. These institutions are as under:

1. Nodal Institution
   a. Department of Water Supply and Sanitation
2. Converging Institutions
   a. Rural Development and Panchayat Department
   b. Department of Irrigation
   c. Department of Agriculture
   d. Punjab Pollution Control Board

Functions and objectives of all these institutions are discussed in below sections:

2.3.1 Nodal Institution: Department of Water Supply and Sanitation

The Public Health Department of the state has been renamed as the Department of Water Supply and Sanitation (DWSS). DWSS is responsible for the following activities:

- The department endeavours to provide safe drinking water and sanitation facilities to rural habitations on sustainable basis;
- To ensure permanent drinking water security in rural areas;
- To promote conjunctive use of ground water, surface water and rain water harvesting to achieve sustainability;
- To involve rural community in planning and execution of rural water supply schemes and to make the community capable of operation & maintenance of schemes on their own;

- To improve rural hygiene by providing individual toilets and sewerage system;
- To encourage the rural population to properly manage water supply and sanitation facilities to make villages Nirmal Gram;

Besides this, the department has been educating and imparting guidance to the public regarding water quality monitoring and surveillance; create awareness about the water borne diseases and other health hazards caused due to lack of sanitation and open defecation.

2.3.2 Converging Departments

2.3.2.1 Department of Rural Development and Panchayats

The rural development department is primarily carrying out the activities for provision of individual household latrines. The Panchayat department is responsible for provision of open drainage and pavements, lining of paths, building of schools, community halls etc. in rural areas.

2.3.2.2 Department of Irrigation

The Department of Irrigation is responsible for:

- Designing and construction of all the dams, reservoirs and barrages;
- Construction and maintenance of canals and drains, macro and micro hydel projects;
- Lining of the existing channels and water courses;
- Flood control interventions;
- Regulation of the flow of waters in rivers and canals;
- Control of water logging in the affected areas.

The surface water / canal based schemes of the DWSS are critically dependent upon the water transmission and distribution network of canals under the Department of Irrigation.

2.3.2.3 Department of Agriculture

The Department of Agriculture oversees all agriculture related activities in the state. It is also responsible for monitoring shallow ground water levels.

2.3.2.4 Punjab Pollution Control Board

Punjab Pollution Control Board was constituted under the Water (Prevention Control of Pollution) Act, 1974. Headquartered at Patiala, it is a regulatory authority for implementing various pollution control laws. The main functions of the Board can be summarized as under:

- To inspect industrial plants and manufacturing process, sewage or trade effluents plants or any control equipment for the treatment of sewage and trade effluent;
- To review plans and specification for installation of effluent treatment plants or air pollution control devices;
- To issue consents for installation and operation of industrial plants, etc.

2.4 Some of the major externally funded projects taken up by GoP – Rural Water Supply and Sanitation

2.4.1 Punjab Rural Water Supply and Sanitation – Assisted by World Bank

The scope of work in the project finalized by World Bank after assessing the status of completed and on-going rural water supply schemes and new projects sanctioned by NABARD etc. was coverage of 739 Not Covered (NC) villages and 2,422 Partially Covered (PC) villages at a cost of INR1,280 crores. Up-to February'2014, total 1240 villages have been covered under IDA SWAP programme, against a coverage target of 1200 villages under the PRWSS project. Villages being covered with IDA Finance have a high percentage of private connections. 100% houses have been covered with water supply connections in 295 villages, 70-99% connections have been provided in 541 villages and in 404 villages where no. of connections are less than 70%. IEC and HRD specialists posted in DPMCs are making efforts to increase the number of water connections by creating awareness and conducting capacity building trainings of GPWSCs. The state has made substantial progress in installation of reverse osmosis plants for drinking water by installing them in 1811 villages.

Community sanitation scheme implementation has commenced in 98 villages against the target of 100 villages. Due to non-availability of land for sewage treatment plant two villages selected for sewerage have been dropped.

The scope of works of this project is as under:

- Service improvement of existing water supply schemes in 223 villages
- Implementation of sewerage schemes in 100 villages on pilot basis along with rejuvenation of village ponds
- Metering of water supply schemes in 6 villages on pilot basis.
- Up-gradation of 3 water testing laboratories.

The project comprises of three components namely, Programme Management, Community Development and Infrastructure Building.

3 Baseline Environment Status

3.1 State at a Glance

Punjab is a state endowed with rich culture, tradition, religion and acknowledged for its self-dependence, self-reliance and glory. It is located in the North-Western region of India and is bounded on the west by Pakistan, on the north by Jammu and Kashmir, on the North East by Himachal Pradesh and on the south by Haryana and Rajasthan. Its area of 50,362 km^2 lies between latitudes 29.30° North to 32.32° North and longitudes of 73.55° East to 76.50° East.

The state is subdivided into three parts namely Malwa, Majha and Doaba. Malwa is a region south to river Sutlej. This region constitutes majority of the region in the state with 11 districts and comprises of cities like Ludhiana, Bathinda, Rupnagar, Sangrur, Patiala, Mansa, Ferozepur, Fazilka, Moga and Mohali, whereas Majha embrace modern districts of Amritsar, Pathankot, Gurdaspur and Tarn Taran and lastly Doaba is one of the most fertile region between the rivers Beas and Sutlej and was the centre of the Green Revolution in India, includes bigger cities such as Jalandhar, Hoshiarpur, Adampur, Nawansher, Kapurthala and Phagwara.

Table 3.1: District Information

Sr. No.	District Name	Latitude	Longitude	Population	Geographical Area (Sq. Km.)
1	Jalandhar	31°19' N	75°34 E	2,181,753	2,632
2	Amritsar	31.35° N	74.59° E	2,490,891	2,647
3	Barnala	30.38° N	75.55° E	596,294	1,410
4	Gurdaspur	31.55° N	75.15° E	2,299,026	3564
5	Kapurthala	31.22° N	75.23° E	817,668	1,633
6	Hoshiarpur	31.35° N	75.59° E	1,582,793	3,365
7	SBS Nagar	31.80° N	76.7° E	614,362	1,267
8	Fatehgarh Sahib	30.38° N	76.23° E	599,814	1,180
9	Ludhiana	30.53° N	75.51° E	3,487,882	3,767
10	Moga	30.20° N	75.20° E	992,289	2,216
11	Firozpur	30.56° N	74.37° E	2,026,831	5,303
12	Sri Muktsar Sahib	30.69° N	74.21° E	902,702	2,615
13	Faridkot	30.54° N	75.25° E	618,008	1,469
14	Bathinda	30.36° N	75.46° E	1,388,859	3,385
15	Mansa	29.59° N	75.23° E	768,808	2,171
16	Patiala	30.47° N	76.54° E	1,892,282	3,218
17	Tarn Taran	31.27° N	74.55° E	1,120,070	2,449
18	Rup Nagar	30.97° N	76.51° E	683,349	1,369

Sr. No.	District Name	Latitude	Longitude	Population	Geographical Area (Sq. Km.)
19	SAS Nagar	30.70° N	76.72° E	986,147	1,093
20	Sangrur	30.23° N	75.83° E	1,654,408	3,610
21	Pathankot	This District came out of Gurdaspur district in 2011 and is 22nd District of Punjab			
22	Fazilka	This District came out of Firozpur district and is 21st District of Punjab			

Source: Census 2011 for Population, Geographical Area is based on www.pbplanning.gov.in

3.2 Physical Environment

3.2.1 Location

Punjab is situated in the North-West of India and is bordered by Pakistan on the West, the Indian states of Jammu and Kashmir on the North, Himachal Pradesh on its North-east and Haryana and Rajasthan to its South. The state is spread over an area of 50,362 sq. km. which is 1.54% of the country's total geographical area.

According to 2011 census, the total population of state is 2.77 Crores out of which male population is 1.46 crores and the female population is 1.31 crores. There are 12,581 villages and 143 towns. The administrative structure of the state consists of 4 divisions, 22 districts and 142 blocks.

3.2.2 Geo-morphology

Most of Punjab is a fertile plain. Towards the southeast the land is semi-arid and desert landscape, whereas a belt of undulating hills extends along the northeast at the foot of the Himalayas.

About 90% of the area of the state is occupied by Quaternary alluvium. In the remaining part, tertiary formations outcrop as Shiwalik hill ranges in north-eastern part of the state. The alluvial plains have been formed by the fluvial deposits of the Ravi, the Beas and the Satluj rivers. The Quaternary formations are represented by alluvial deposits, which are part of Indo-Gangetic alluvial system. The Quaternary deposits are divided into:

1. Piedmont deposits occurring along a narrow belt along the Shiwalik, commonly known as "Kandi";
2. Alluvial Plains;
3. Aeolin deposits occurring in the south-western part of the State;
4. An intermountain valley at Anandpur Sahib of Rupnagar District.

3.2.3 Ecologically Sensitive Areas

There are 12 wildlife sanctuaries duly notified in the State. The total area under these sanctuaries is 32,370.64 ha. The important features of these protected areas are given in Table 3.2.

Table 3.2: Wildlife Sanctuary Falling within 22 districts of Punjab

Sanctuary	Location, District	Area of Sanctuary in ha	Predominant Species
Bir Moti Bagh Wildlife Sanctuary	Patiala – Dakola Road, Patiala	654	Black Buck, Chital, Hog Deer, Blue Bull, Wild Boar, Jackal, Rhesus Monkey, Peafowl, Brahminy Myna, Black & Grey Partridges
Bir Gurdialpura Wildlife Sanctuary	Patiala-Samana-Shatrana Road, Patiala	620.53	Wild Boar, Blue Bull, Jungle Cat, Jackal, Hog Deer, Rhesus Monkey, Peafowl, Black & Grey Partridges, Dove etc.
Bir Bhunerheri Wildlife Sanctuary	Patiala-Devigarh Road, Patiala	661.66	Hog Deer, Blue Bull, Porcupine, Black Buck, Sambar, Jungle Cat, Jackal, Rhesus Monkey, Peafowl, Black & Grey Partrides, Dove
Bir Mehas Wildlife Sanctuary	Nabha-Malerkotla Road,	123.43	Rhesus Monkey, Jungle Cat, Peacock, Blue Bull, Jackal, Black and Grey Partridges
Bir Dosanjh wildlife Sanctuary	Nabha-Jorepul Road	517.59	Blue Bull, Jungle Cat, Jackal, Rhesus Monkey, Peafowl, Black & Grey Partridges
Bir Bhadson Wildlife Sanctuary	Nabha-Bhadson-Gobindgarh Road, Patiala	1,022.63	Blue Bull, Jungle Cat, Jackal, Rhesus Monkey, Peafowl, Black & Grey Partridges, Hare, Spotted owlet
Bir Aishwan Wildlife Sanctuary	Sohian road, Sangrur	264.40	Blue Bull, Jungle Cat, Jackal, Rhesus Monkey, Peafowl, Black & Grey Partridges, Hare, Spotted Owlet
Abohar Wildlife Sanctuary	Abohar City, Ferozepur	18,650	Black Buck, Blue Bull
Harike Wildlife Sanctuary	Kot Isa Khan – Harike Road, Amritsar	8,600	Large Cormorant, Darter, Purple Moorhen, Bar-headed Goose, Pintail, Common Teal, Pigeon, Shoveller, Common Pochard, Red Crested Pochard
Takhni Rehmapur Wildlife Sanctuary	Hoshiarpur – Mehengrowal Road, Hoshiarpur	382	Barking Deer, Pangolin, Python, Hog Deer, Jungle Cat, Jackal, Mongoose, Wild Boar, Rat Snake, Kalij Pheasant
Jhajjar Bahauli Wildlife Sanctuary	Anandpur Sahib City, Rupnagar	116	Sambar, Barking Deer, Hare, Jackal, Python, Cobra, Rat Snake, Leopard
Kathlaur Kushlian Wildlife Sanctuary	Amritsar-Jammu Highway, Pathankot	758.40	Different Ungulates and Deer

Source: Department of Forests and Wildlife Preservation, Punjab, www.pbforests.gov.in

3.2.4 Forests Cover

The state of Punjab shares the national vision of sustainable management of forests to meet the needs of present and future generations. This vision has the following characteristics:

- The total area under the forest and tree cover is increased through afforestation and land-use diversification;
- The forest resources are well protected and managed to retain their integrity and bio-diversity using modern technologies and scientific knowledge;
- The forest resources are managed in an eco-sensitive and sustainable manner to optimize all types of benefits to the society.

Table 3.3: District-wise Forest Cover in Punjab 2013 Assessment (Area in Sq.km.)

		Total Forest Area				
District	Geographical Area	Very Dense	Moderate Dense	Open Forest	Total	Percentage of Geographical Area
Amritsar	2647	0	15	30	45	0.88
Tarn Taran	2449					
Bathinda	3,385	0	13	34	47	1.39
Faridkot	1,469	0	4	18	22	1.51
Fatehgarh Sahib	1,180	0	3	0	3	0.25
Ferozepur	5,303	0	5	24	29	0.49
Fazilka	This District came out of Ferozepur district and is 21st District of Punjab					
Gurdaspur	3,564	0	94	92	186	5.24
Pathankot	This District came out of Gurdaspur district and is 22nd District of Punjab					
Hoshiarpur	3,365	0	343	345	688	20.44
Jalandhar	2,632	0	1	9	10	0.38
Kapurthala	1,632	0	2	9	11	0.67
Ludhiana	3,767	0	33	35	68	1.81
Mansa	2,171	0	1	5	6	0.27
Moga	2216	0	0	11	11	0.65
Sri Muktsar Sahib	2,615	0	7	14	21	0.81
SBS Nagar	1,267	0	25	86	111	8.76
Patiala	3,218	0	38	53	91	2.49
Rupnagar	1,369	0	146	245	391	15.88
SAS Nagar	1093					
Sangrur	3,610	0	6	26	32	0.62
Barnala	1410					
Total	**50,362**	**0**	**602**	**1036**	**1772**	**3.52**

Source: www.pbforests.gov.in

3.2.5 Climate and Rainfall

The Punjab climate is determined by the extreme hot and extreme cold conditions. The mean monthly temperature in June is 42°C and mean minimum temperature in January is 4.7°C. The region lying near the foot hills of Himalayas receive heavy rainfall whereas the region lying at a distant from the hills, the rainfall is scanty and the temperature is high.

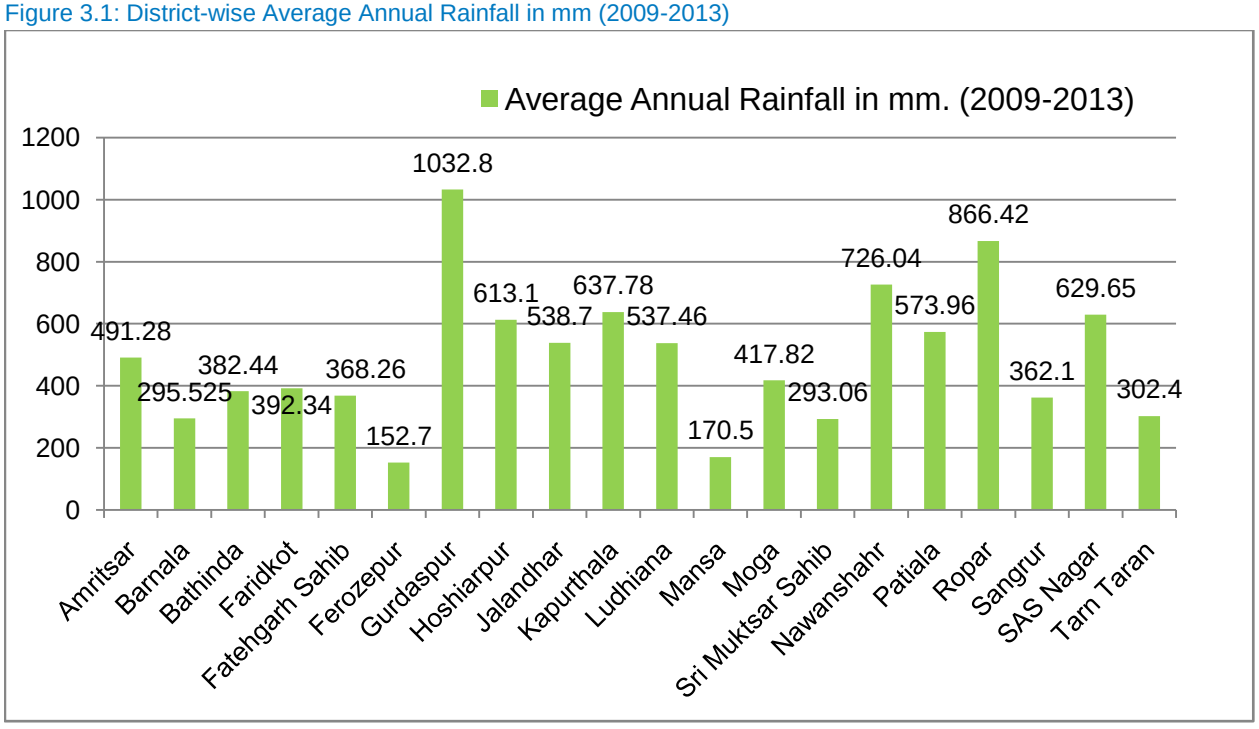
Punjab climate comprises of three seasons:

- Summer months that spans from mid April to the end of June
- Rainy season is from the months of early July to end of September.
- Winter season is experienced during the months of early December to the end of February.

Summer in Punjab actually commences from mid April. But the temperature starts rising from February onwards. The summer months are followed by the rainy seasons. Generally, the rainy season in Punjab begins in the first weeks of July; rainfall ranges from 250mm to 1000mm. The monsoon is brought by the monsoonal winds blowing over the Bay of Bengal.

The post monsoonal transitional season remains quite fair and dry. In the post winter transitional season, hail storms and brief showers occur which causes damage to the crops. The district-wise average annual rainfall for the period (2009-2013) is given in Figure 3.1.

Figure 3.1: District-wise Average Annual Rainfall in mm (2009-2013)



Source: IMD Website, Mott MacDonald

3.2.6 Demographic Status

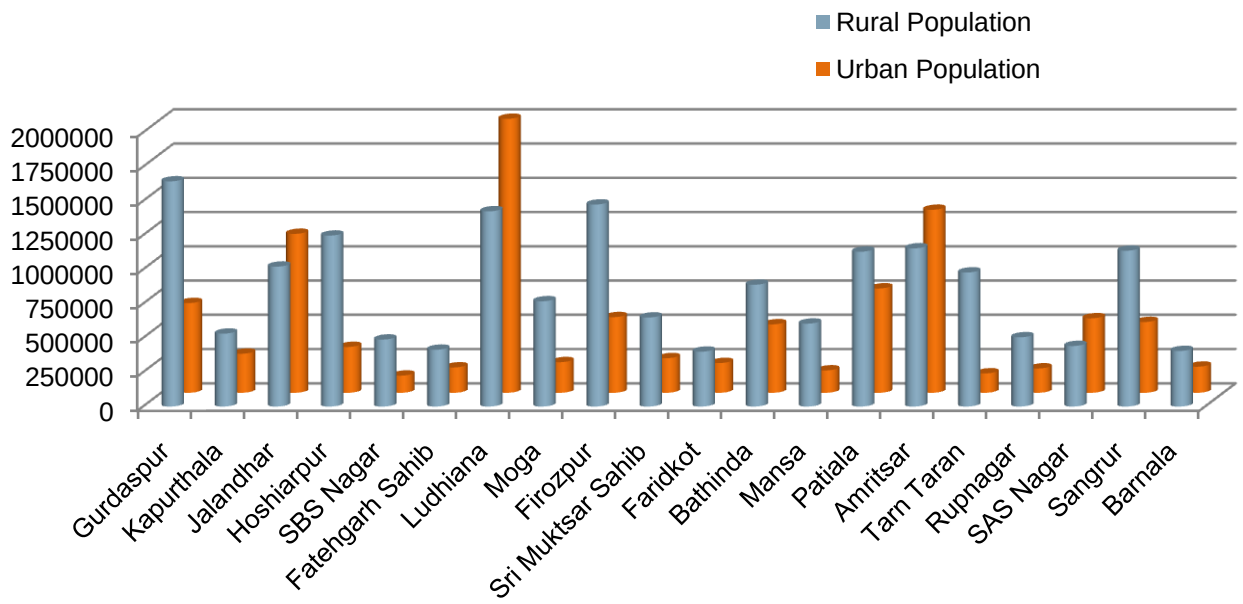
Punjab is the only state in India with a majority of Sikh Population. As per details from Census 2011, Punjab has a population of 2.77 Crores, an increase from figure of 2.43 Crores in 2001 census. Total population of Punjab as per 2011 census is 2,77,04,236 of which male and female are 1,46,34,819 and 1,30,69,417 respectively. In 2001, total population was 2,43,58,999 in which males were 1,29,85,045 and females were 1,13,73,954. Of the total population of Punjab state, around 62.51% live in the rural areas. In actual numbers, males and females were 90,86,466 and 82,30,334. Total rural population of the state as per 2011 census is 1,73,16,800. The rural population growth rate in decade (2001-2011) is 7.98% while in previous decade (1991-2001) it was 12.96%. The Total population growth rate in decade (2001-2011) is 13.73% while in decade (1991-2001) it was 20.10%. In rural areas of Punjab state, female sex ratio per 1000 males was 906 while same for the child (0-6 age) was 843 per 1000 boys. In Punjab, 18,65,019 children (0-6 age) lives in rural areas, which forms 10.77% of total rural population. In rural areas of Punjab, literacy rate for male and female stands at 77.92% and 66.47% respectively. Total literates in rural areas were 1,11,95,395.

Table 3.4: District-wise Rural Population in Punjab (Census 2011)

Sr. No.	District	Total No. of Households	Persons	Males	Females
1	Gurdaspur	3,11,353	16,43,882	8,58,429	7,85,453
2	Kapurthala	1,07,370	5,32,296	2,75,420	2,56,876
3	Jalandhar	2,13,157	10,21,388	5,23,390	4,97,998
4	Hoshiarpur	2,63,705	12,47,969	6,32,251	6,15,718
5	SBS Nagar	1,02,491	4,88,857	2,49,182	2,39,675
6	Fatehgarh Sahib	78,498	4,14,649	2,19,831	1,94,818
7	Ludhiana	2,79,426	14,25,201	7,52,685	6,72,516
8	Moga	1,46,750	7,68,499	4,05,793	3,62,706
9	Ferozepur	2,76,024	14,74,592	7,75,601	6,98,991
10	Sri Muktsar Sahib	1,23,732	6,50,004	3,42,495	3,07,509
11	Faridkot	76,526	4,00,494	2,11,036	1,89,458
12	Bathinda	1,70,817	8,88,943	4,75,070	4,13,873
13	Mansa	1,16,682	6,05,356	3,22,466	2,82,890
14	Patiala	2,13,190	11,30,279	5,98,239	5,32,040
15	Amritsar	2,13,921	11,54,831	6,08,303	5,46,528
16	Tarn Taran	1,75,932	9,78,611	5,15,291	4,63,320
17	Rupnagar	97,419	5,05,529	2,63,818	2,41,711
18	SAS Nagar	84,663	4,42,112	2,36,684	2,05,428
19	Sangrur	2,16,801	11,37,633	6,04,462	5,33,171
20	Barnala	76,521	4,05,675	2,16,020	1,89,655
21	Pathankot	This District came out of Gurdaspur district in 2011 and is 22nd District of Punjab			
22	Fazilka	This District came out of Ferozepur district and is 21st District of Punjab			

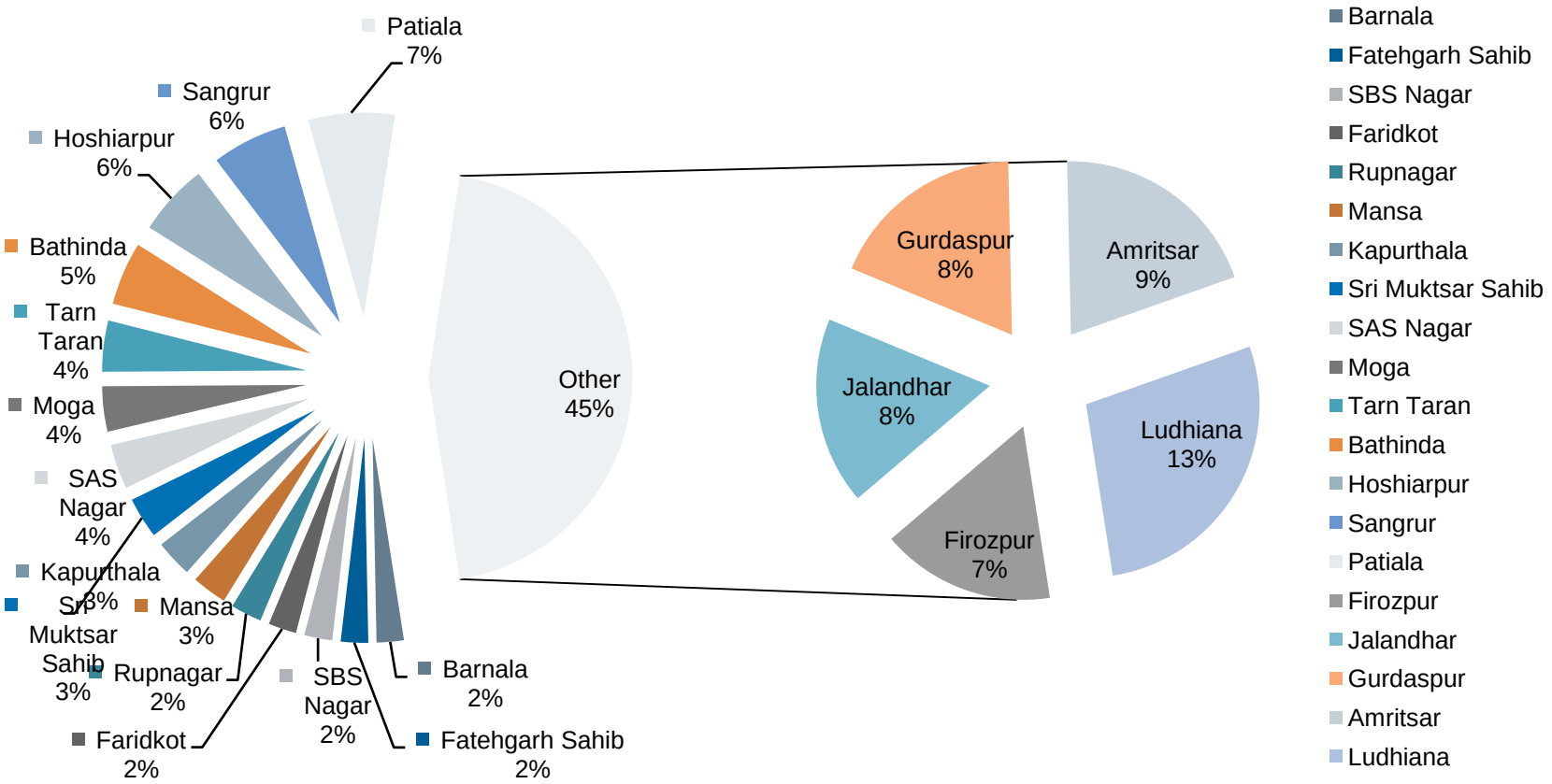
Source: Total No. of Households from Censusindia.gov.in, Persons – Males – Females from Director of Census Operations, Punjab

Figure 3.2: District-wise Graph showing Urban & Rural Population



Source: Census of India 2011, Mott MacDonald Analysis

Figure 3.3: Graph Showing Percentage wise Distribution of Total Population across all Districts



Source: Census of India 2011 Data, Mott MacDonald Analysis

3.2.7 Livestock

Livestock plays an important role in the rural economy of the State. The contribution of the livestock sector in the Net State Domestic Product is about 13%. The state government is providing highest priority for the removal of poverty and creation of self-employment opportunities to the rural masses. Animal Husbandry activities have attained importance as they create self-employment opportunities as well as subsidiary occupation to the weaker section of the society. The main objectives of the department are as under:

- To improve the genetic potential of the livestock through scientific breeding;
- To provide efficient and effective health cover to the livestock wealth of the state;
- To provide improved feeding and management practices;
- To provide effective extension services in the field of animal husbandry.

Table 3.5: District-wise Livestock Population in Punjab (as per 18th Livestock Census, 2007)

District	Cows		Total	Buffaloes	Pigs	Dogs	Rabbits	Poultry	Sheep	Goat	Horses	Donkeys	Camels
	CB	Desi	Total										
Gurdaspur	116222	26831	143053	281394	412	18882	932	3041500	4325	10641	3769	354	28
Amritsar	87910	13884	101794	298007	820	25911	290	271645	8183	11265	2473	643	20
Tarn Taran	69648	4885	74533	291105	646	21112	608	514348	11992	15640	1443	1493	5
Kapurthala	51792	1482	53274	140947	353	6563	593	244545	297	4007	722	22	2
Jalandhar	110909	9621	120530	248965	728	23499	144	2885075	2452	13964	1114	44	1
Nawansher	38320	2677	40997	131071	269	6943	50	115364	387	4801	316	43	0
Hoshiarpur	100494	26009	126503	232945	633	23604	0	629149	1063	15288	1240	446	0
Ropar	27514	8181	35695	154894	744	9854	29	735003	262	6630	371	60	4
SAS Nagar	17491	9962	27453	147806	2796	8363	23	2558060	6036	6331	437	165	36
Ludhiana	116047	37429	153476	505091	4822	44671	314	2836507	4832	15493	2573	219	7
Ferozepur	120173	63850	184023	392107	668	16606	535	176082	54266	32701	1820	396	827
Faridkot	31546	15654	47200	125968	291	9820	145	107134	7295	11430	1367	43	30
Moga	65452	26509	91961	244527	1069	19493	488	122143	5324	10594	2301	113	5
Sri Muktsar Sahib	62241	33895	96136	147270	466	14761	159	388961	21803	27370	2766	230	103
Bathinda	54465	51007	105472	274028	1038	23303	76	247450	29746	39301	2001	212	864
Mansa	18440	37234	55674	233097	781	13176	8	216980	18599	18410	1227	117	182
Patiala	62275	30620	92895	337356	4131	17339	10	726655	13732	13837	1237	185	2
Fatehgarh Sahib	38052	4955	43007	147601	1116	0	58	628498	995	5783	316	6	1
Sangrur	49657	73238	122895	486333	2699	16781	70	1172262	14600	21202	1630	86	59
Barnala	19502	24849	44351	181260	730	9821	39	1282330	4482	7785	848	41	38
Total	1258150	502772	1760922	5001772	25212	330502	4571	18899691	210671	292473	29971	4918	2214

Source: Animal Husbandry, Government of Punjab

3.2.8 Agriculture

Out of total geographical area of Punjab State, about 4.23 million hectare area is under cultivation. Agriculture is a way of life. About 75% of its population depends directly on agriculture.

It has shaped the thought, outlook, culture and economic life of people. Since the advent of Green Revolution, the State has made rapid strides in agricultural production. The progressive, hard-working and enterprising farmers were the first in the country who readily accepted and introduced high yielding hybrid varieties of wheat and rice. The startling facts of rich agriculture are given below:

1. The cropping intensity increased from 126% to 176% during the period 1965-66 to 2004-05.
2. Area under wheat has increased by 216% whereas the production by 756%.
3. Area under rice has increased by 895% and the production by 3307%

The state has played prominent role by achieving self-sufficiency in food grains by contributing 60% wheat and 40% rice to the central pool.

Table 3.6: District wise Land-use Pattern in Punjab (2006-07), Area in Thousand hectares

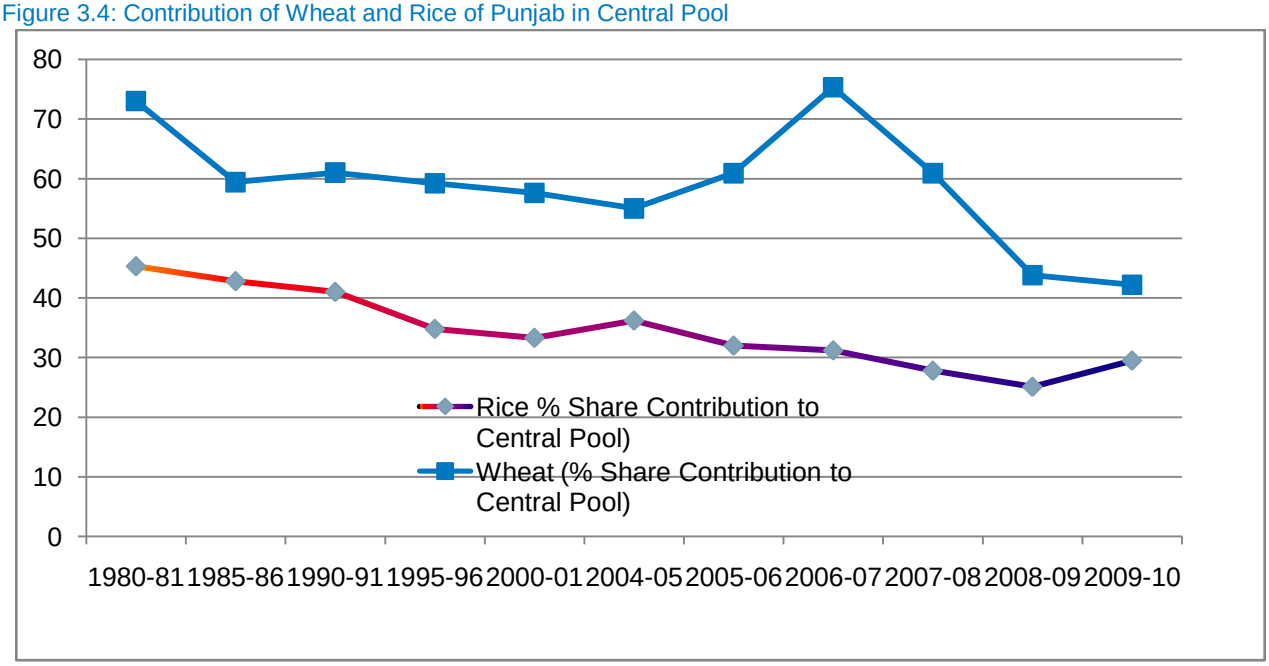
District [1]	Geographical Area	Area under Forest	Land put to Non-Agricultural Use	Culturable Waste	Fallow Land	Net Area Sown	Total Cropped Area
Gurdaspur	356.4	186	21	-	-	288	512
Pathankot	This District came out of Gurdaspur district and is 22nd District of Punjab						
Amritsar	264.7	45	31	Less than 500 Ha.	Less than 500 Ha.	222	424
Tarn Taran	244.9		18	-	-	218	404
Kapurthala	163.2	11	29	Less than 500 Ha.	-	136	275
Jalandhar	263.2	10	21	-	-	239	418
Nawansher	126.7	111	11	1	-	95	178
Hoshiarpur	336.5	688	28	Less than 500 Ha.	-	201	355
Rupnagar	136.9	391	14	1	-	78	141
SAS Nagar	109.3		15	-	-	75	119
Ludhiana	376.7	68	52	-	-	305	580
Ferozepur	530.3	29	38	-	-	476	873
Fazilka	This District came out of Ferozepur district and is 21st District of Punjab						
Faridkot	146.9	22	17	-	-	128	254
Sri Muktsar Sahib	261.5	21	14	2	-	227	449

[1] During 2006-07, total no. of districts were 20 and hence other two districts are not included in this table.

District [1]	Geographical Area	Area under Forest	Land put to Non-Agricultural Use	Culturable Waste	Fallow Land	Net Area Sown	Total Cropped Area
Moga	221.6	11	22	-	-	195	371
Bathinda	338.5	47	32	-	-	297	555
Mansa	217.1	6	14	-	-	190	360
Sangrur	361	32	38	Less than 500 Ha.	-	315	624
Barnala	141		13	Less than 500 Ha.	Less than 500 Ha.	124	240
Patiala	321.8	91	36	-	1	273	536
Fatehgarh Sahib	118	3	11	-	-	102	193

Source: ENVIS Centre, Punjab

Figure 3.4: Contribution of Wheat and Rice of Punjab in Central Pool



Source: ENVIS Centre, Punjab & Mott MacDonald Analysis

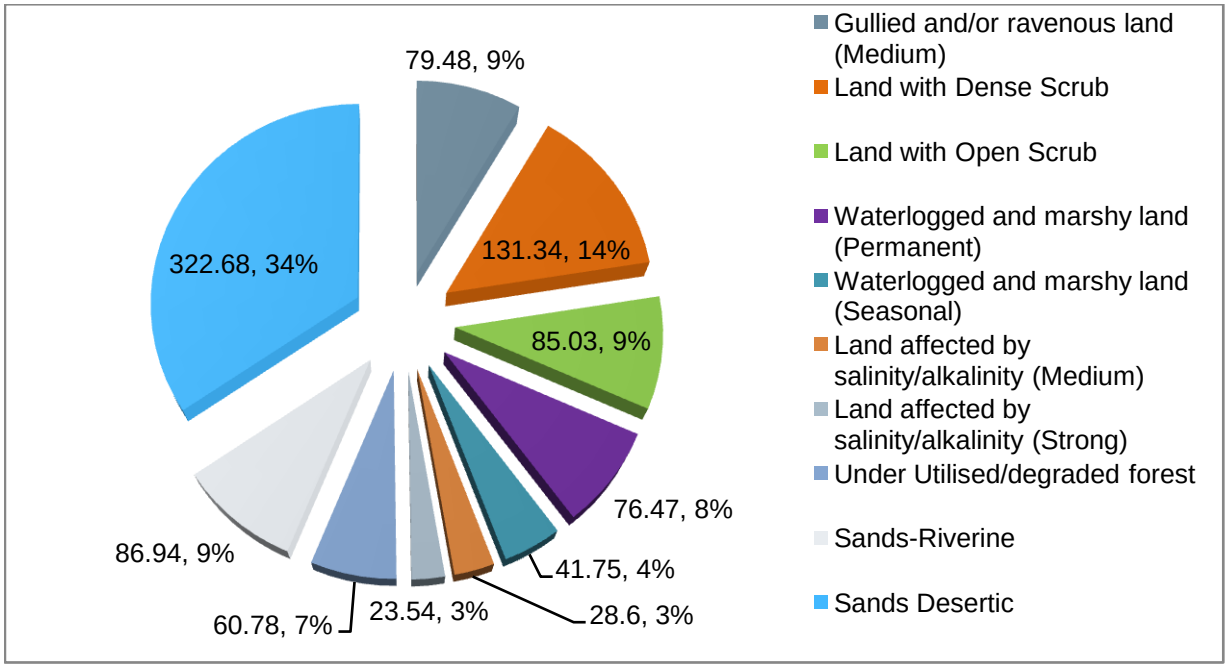
3.2.9 Land Degradation

Land is the most valuable asset blessed by nature and is prime resource for survival of mankind. Demand for land is ever increasing for agriculture, housing, industrial growth and communications. This resource is degraded due to soil erosion, salinity/alkalinity, water logging, depleting underground water, deforestation, removal of natural vegetation, frequent use of heavy machinery, improper crop rotation etc.

Land degradation may be physical, chemical and biological in nature. Each of these types has different processes responsible for decline in land quality and productivity.

- Only 1.86% (936.61 Sq.km.) of total area of the state is under various categories of wastelands.
- Ferozepur has the highest area (117.95 sq.km.) of wastelands followed by Bathinda (116.83 sq.km.), Hoshiarpur (112.45 sq.km.) and Sri Muktsar Sahib (110.88 sq.km.).

Figure 3.5: Percentage Area under Various Categories of Degraded / waste lands in Punjab



Source: Mott MacDonald Analysis

Table 3.7: District-wise Distribution of Wastelands (Area in Sq. km.)

District	Gullied and/or ravenous land (Medium)	Land with Dense Scrub	Land with Open Scrub	Waterlogged and marshy land (Permanent)	Waterlogged and marshy land (Seasonal)	Land affected by salinity/alkalinity (Medium)	Land affected by salinity/alkalinity (Strong)	Under Utilised/degraded forest	Sands-Riverine	Sands Desertic	Total
Amritsar	0.90	8.94	0.51	0.99	1.53	0.79	0.19	0.00	3.02	0.00	**16.87**
Barnala	0.00	0.00	0.00	0.05	0.06	0.00	0.00	0.00	0.00	11.20	**11.31**
Bathinda	0.00	0.00	0.17	0.00	0.00	1.60	0.20	0.00	0.00	114.86	**116.83**
Faridkot	0.00	0.00	1.50	0.56	1.41	0.66	0.49	7.47	0.00	5.41	**17.5**
Fatehgarh Sahib	0.00	0.02	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.32**
Ferozepur	0.00	6.72	4.83	4.09	2.50	4.83	13.88	0.00	14.42	66.68	**117.95**
Gurdaspur	17.66	6.89	2.08	27.45	12.62	0.20	0.00	8.34	11.30	0.00	**86.54**
Hoshiarpur	4.67	42.33	9.88	3.39	5.84	0.11	0.00	24.93	21.30	0.00	**112.45**
Jalandhar	0.00	0.00	0.98	0.11	0.00	0.01	0.11	0.00	2.35	1.03	**4.59**
Kapurthala	0.00	6.04	1.59	4.39	1.64	0.24	0.94	0.00	0.66	0.48	**15.98**
Ludhiana	0.00	1.41	0.45	0.84	0.62	0.00	0.00	0.00	7.65	3.00	**13.97**
Mansa	0.00	0.00	0.00	0.00	0.72	0.04	0.00	0.00	0.25	52.81	**53.82**
Moga	0.00	0.00	0.88	0.00	0.00	0.12	0.00	0.00	0.76	1.45	**3.21**
Sri Muktsar Sahib	0.00	0.00	4.11	32.17	14.14	6.81	7.28	0.00	0.00	46.37	**110.88**
Nawansher	22.05	3.93	4.92	0.02	0.00	0.00	0.00	2.48	4.38	0.00	**37.78**
Patiala	0.00	3.99	3.10	0.00	0.08	3.83	0.01	1.02	0.05	3.98	**16.06**
Rupnagar	13.03	28.52	31.75	2.07	0.00	0.00	0.00	13.57	9.85	0.00	**98.79**
Sangrur	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	15.28	**15.32**
SAS Nagar	10.74	16.14	17.25	0.00	0.55	9.12	0.01	2.78	0.24	0.00	**56.83**
Tarn Taran	10.43	6.41	0.73	0.34	0.00	0.24	0.43	0.19	10.71	0.13	**29.61**
Total	**79.48**	**131.34**	**85.03**	**76.47**	**41.75**	**28.6**	**23.54**	**60.78**	**86.94**	**322.68**	**936.61**

Source: Wasteland Atlas of India 2011

3.3 Disasters

3.3.1 Flood

A major part of geographical area of the state is prone to floods although substantial part has been protected through flood control measures. Nevertheless, the protected area also faces risk, although in reduced magnitude, because of possibility of flood in case of failure of protection works.

History suggest that, high to very high damage from flood to a large number of houses and medium risks to many houses in the protected area from the consideration of possibility of failure of flood control works in extreme floods. As per records, about 62,000 houses are damaged due to floods annually on an average. The maximum damage of 6,27,000 houses was reported in floods of 1955.

Apart from the state govt. Bhakra Beas Management Board is the focal organization in-charge of management of flood related aspects in the state. Detailed study of flood problem of particular areas, drainage problem and systematic maintenance of embankments are some vital aspects for disaster mitigation in the state.

In Punjab, damages due to floods are caused mainly by the river Ravi, Sutlej and Ghaggar, which have a common delta where floodwaters intermingle, and when in spate simultaneously, wreaks considerable havoc. The problem is further accentuated when flood synchronises with high tide.

3.3.2 Drought

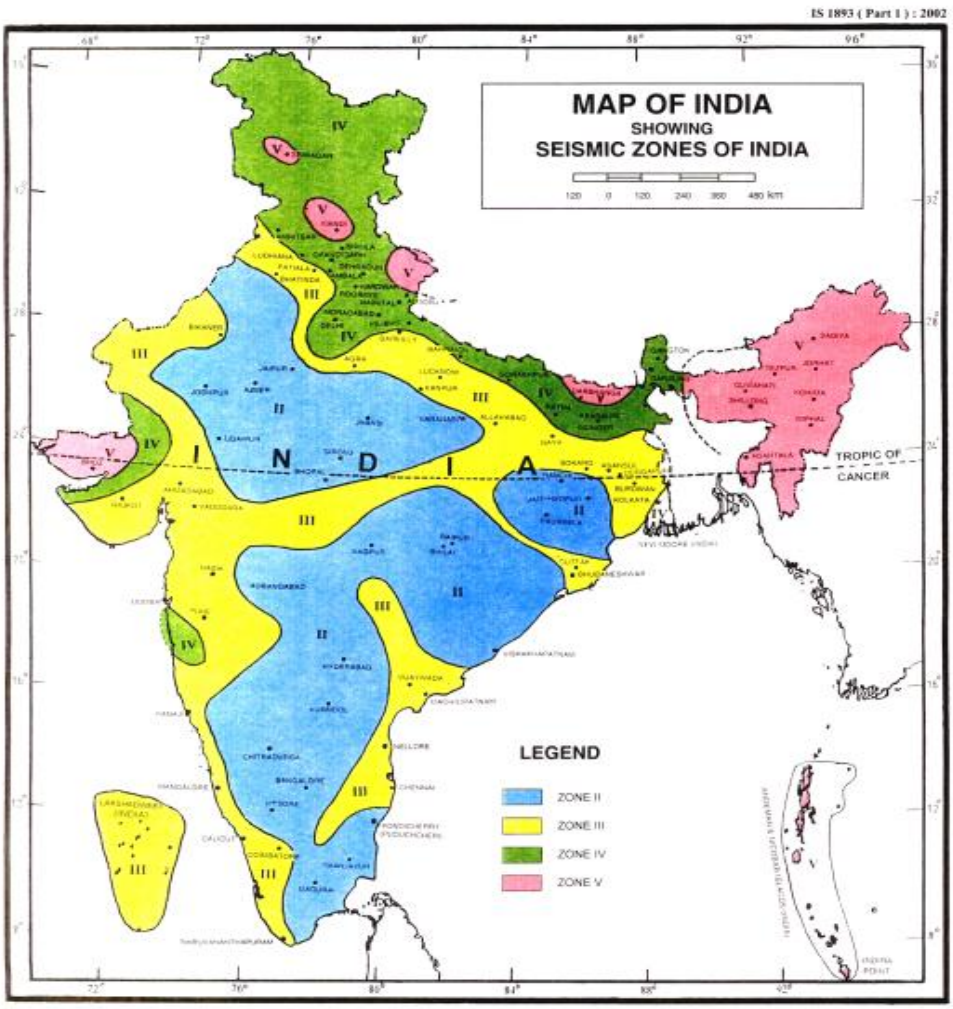
Punjab have experienced drought due to inadequate rain in monsoon. The state has experienced drought in 1978, 1979, 1985, 1987, 2002 and 2004, both in rural and urban areas. In 1987, a major drought was experienced in the state but in 2002, the intensity of the drought has made the situation much more acute and has broken the back of the farming community. At that point of time, the State Government declared all the 17 districts in the state as drought affected.

The primary cause of drought includes low rainfall. However, other factors may also contribute to drought conditions including land degradation and an increase in water demand.

3.3.3 Earthquake

Based on tectonic features and records of past earthquakes, a seismic zoning map of India has been prepared by a committee of experts under the Bureau of Indian Standards. The seismic zone map is revised with only four zones, instead of five. Erstwhile Zone I has been merged to Zone II and hence Zone I does not appear in the new zoning; only Zones II, III, IV and V do.

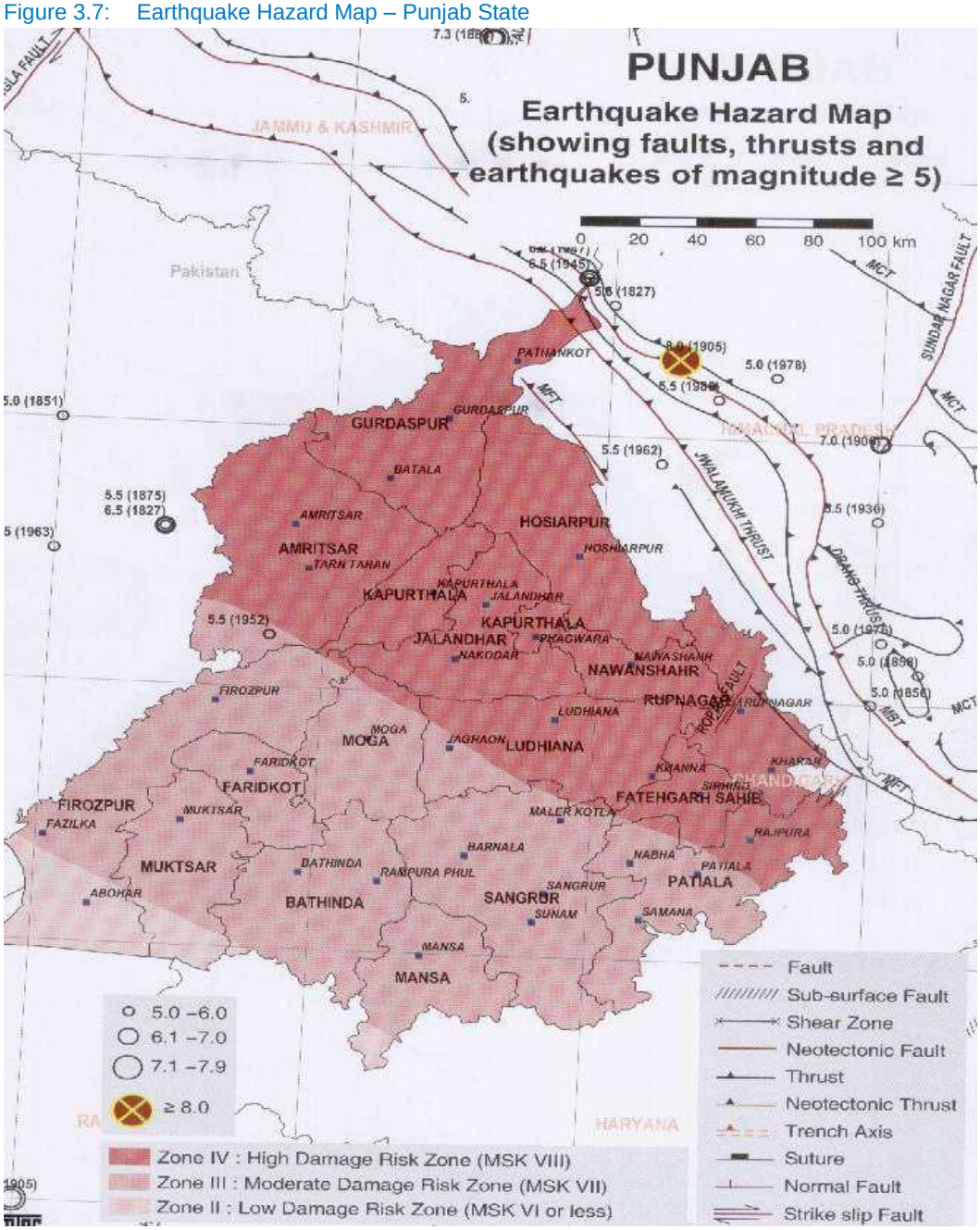
Figure 3.6: Seismic Zones of India



Source: IS 1893: Part I, 2002

In this seismic zoning map, most of the area of Punjab state lies in Zone III and IV. However, northern boundary of Punjab state with Himachal Pradesh is in close proximity to Zone V.

Figure 3.7: Earthquake Hazard Map – Punjab State



Source: National Disaster Management Authority

From the map given above, it is seen that about 50% of the area of the state in the north, consisting of Amritsar, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Patiala and Rup Nagar districts is liable to intensity VIII and about 45% could have intensity VII.

Table 3.8: Magnitude & Intensity Relationship

Magnitude (Richter Scale)	Description	Mercalli Intensity / MSK
Less than 2.0	Micro	I
2.0-2.9	Minor	I to II
3.0-3.9		
4.0-4.9	Light	II to IV
5.0-5.9	Moderate	IV to VI

Magnitude (Richter Scale)	Description	Mercalli Intensity / MSK
6.0-6.9	Strong	VI to VIII
7.0-7.9	Major	VII to X
8.0-8.9	Great	VIII or Greater
9.0 and Greater		

Source: Wikipedia

Districts coming under Moderate Risk Zones: Ferozepur, Fazilka, Faridkot, Moga, Sri Muktsar Sahib, Bathinda, Mansa, Sangrur and Patiala

Districts coming under Low Damage Risk Zones: Amritsar, Tarn Taran, Kapurthala, Gurdaspur, Pathankot, Jalandhar, Hoshiarpur, Ludhiana, Nawansher, Rupnagar and Fatehgarh Sahib

3.4 Water Resources

3.4.1 Surface Water

Punjab, the name derived from the Persian words, Punj (five) and ab (water) is a land of five rivers which formed part of Indus basin till 1947. After partition of the country, India's rights of usage was restricted to only three Eastern rivers namely Satluj, Ravi and Beas, the three western rivers (Indus, Chenab and Jhelum) were earmarked for exclusive usage of Pakistan.

The canal systems of entire Punjab state comprises of following:

- The main canals from river Satluj are Anandpur Hydel Channel and Bhakhra Main Line (BML). BML further bifurcates into Narwana branch and Bhakhra main branch.
- At Ropar Head-works two main canals, Sirhind canal and Bist Doab canal originates.
- At Harike Head-works, Satluj feeds water to Rajasthan feeder canal and Ferozepur feeder canal.
- The Bikaner canal originates at Hussainiwala Head-works
- Main canal originates from Beas at Shah Nehar Barrage called Shah Nehar canal or Mukerian Hydel channel.
- The major irrigation canal originating from Ravi at Madhopur Head-works is Upper Bari Doab Canal.

The total stretch of canals and distributaries including minors in Punjab state is approximately 14,500 km. with Canal Network of Punjab is presented in Table 3.9.

Table 3.9: Canal Systems in Punjab

Sr. No.	Name of the Canal	Length of the Canal in km.	Capacity of Canal in Cusecs	Off-taking Point	Culturable Area in Ha.
1	Sirhind Canal		12,620	Ropar Headwork	13.59 Lacs
2	Bhakra Main Line (Extension of Nangal Hydel Channel)	164	12,500	Nangal Barrage D/s of Bhakra Dam	
3	Narwana Branch	98	4500	Off-takes from Bhakra Main Line	
4	Bist Doab Canal	805	1452	Right bank of Sutlej river U/S of Ropar Headwork	1.99 Lacs
5	Upper Bari Doab Canal	3119	9000	Madhopur Head-works	5.73 Lacs

Sr. No.	Name of the Canal	Length of the Canal in km.	Capacity of Canal in Cusecs	Off-taking Point	Culturable Area in Ha.
6	Rajasthan Feeder (Exclusively for Rajasthan)	149.53	18500	Harike Head-works	
7	Ferozepur Feeder	51.30	11192	Harike Head-works	
8	Sirhind Feeder	136.50	5264	Off-takes from Ferozepur feeder	3.6 Lacs
9	Eastern Canal	8.02	3197	Hussainiwala Head-works	2.16 Lacs
10	Makhu Canal	92.8	292	Harike Head-works	20,600
11	Shah Nehar Canal	24.23	875	D/s of Pong Dam	0.33

Source: Department of Irrigation, Punjab

The state also has 12 natural and 9 manmade wet lands covering area of more than 14,000 ha. Three of these wetlands – Harike, Kanjli and Roopnagar are recognised as wetlands of international importance, and hence classified as Ramsar sites. The list of major natural and manmade wetlands are presented in Table 3.10&Table 3.11.

Table 3.10: Natural Wetlands in Punjab

Name of Wetland	Nearest Town	District	Area in Ha.
Jastarwal Jheel	Jastibwal / Ajnala	Amritsar	135
Aliwal Kotli	Aliwal / Arnala	Amritsar	25
Bareta	Bareta	Mansa	50
Chawariam – Banghar – Chhamb	Kanuwan / Banghar	Gurdaspur	315
Keshopur – miani Zeel	Keshopur, Miani Jhamela	Gurdaspur	1000
Mand Bharthala	Bharthala	Hoshiarpur	150
Narayangarh Terkiana	Terkiana Darsuya	Hoshiarpur	200
Rababsar	Bharowana	Kapurthala	100
Lahail Kalan	Lahail	Sangrur	50
Gobindgarh Khokhar	Gobindgarh Khokhar	Sangrur	20
Sital Sagar	Mansar	Hoshiarpur	2000
Lobana	Nabha	Patiala	28

Source: ENVIS Centre, Punjab

Table 3.11: Manmade Wetlands / Lakes in Punjab

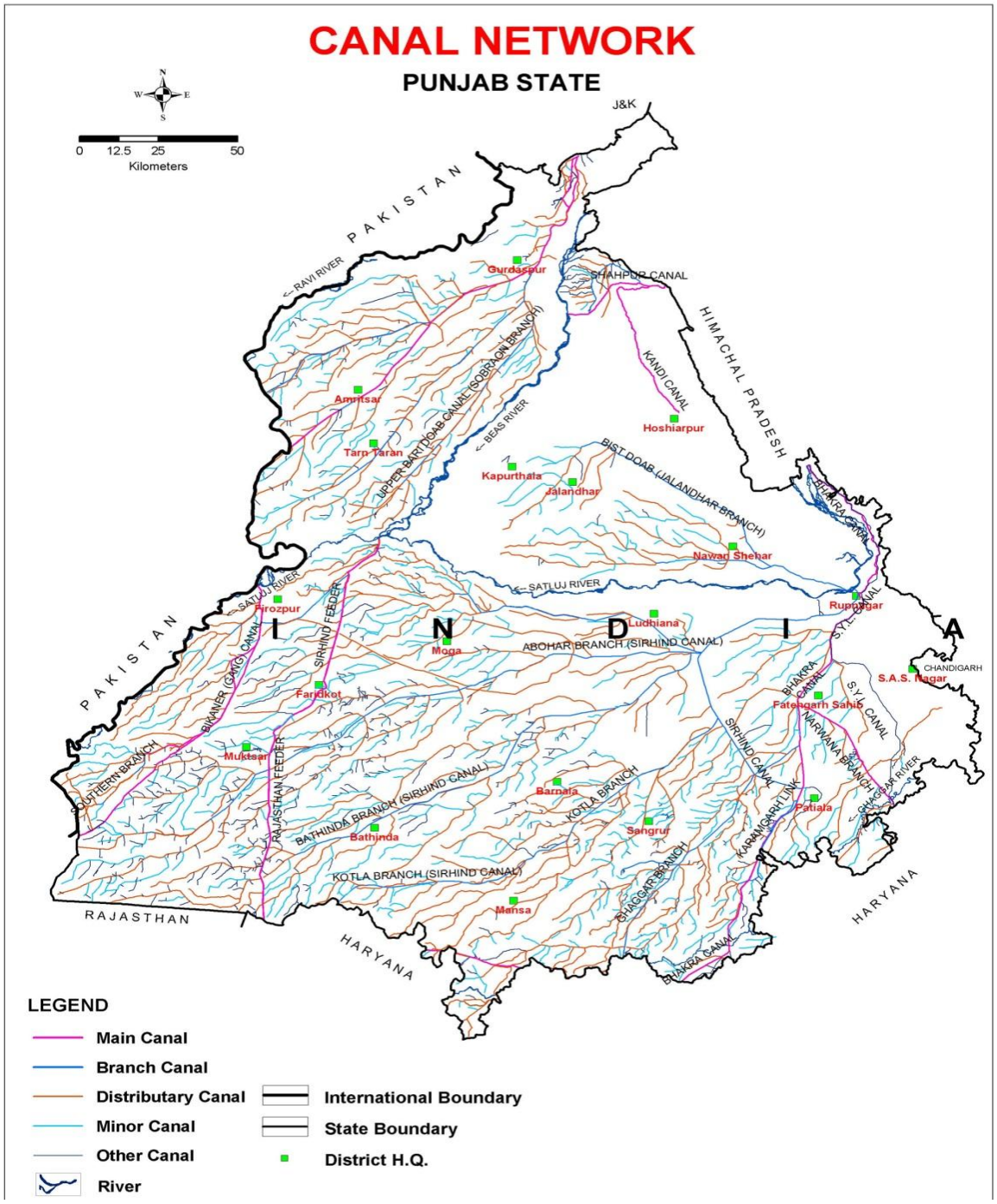
Name of Wetland / Lake	Nearest Town	District	Area in Ha.
Harike Lake	Harike	Amritsar, Kapurthala, Ferozepur	4100
Kanjli Lake	Kanjli	Kapurthala	184
Ropar Lake	Ropar	Ropar	1365
Hussainiwala Reservoir	Ferozepur	Ferozepur	688
Ranjit Sagar	Shahpur Kandi	Gurdaspur	3237
Dholbaha Dam	Dholbaha	Hoshiarpur	132
Maili Dam	Maili	Hoshiarpur	72
Mangrowal Dam	Mangrowal	Hoshiarpur	70
Nangal Lake	Nangal	Ropar	400

Source: ENVIS Centre, Punjab

Figure 3.8: Location Map of Wetlands in Punjab

Source: ENVIS Centre, Punjab

Figure 3.9: Canal Network of Punjab State



Source: http://punenvis.nic.in

3.4.1.1 Feasibility Study to meet drinking water needs from Surface Water Sources

In view of quality problems with ground water sources and due to continuous exploitation of ground water for irrigation (resulting in depletion of ground water potential), the ground water sources are found to be not sustainable over a period. It is therefore felt necessary to transfer surface water from available surface water resources for the existing drinking water supply schemes, and thereby, reducing the use of contaminated ground water. Accordingly, Drinking Water Supply and Sanitation

Department of Government of Punjab (DWSS-GOP) hasinitiated a feasibility study to supply surface water to meet drinking water needs in 6 Districts with the World Bank Assistance.

The Feasibility study has been proposed to be carried in the six districts - (a) Moga, (b) Ludhiana, (c) Jalandhar, (d) Sangrur, (e) Barnala, and (f) Hoshiarpur.

As a part of the study, the following surface water sources are identified, which are for the unrestricted use of India as per the Indus Treaty, 1960.

District	Available sources	Origin of the Source	Discharge in the canal at start (cusecs)	Length of canal in the district (in Km)
Hoshiarpur	Mukerian Hydel channel	Pong Dam (Beas River)	11500	40
	Kandi canal (stage-1)	Pong Dam (Beas River)	242	59
	Jalandhar Branch (Bist Doab Canal)	Ropar Headworks (Sutlej river)	500	43
Jalandhar	Jalandhar Branch (Bist Doab Canal)	Ropar Headworks (Sutlej river)	500	22
	Beas river near Miani village	Beas river	-	-
	Nawan Shahar Branch	Ropar Headworks (Sutlej river)	497	7
	Sutlej River		-	-
Ludhiana	Sirhind Canal	Ropar Headworks (Sutlej river)	12622	63
	Sidhwan Branch Canal		1751	72
	Abohar Branch Canal		3029	68
	Sutlej river		-	-
	Bathinda Branch		2890	36
Moga	Sidhwan Branch canal	Ropar Headworks (Sutlej river)	1751	23
	Abohar Branch Canal		3029	48
Barnala	Bathinda Branch Canal	Ropar Headworks (Sutlej river)	2890	36
	Kotla Branch Canal		3018	19
Sangrur	Bathinda Branch Canal	Ropar Headworks (Sutlej river)	2890	21
	Kotla Branch Canal		3018	61
	Ghaggar Branch		1850	69
	Bhakra Main Canal	Bhakra Dam (Sutlej river)	12455	23

As per the feasibility report, to meet the drinking water needs of rural habitations in six districts, based on the above mentioned surface water sources, 20 schemes have been formulated covering 4005 villages with ultimate prospective water demand of 956.54 MLD, This requirement of water works out to be approximately 0.45% of the identified surface water sources (rivers and canals), which is quite

marginal and does not affect the water requirement for irrigation significantly and downstream requirements of the rivers. The proposed project will consider some of the schemes conceived in the feasibility study on priority basis as per the need.

3.4.2 Ground Water

3.4.2.1 Disposition of Aquifers

The following zones have been demarcated in the State based on the yield characteristics of the various aquifers.

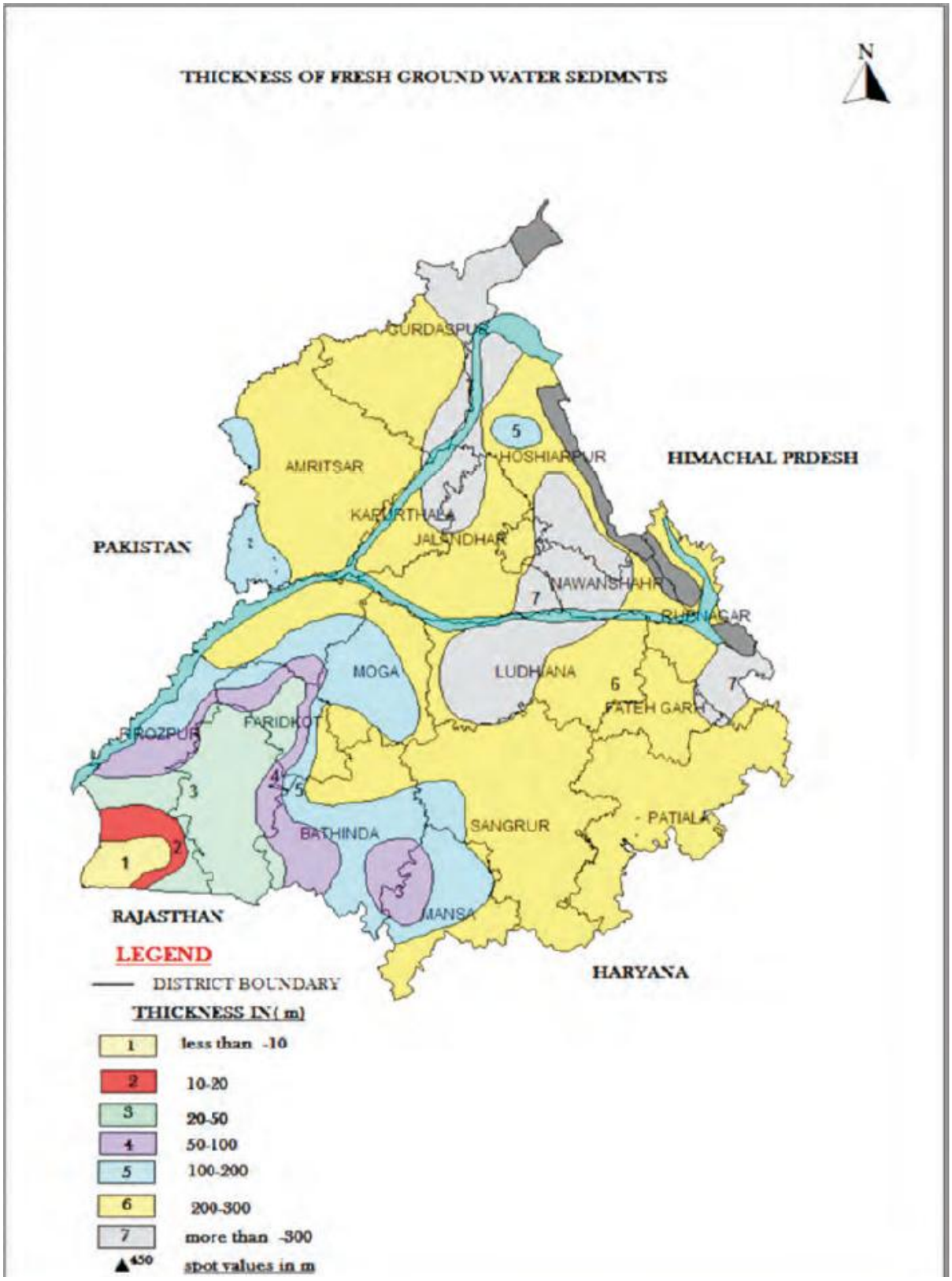
1. Local and discontinuous, fairly thick aquifers having fresh water down to 150 metres with average yield of wells below 50 m3/hr. exist in an area of about 12,350 sq.km. covering Sri Muktsar Sahib, Faridkot, Moga, Bathinda, Mansa, Southern parts of Sangrur and Ferozepur districts. Although there are local concentrations of fine grained sediments of considerable thickness, individual strata are generally lenticular and have little horizontal or vertical continuity.

2. In a narrow strip extending from South of Fazilka to north of Moga and also in the north eastern parts of Gurdaspur, Hoshiarpur, Nawansher, Patiala, Ropar districts and Anandpur Sahib valley of Ropar district, comprising an area of about 6900 sq. kms. Aquifers are regionally extensive and fairly thick down to 300 metres with an average yield of wells between 50-150 m3/hr.

3. In an area of about 29,280 sq. km. covering whole of Amritsar, Kapurthala, Fatehgarh Sahib, Ludhiana, Patiala districts and parts of Sangrur, Gurdaspur, Ferozepur, Patiala, Nawansher, Jalandhar and Ropar districts regionally extensive and fairly thick aquifers down to 300 meters with an average yield of wells above 150 m3/hr are occurring. The disposition, interrelationship of granular zones, nature, geometry and extension of aquifers of the entire Upper Bari Doab area embodies a number of granular layers alternating with thick or thin clay lenses.

4. Hilly terrain of about 11,050 sq. km. in parts of Ropar, Gurdaspur, Hoshiarpur and Nawansher districts is underlain by semi-consolidated formations having limited yield potentials below 50 m3/hr. except plateau area in Garhshankar block of Hoshiarpur district which has yield potential of 100-200 m3/hr. The hydrogeological formations are mainly composed of thick beds of sand, boulders with alternating thin layers of clay.

5. Free flow of ground water to the land surface due to artesian conditions exists in some areas. Auto flow zones in Punjab fall mostly in Gurdaspur district covering an area of about 100 sq. km. The flowing artesian aquifers also exist on left bank of the Beas river in Mukerian block of Hoshiarpur district and Anandpur Sahib block of Ropar district. The artesian aquifer occurs below 40 metres depth and along left bank of Ravi river up-to 155 m. bgl.


THICKNESS OF FRESH GROUND WATER SEDIMNTS
N
GURDASPUR
AMRITSAR
HOSHIARPUR
HIMACHAL PRDESH
KAPURTHALA
JALANDHAR
PAKISTAN
NAWANSHAHR
RUPNAGAR
MOGA
LUDHIANA
FATEH GARH
FIROZPUR
FARIDKOT
BATHINDA
SANGRUR
PATIALA
MANSA
RAJASTHAN
HARYANA
LEGEND
DISTRICT BOUNDARY
THICKNESS IN(m)
1 less than -10
2 10-20
3 20-50
4 50-100
5 100-200
6 200-300
7 more than -300
▲450 spot values in m

3.4.2.2 Natural Ground-Water Recharge

Rainfall and ensuing runoff is the main source of natural groundwater recharge in Punjab. However, the extensive coverage by irrigation and an extensive canal network imply that there is a significant groundwater recharge resulting from irrigation return flows and canal seepages.

The deep aquifers in Punjab are confined and hydro-geologically connected with the water bearing zone of the Himalayan range. The water recharge and its movement in the deep aquifer, although characterized by a longer time scales than those for the shallow aquifer, are connected to the larger scale processes of snow-melt and precipitation in the Himalayan water bearing zone.

Pre-monsoon Depth to Water Level

The pre-monsoon depth to water level map reveals that 48% of the wells fall within the range of 10m and 36% of the wells show water level within 10-20 mbgl. Deeper water level conditions in the range of 20-40 mbgl is observed in 15.17% of the observation wells. The district-wise area falling in the different water level depth range is given in Table below.

Post-monsoon depth to water level

The post monsoon water depth to water level reveals that 46.27% of the wells analysed have shown water level lying within 10 mbgl whereas 38.31% wells are in the range of 10-20 mbgl. Deeper water level conditions in the range of 20-40 mbgl are observed in 15.42% of the wells.

Distribution of Principal Aquifer Systems in Punjab

Principal Aquifer	Area in Sq. km.	% of total Aquifer Area in Punjab	Area (sq. km.) of Aquifer under Over Exploited Blocks	Area (sq. km.) of Aquifer under Critical blocks
Alluvium	48446	98.5	37770	995
Sandstone	738	1.5	46	0

Source: Aquifer Systems of India, CGWB, September 2012

State-wise Pre-monsoon depth to water level (Decadal mean 2002-2011) (m below ground level)

Alluvium		Sandstone		Granite	
Min.	Max	Min.	Max	Min.	Max.
7.4	12.0	6.1	8.5	4.0	5.0

Source: Aquifer Systems of India, CGWB, September 2012

State-wise Post-monsoon depth to water level (Decadal mean 2002-2011) (m below ground level)

Alluvium		Sandstone		Granite	
Min.	Max	Min.	Max	Min.	Max.
0.1	31.9	3.6	17.7	4.6	6.6

Source: Aquifer Systems of India, CGWB, September 2012

Distribution and Characteristics of Alluvium Aquifer System

Major Aquifers (Area in Sq. km.)					Aquifer System	Type of Aquifer	Aquifer Properties				
Younger Alluvium	Pebble / Gravel	Older Alluvium	Aeolian Alluvium	Valley Fills			Thickness in m	Zones Tapped in m bgl	Depth to Water in m bgl	Yield in m^3/day	Specific Yield %
5592	460	33094	8967	335	Multiple	Semi Confined to Confined	20-600	70-450	10-20	432-5184	8-15

Source: Aquifer Systems of India, CGWB, September 2012

Distribution and Characteristics of Sandstone Aquifer System

Major Aquifers (Area in Sq. km.)		Aquifer System	Type of Aquifer	Aquifer Properties				
Sandstone / Conglomerate	Sandstone with Shale			Thickness in m	Depth to Water in m bgl	Transmissivity in m^2/day	Yield in m^3/day	Specific Yield %
694	44	Single	-	-	10-20	100-1000	86-864	-

Source: Aquifer Systems of India, CGWB, September 2012

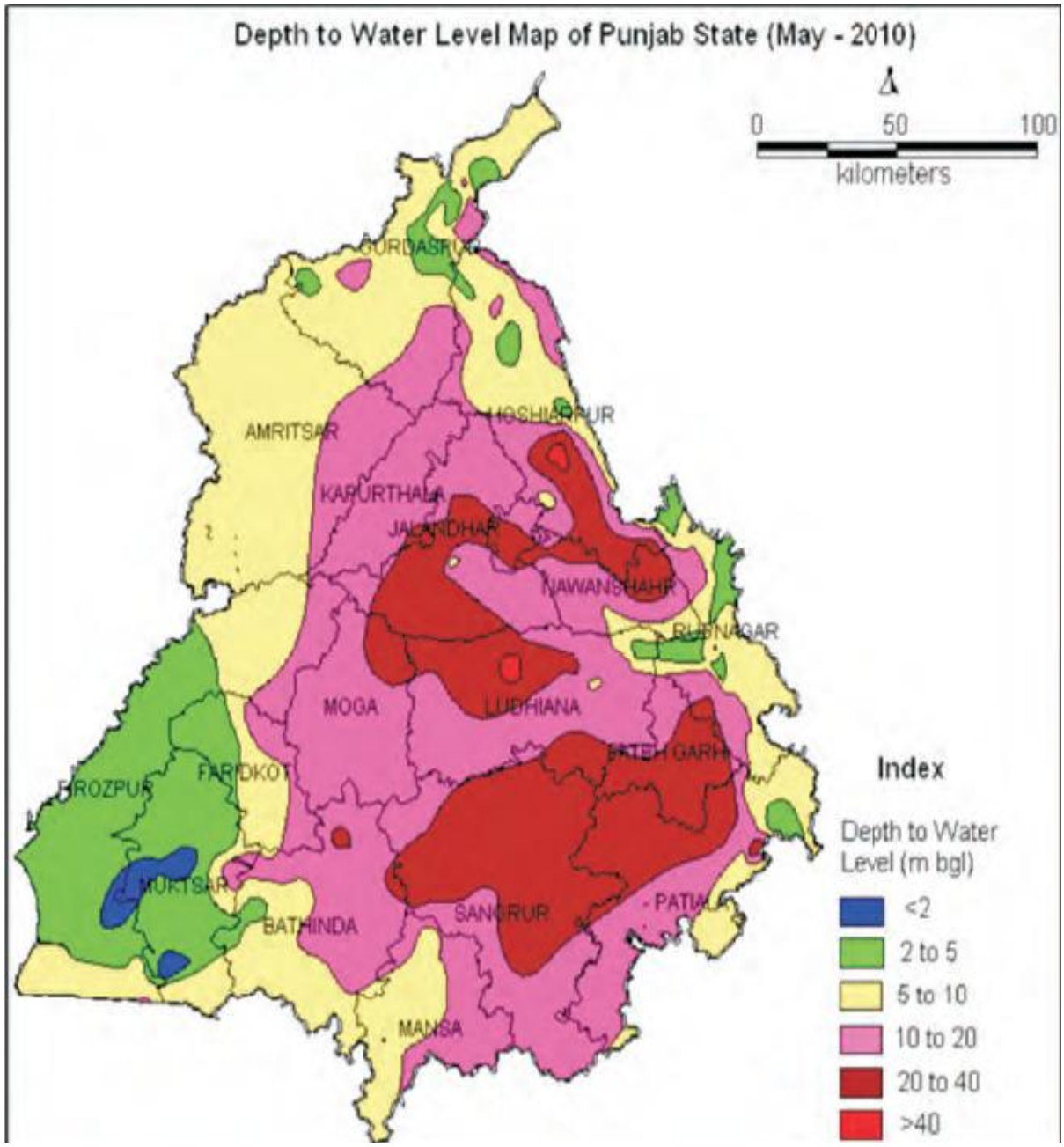
District-wise Depth to Water Level Ranges in Punjab (CGWB, May 2010)

Sr. No.	District/Region	**Depth to water level ranges**											
		0 to 2 (in m.)		2 to 5 (in m.)		5 to 10 (in m.)		10 to 20 (in m.)		20 to 30 (in m.)		30 to 40 (in m.)	
		Area*	**%**	**Area***	**%**	**Area***	**%**	**Area***	**%**	**Area***	**%**	**Area***	**%**
1	Amritsar	-	0.00	5	0.20	346	13.79	1769	70.51	389	15.50	-	0.00
2	Gurdaspur	-	0.00	484	13.40	2176	60.23	953	26.38	-	0.00	-	0.00
3	Tarn Taran	-	0.00	0	0.00	21	0.82	2515	98.70	12	0.47	-	0.00

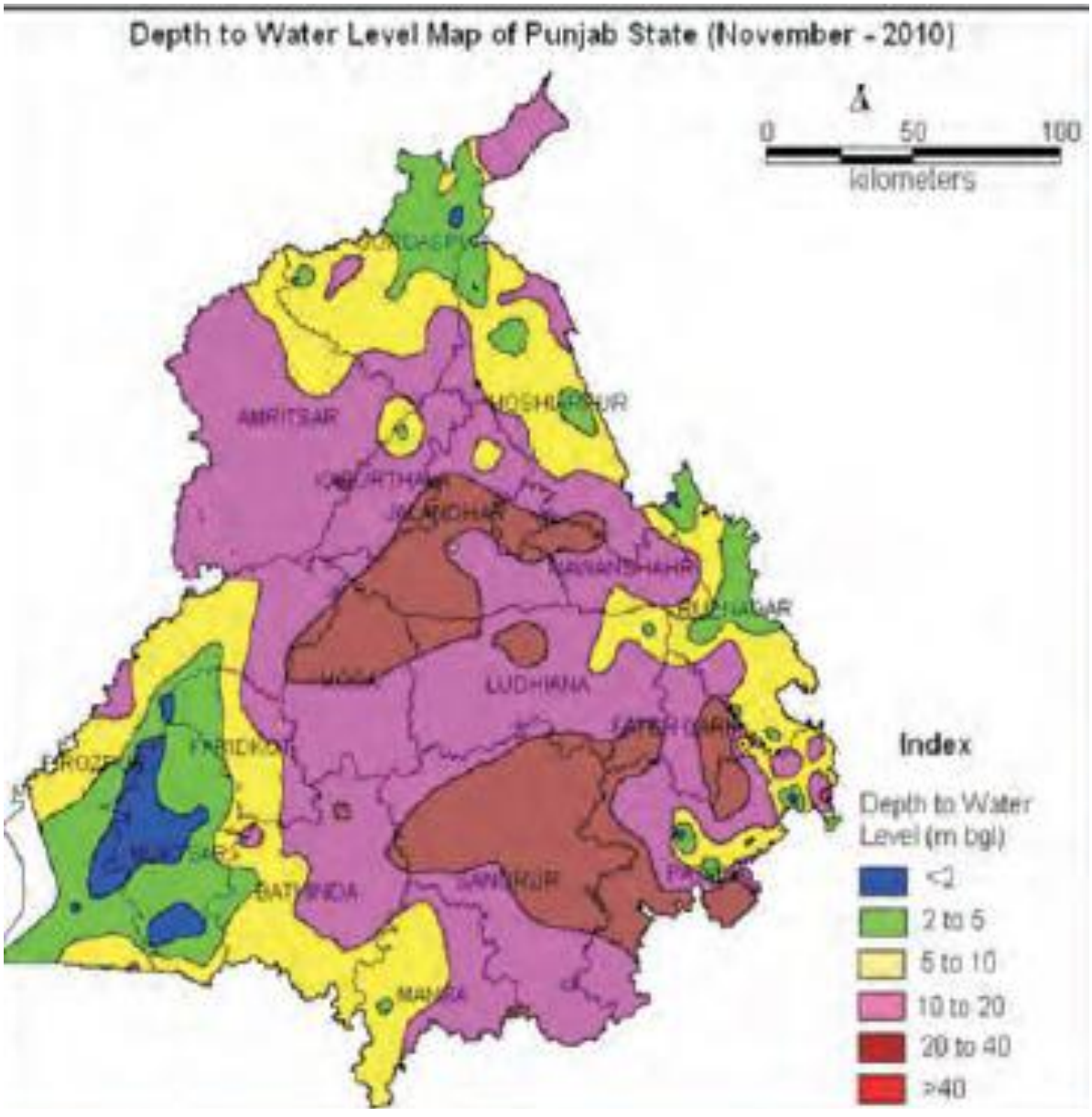
	Upper Bari Doab	**-**	**0.00**	**489**	**5.64**	**2543**	**29.33**	**5237**	**60.40**	**401**	**4.63**		**0.00**
4	Hoshiarpur	-	0.00	169	4.99	1587	46.90	1213	35.85	267	7.89	148	4.37
5	Jalandhar	-	0.00	-	0.00	125	4.75	1294	49.16	1213	46.09	-	0.00
6	Kapurthala	-	0.00	-	0.00	195	11.85	1245	75.68	205	12.46	-	0.00
7	Nawansher	-	0.00	25	1.95	173	13.53	694	54.26	357	27.91	27	2.11
	Bist Doab	**-**	**0.00**	**194**	**2.17**	**2080**	**23.27**	**4446**	**49.75**	**2042**	**22.85**	**175**	**1.96**
8	Barnala	-	0.00	-	0.00	-	0.00	565	39.90	837	12.00	14	0.99
9	Ropar	-	0.00	417	30.02	612	44.06	347	24.98	13	0.94	-	0.00
10	Patiala	-	0.00	16	0.48	417	12.50	1721	51.59	1145	34.32	37	1.11
11	Fatehgarh Sahib	-	0.00	-	0.00	39	3.37	442	38.17	635	54.84	42	3.63
12	SAS Nagar	-	0.00	57	5.27	508	46.99	516	47.73	-	0.00	-	0.00
13	Ludhiana	--	0.00	49	1.32	160	4.32	2378	64.27	887	23.97	226	6.11
14	Sangrur	-	0.00	-	0.00	-	0.00	1394	38.78	2201	61.22	-	0.00
	Upper Malwa	**-**	**0.00**	**539**	**3.44**	**1736**	**11.07**	**7363**	**46.97**	**5718**	**36.48**	**319**	**2.04**
15	Mansa	-	0.00	-	0.00	1131	51.67	1058	48.33	-	0.00	-	0.00
16	Bathinda	--	0.00	143	4.21	1387	40.83	1792	52.75	75	2.21	-	0.00
17	Ferozepur	151	2.86	1092	20.65	2003	37.88	1939	36.67	103	1.95	-	0.00
18	Faridkot	-	0.00	458	31.39	621	42.56	390	26.73	-	0.00	-	0.00
19	Moga	-	0.00	-	0.00	-	1736	1530	68.61	700	31.39	-	0.00
20	Sri Muktsar Sahib	395	14.99	1697	64.40	427	16.20	116	4.40	-	0.00	-	0.00
	Lower Malwa	**546**	**3.17**	**3390**	**19.70**	**5569**	**32.36**	**6825**	**39.66**	**878**	**5.10**	**-**	**0.00**
	Total	**546**	**1.08**	**4612**	**9.13**	**11928**	**23.62**	**23871**	**47.28**	**9039**	**17.90**	**494**	**0.98**

***Area in Sq. km.**

Source: Water Quality Issues and Challenges in Punjab, Central Ground Water Board, March 2014



Source: Water Quality Issues and Challenges in Punjab, Central Ground Water Board, March 2014



Source: Water Quality Issues and Challenges in Punjab, Central Ground Water Board, March 2014

The state is occupied by Indus alluvium of Quaternary age with tertiary sedimentaries bordering the eastern fringe. Water table elevation contours have a maximum value of 476.8 amsl rising in the North East along the Himalayas while the minimum value of 173.3 amsl is in the Punjab plains. General ground water flow direction follows the natural slope. There is not much change in the ground water flow direction which still remains northeast - southwest, but the ground water gradient between contour level 190m and 180m in Muktsar /Ferozepur districts has become gentle indicating slowing of ground water movement resulting in spreading of water logged areas to other districts.

- Deep water levels are observed in the central, eastern and southern parts of the state in parts of Ludhiana, Hoshiarpur, Sangrur, Bhatinda, Ropar, Fatehgarh districts.
- Deepest water levels (>20m) in about only 4% of wells are prevalent along the Kandi areas in the north eastern parts of the state.
- Very shallow water levels (<2m) in about 3% of wells have been observed in a patch south of Satluj river in Ferozepur and Faridkot district, which are mainly canal command areas and are water logged.
- Otherwise about 35 % of wells fall in 5-10m and 34% of wells fall in 10-20 m category.

The ground water resources have been assessed block wise. The annual Replenishable Ground Water Resource of the State has been estimated as 22.53 bcm and Net Annual Ground Water Availability is 20.32 bcm. The Annual Ground Water Draft is 34.88 bcm and stage of Ground Water Development is 172%.

Based on assessment, out of 142 blocks, 110 blocks have been categorized as 'Over-exploited, 4 as 'Critical', 2 as 'Semi-Critical and 22 as 'Safe' in the State. Status of 4 blocks (one each in Amritsar, Bathinda, Gurdaspur & Pathankot districts) is not available in the CGWB report. The district wise stage of ground water development (i.e. Ratio of Annual Ground Water Draft and Net Annual Ground Water Availability) varies from 69% in Muktsar District to 283% in Sangrur District.

Table 3.12: Ground Water Availability in Punjab as on 31st March 2011

Dynamic Ground Water Resources	
Annual Replenishable Ground water Resource	22.53 BCM
Net Annual Ground Water Availability	20.32 BCM
Annual Ground Water Draft	34.88 BCM
Stage of Ground Water Development	172%

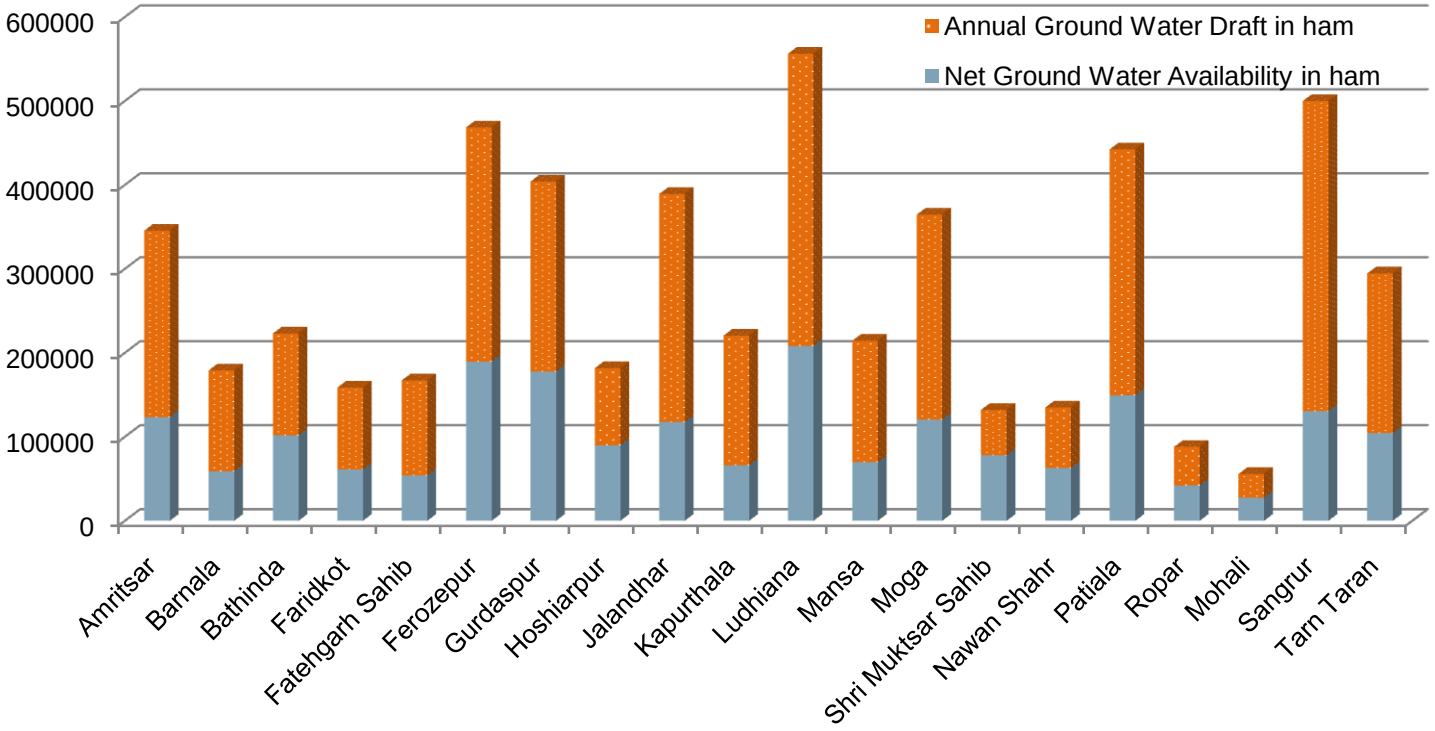
Source: Central Ground Water Board

Table 3.13: District-wise Ground Water Resources Availability, Utilization and Stage of Development

Sr. no.	District	Annual Replenishable Ground Water Resource							Annual Ground Water Draft			Projected Demand for Domestic and Industrial uses up-to 2025	Net Ground water Availability for Future Irrigation use	Stage of Ground Water Development (%)
		Monsoon Season		Non-monsoon Season			Natural Discharge during Non-monsoon Period	Net Ground Water Availability	Irrigation	Domestic & Industrial Water Supply	Total			
		Recharge from Rainfall	Recharge from Other sources	Recharge from Rainfall	Recharge from Other sources	Total								
1	Amritsar	31831	73083	8390	23767	137071	13707	123365	217150	5008	222158	7810	-101596	180
2	Barnala	12058	34679	2239	16512	65488	6549	58939	118878	1254	120132	1839	-61778	204
3	Bathinda	27051	37913	5030	41144	111138	9458	101681	118446	3005	121452	4500	-21266	119
4	Faridkot	12575	35926	2187	17158	67846	6785	61061	95603	1943	97546	1943	-36485	160
5	Fatehgarh Sahib	16209	30474	3685	9542	59910	5991	53919	111180	2076	113256	2702	-59963	210
6	Ferozepur	40799	114703	8670	46442	210614	21061	189552	275576	3375	278951	4989	-91013	147
7	Gurdaspur	57702	92053	15253	31224	196232	18612	177621	219741	6637	226378	9313	-51433	127
8	Hoshiarpur	48029	27202	12219	11075	98525	8752	89774	87047	4917	91963	6248	-3522	102
9	Jalandhar	36096	61810	8341	24282	130529	13053	117476	267002	4729	271731	6813	-156339	231
10	Kapurthala	21559	38424	5914	7458	73355	7335	66019	150588	3900	154488	4693	-89261	234
11	Ludhiana	48155	110670	10141	62300	231266	23127	208139	336828	11229	348057	16442	-145131	167
12	Mansa	17834	35437	3586	20529	77386	7739	69647	144741	13	144754	13	-75107	208
13	Moga	21876	77174	4277	30642	133969	13397	120572	242148	1802	243949	2378	-123953	202
14	Muktsar	20934	28256	3921	33460	86571	8657	77914	51625	2460	54085	2460	23829	69
15	Nawan Shahr	20248	28986	4971	15512	69717	6972	62746	70742	1515	72256	1887	-9883	115
16	Patiala	44007	79988	9392	32670	166057	16606	149451	288631	4348	292979	6675	-145855	196
17	Ropar	18731	13350	4327	9215	45623	3794	41829	43775	2384	46159	3191	-5136	110
18	Mohali	19496	4665	4263	2113	30537	3054	27484	23576	4618	28194	5535	-1626	103
19	Sangrur	40154	76431	9016	19456	145057	14506	130551	366396	3031	369427	4445	-240290	283
20	Tarn Taran	27149	62516	7297	19040	116002	11600	104402	187566	2664	190230	4217	-87381	182
State Total (ham)		**582493**	**1063740**	**133119**	**473541**	**2252893**	**220755**	**2032142**	**3417239**	**70908**	**3488145**	**98093**	**-1483189**	**172**
State Total (bcm)		5.82	10.64	1.33	4.74	22.53	2.21	20.32	34.17	0.71	34.88	0.98	-14.83	172

Source: Dynamic Ground Water Resources of India, Central Ground Water Board, 31/03/2011

Figure 3.10: Comparison showing Net Ground Water Availability vs. Annual Ground Water Draft – Punjab State



Source: Mott MacDonald Analysis

Table 3.14: District-wise Ground Water Observation Wells as on March 2011

Sr. No.	District	No. of Ground Water Observation of Wells (As on 31/03/2010)			No. of Ground Water Observation of Wells (Abandoned)			No. of Ground Water Observation of Wells (Established)			No. of Ground Water Observation of Wells (Operational) as on 31/03/2011		
		Wells	Pz	Total	Wells	Pz	Total	Wells	Pz	Total	Wells	Pz	Total
1	Amritsar	14	0	14	3	0	3	0	0	0	11	0	11
2	Bathinda	22	3	25	2	0	2	0	3	3	20	9	29
3	Faridkot	7	0	7	0	0	0	0	0	0	7	0	7
4	Fatehgarh Sahib	7	4	11	0	0	0	0	1	1	7	5	12
5	Ferozepur	12	7	19	0	0	0	0	2	2	12	9	21
6	Gurdaspur	26	1	27	2	0	2	0	0	0	24	1	25
7	Hoshiarpur	9	6	15	0	0	0	0	1	1	9	7	16
8	Jalandhar	4	27	31	0	0	0	0	0	0	4	27	31
9	Kapurthala	1	10	11	0	0	0	0	1	1	1	11	12
10	Ludhiana	7	12	19	0	0	0	0	0	0	7	12	19
11	Mansa	9	3	12	1	0	1	0	0	0	8	3	11
12	Moga	1	1	2	0	0	0	0	5	5	1	6	7
13	Sri Muktsar Sahib	9	0	9	1	0	1	0	0	0	8	0	8
14	Nawanshahr	4	2	6	2	0	2	0	0	0	2	2	4
15	Patiala	9	21	30	0	0	0	0	3	3	9	24	33
16	Ropar	15	0	15	1	0	1	0	3	3	14	3	17
17	Sangrur	6	12	18	1	0	1	0	0	0	6	12	18
	Total	162	109	271	13	0	13	0	19	19	150	131	281

Source: http://punenvis.nic.in

Table 3.15: District-wise Categorization of Blocks as per Ground Water Availability

District	Safe	Critical	Semi-critical	Over-exploited
Amritsar (Total Blocks – 8)	-	-	-	Ajnala
	-	-	-	Chogawan
	-	-	-	Harsha China
	-	-	-	Jandiala
	-	-	-	Majitha
	-	-	-	Rayya
	-	-	-	Tarsika
	-	-	-	Verka
Sub-Total	***0***	***0***	***0***	***8***

District	Safe	Critical	Semi-critical	Over-exploited
Barnala (Total Blocks – 3)	-	-	-	Barnala
	-	-	-	Mahal Kalan
	-	-	-	Sehna
Sub-Total	***0***	***0***	***0***	***3***
Bathinda (Total Blocks – 7)	Talwandi Saboo	Nathana	-	Phul
	Sangat	Rampura	-	Maur
	-	-	-	Bathinda
Sub-Total	***2***	***2***	***0***	***3***
Faridkot (Total Blocks – 2)	-	-	-	Faridkot
	-	-	-	Kot Kapura
Sub-Total	***0***	***0***	***0***	***2***
Fatehgarh Sahib (Total Blocks – 5)	-	-	-	Khera
	-	-	-	Sirhind
	-	-	-	Amloh
	-	-	-	Bassi Pathana
	-	-	-	Khamanon
Sub-Total	***0***	***0***	***0***	***5***
Ferozepur (Total Blocks – 10)	Abohar	-	-	Fazilka
	Khuyian Sarwar	-	-	Ferozepur
	-	-	-	Ghall Khurd
	-	-	-	Guru Har Sahai
	-	-	-	Jalalabad
	-	-	-	Makhu
	-	-	-	Mamdot
	-	-	-	Zara
Sub-Total	***2***	***0***	***0***	***8***
Gurdaspur (Total Blocks – 14)	Bamyal	Gurdaspur	Narot Jaimal Singh	Batala
	Dhar Kalan	-	-	Fatehgarh Churian
	Dina Nagar	-	-	Kahnuwan
	Pathankot	-	-	Kalanaur
	-	-	-	Qadian
	-	-	-	Sri Hargobindpur
	-	-	-	Dera Baba Nanak
	-	-	-	Dhariwal
Sub-Total	***4***	***1***	***1***	***8***
Hoshiarpur (Total Blocks – 10)	Bhunga	Hoshiarpur 1	Talwara	Dasuya
	Hoshiarpur II	-	-	Garhsahnkar
	Mahilpur	-	-	Hazipur
	Mukerian	-	-	Tanda

District	Safe	Critical	Semi-critical	Over-exploited
Sub-Total	***4***	***1***	***1***	***4***
Jalandhar (Total blocks – 10)	-	-	-	Adampur
	-	-	-	Bhogpur
	-	-	-	Rurka Kalan
	-	-	-	Jalandhar East
	-	-	-	Jalandhar West
	-	-	-	Lohian
	-	-	-	Nakodar
	-	-	-	Nur Mahal
	-	-	-	Phillaur
	-	-	-	Shahkot
Sub-Total	***-***	***-***	***-***	***10***
Kapurthala (Total Blocks – 5)	-	-	-	Nadala
	-	-	-	Dhilwan
	-	-	-	Kapurthala
	-	-	-	Phagwara
	-	-	-	Sultanpur Lodhi
Sub-Total	***0***	***0***	***0***	***5***
Ludhiana (Total Blocks – 12)	Machhiwara	-	-	Dehlon
	-	-	-	Doraha
	-	-	-	Jagraon
	-	-	-	Khanna
	-	-	-	Ludhiana
	-	-	-	Mangat
	-	-	-	Pakhowal
	-	-	-	Raikot
	-	-	-	Samrala
	-	-	-	Sidhwan Bet
	-	-	-	Sudhar
Sub-Total	***1***	***0***	***0***	***11***
Mansa (Total Blocks – 5)	-	-	-	Bhikhi
	-	-	-	Budhlada
	-	-	-	Jhunir
	-	-	-	Mansa
	-	-	-	Sardulgarh
Sub-Total	***0***	***0***	***0***	***5***
Moga (Total Blocks – 5)	-	-	-	Bagha Purna
	-	-	-	Dharamkot (Kot Isa Khan)

District	Safe	Critical	Semi-critical	Over-exploited
	-	-	-	Moga I
	-	-	-	Moga II
	-	-	-	Nihal Singh Wala
Sub-Total	***0***	***0***	***0***	***5***
Sri Muktsar Sahib (Total Blocks – 4)	Gidderbaha	-	-	-
	Lambi	-	-	-
	Malout	-	-	-
	Muktsar	-	-	-
Sub-Total	***4***	***0***	***0***	***0***
Nawansher (Total Blocks – 5)	Balachaur	-	-	Aur
	Saroya	-	-	Nawansher
	-	-	-	Banga
Sub-Total	***2***	***0***	***0***	***3***
Patiala (Total Blocks – 8)	-	-	-	Bhuner Heri
	-	-	-	Ghanaur
	-	-	-	Nabha
	-	-	-	Patiala
	-	-	-	Rajpura
	-	-	-	Samana
	-	-	-	Sanaur
	-	-	-	Patran
Sub-Total	***0***	***0***	***0***	***8***
Ropar (Total Blocks – 5)	Anandpur Sahib	-	-	Chamkaur Sahib
	Ropar	-	-	Morinda
	-	-	-	Nupur Bedi
Sub-Total	***2***	***0***	***0***	***3***
SAS Nagar (Total Blocks – 3)	Sialba Majri	-	-	Dera Bassi
	-	-	-	Kharar
Sub-Total	***1***	***0***	***0***	***2***
Sangrur (Total Blocks – 9)	-	-	-	Ahmedgarh
	-	-	-	Andana
	-	-	-	Bhiwanigarh
	-	-	-	Dhuri
	-	-	-	Lehraghaga
	-	-	-	Maler Kotla
	-	-	-	Sangrur
	-	-	-	Sherpur
	-	-	-	Sunam
Sub-Total	***0***	***0***	***0***	***9***

District	Safe	Critical	Semi-critical	Over-exploited
Tarn Taran (Total Blocks – 8)	-	-	-	Bhikhiwind
	-	-	-	Chola Sahib
	-	-	-	Gandiwind
	-	-	-	Khadur Sahib
	-	-	-	Naushehra Panuan
	-	-	-	Patti
	-	-	-	Tarn Taran
	-	-	-	Valtoha
Sub-Total	***0***	***0***	***0***	***8***
Total Blocks - 138	***22***	***4***	***2***	***110***

Source: Dynamic Ground Water Resources of India (As on 31st March 2011)

3.4.3 Water Quality

For any water body to function adequately in satisfying the desired use, it must have corresponding degree of purity. Drinking water should be of highest purity. As the magnitude of demand for water is fast approaching the available supply, the concept of management of the quality of water is becoming as important as of its quantity.

In India, the Central Pollution Control Board (CPCB) has developed a concept of designated best use. According to this, out of the several uses of water of a particular body, the use which demands highest quality is termed its designated best use. Five designated best uses have been identified as given in Table 3.16.

Table 3.16: Primary Water Quality Criteria for Designated Best Use - Classes

Designated Best Use	Class	Criteria
Drinking Water source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100 ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20° C, 2 mg/l or less
Outdoor Bathing (Organized)	B	• Total Coliforms Organism MPN/100 ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20° C, 3 mg/l or less
Drinking Water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100 ml shall be 5000 or less • pH between 6 and 9 • Dissolved Oxygen 4mg/l or more

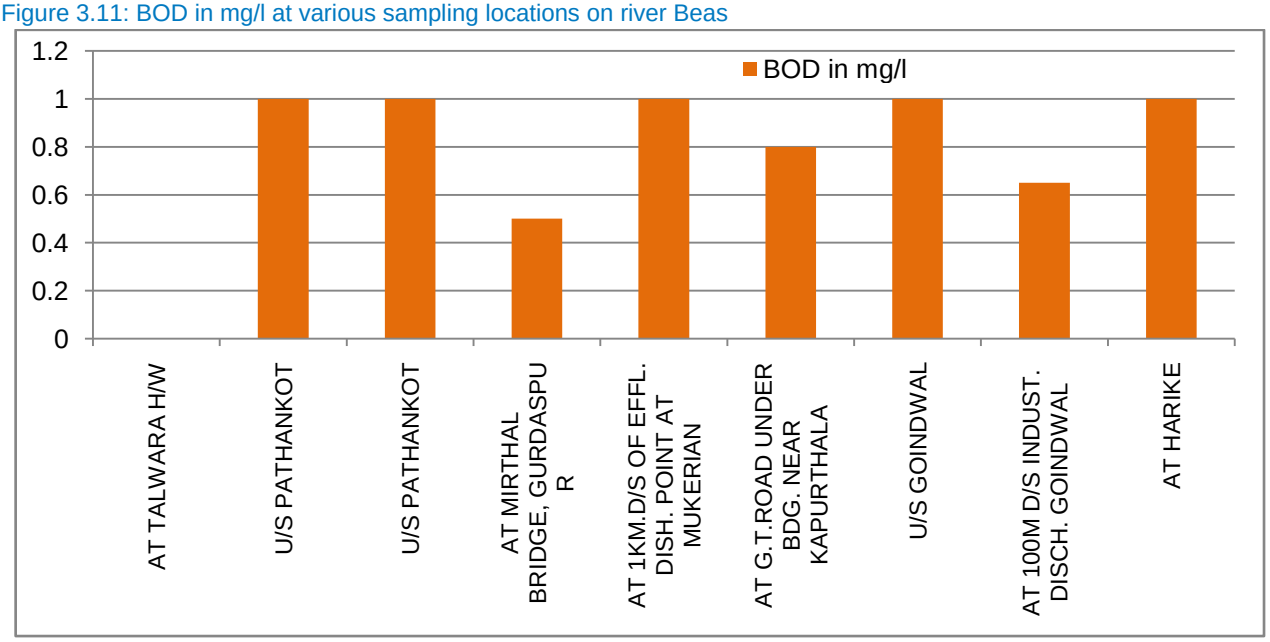
Designated Best Use	Class	Criteria
		• Biochemical Oxygen Demand 5 days 20° C, 3 mg/l or less
Propagation of Wild Life and Fisheries	D	• pH between 6.5 and 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia • Biochemical Oxygen Demand 5 days 20° C, 2 mg/l or less
Irrigation, Industrial Cooling, Control Waste Disposal	E	• pH between 6.5 and 8.5 • Electrical Conductivity at 25 C micro mhos/cm, maximum 2250 • Sodium Absorption Ratio, Maximum 26 • Boron, Max. 2 mg/l
	Below E	• Not meeting any of the A,B,C,D & E Criteria

Source: Central Pollution Control Board (CPCB)

3.4.3.1 Surface Water Quality of River Beas

The Beas enters near the Rohtang Pass in Kulu at a height of 3,960m and flows through a gorge from Larlji to Talwara and then enters the Punjab to meet the Sutluj at Harike. Its total length is 460 km and catchment area is 20,303 sq.km. Data presented in Table 3.17 shows that the quality of water of river Beas when it enters Punjab state at Talwara is fairly good. The river has sufficiently high Dissolved oxygen content through-out till Harike. The water quality deteriorates near Mukerian as it receives effluents and sewage from town. Further downstream, water quality remains same due to discharge of industrial effluents and sewage from Goindwal town and industrial complex. However, the quality of water improves once it reaches to Harike.

Figure 3.11: BOD in mg/l at various sampling locations on river Beas

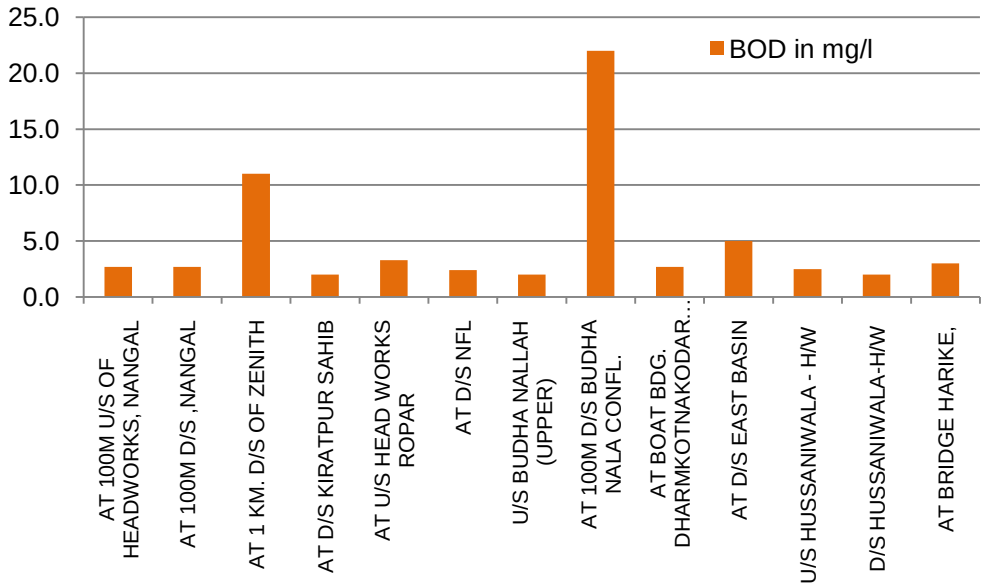


Source: Mott MacDonald Analysis

3.4.3.2 Surface Water Quality of River Sutluj

Many important towns like Nangal, Ropar, Ludhiana and Ferozepur are situated along this river. Punjab Pollution Control Board (PPCB) is monitoring the quality of the river for various physio-chemical parameters. The Water quality of river Sutlej in 2011, at various sampling locations, indicates that its quality with respect to BOD and Total Coliform starts deteriorating once it reaches Budha Nallah.

Figure 3.12: BOD in mg/l at various sampling locations on river Satluj



Source: Mott MacDonald Analysis

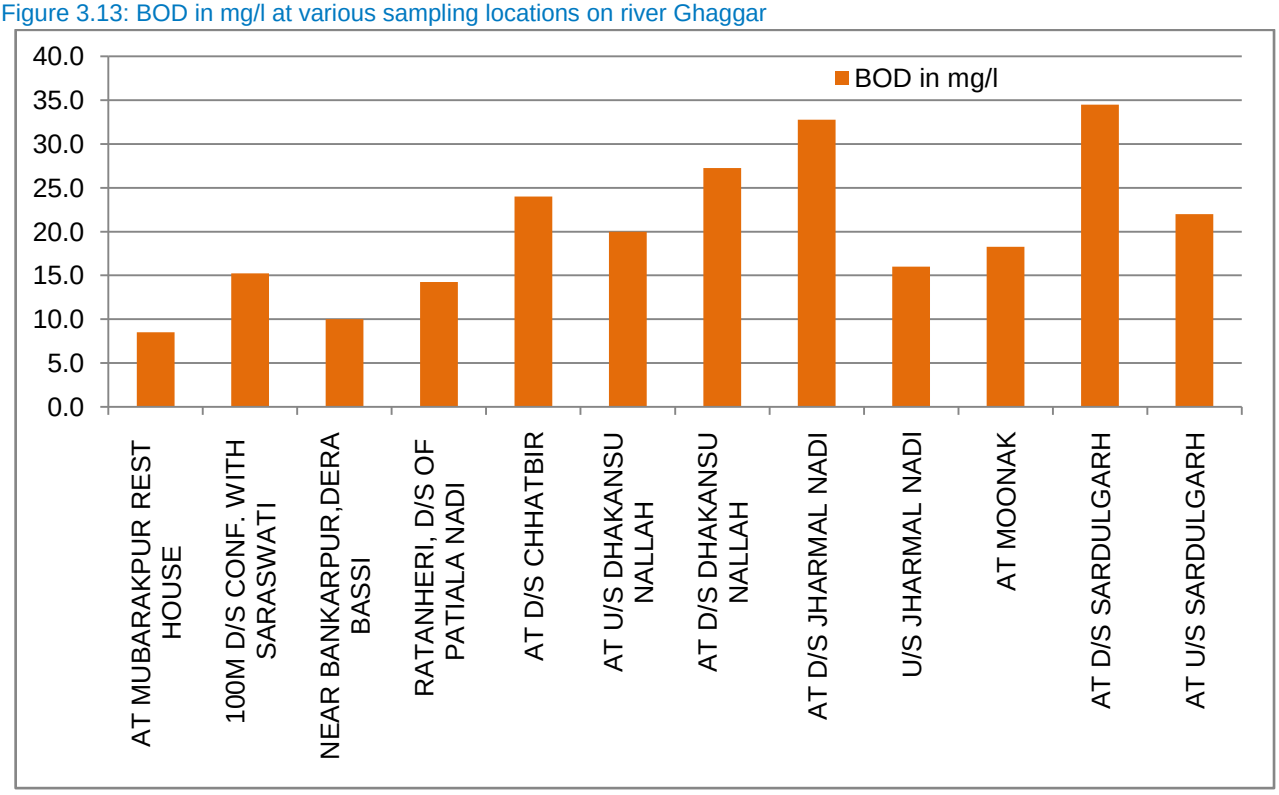
3.4.3.3 Surface Water Quality of River Ravi

This river rises in Kulu, flows westward through a triangle formed by the junction of the Pirpanjal and Dhaola Dhar ranges. It enters Punjab plains near Madhopur and later enters Pakistan 26 kms. below Amritsar. There is only one sampling point on the upstream side of Madhopur Head-works in Gurdaspur district. The water quality predominately conforms to Class A (Drinking Water source without conventional treatment but after disinfection) as per designated best use classification of CPCB.

3.4.3.4 Surface Water Quality of River Ghaggar

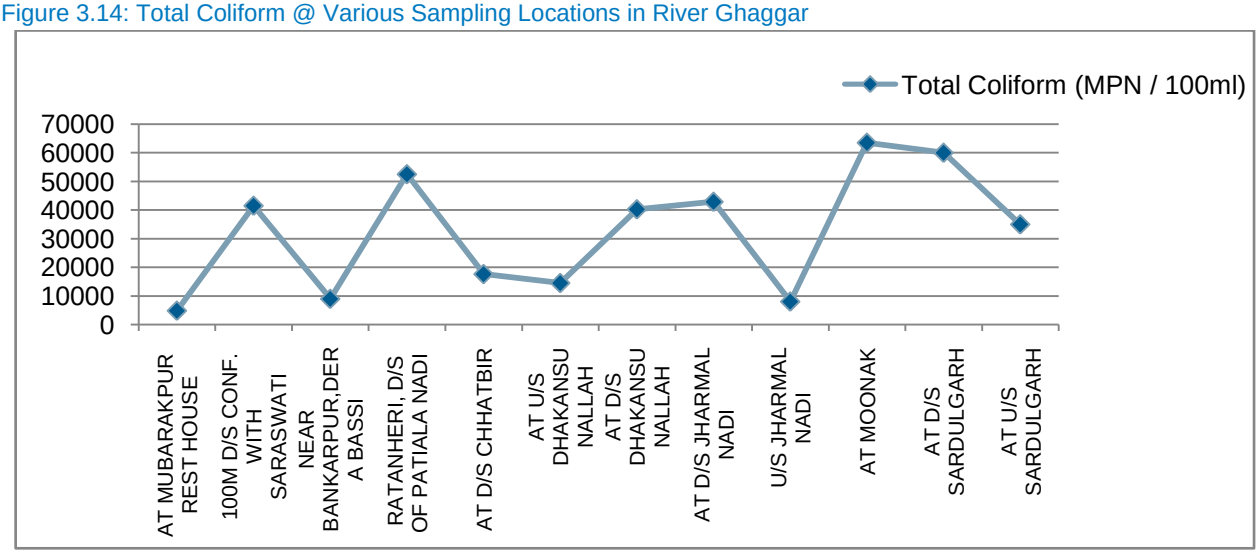
This river originates from Shiwalik hills and runs towards North-East of Kalka. It enters Punjab in Dera Bassi block near village Kakrali and passes through Patiala, Sangrur and Bathinda districts of Punjab. The surface water quality of entire stretch of Ghaggar river is of D category. The BOD values are very high at Chhatbir and remains very high through-out its tail end at Sardulgarh. The total coliform though high at all sampling locations of this river, increases sharply D/S of Patiala Nadi, Moonak and Sardulgarh.

Figure 3.13: BOD in mg/l at various sampling locations on river Ghaggar



Source: Mott MacDonald Analysis

Figure 3.14: Total Coliform @ Various Sampling Locations in River Ghaggar



Source: Mott MacDonald Analysis

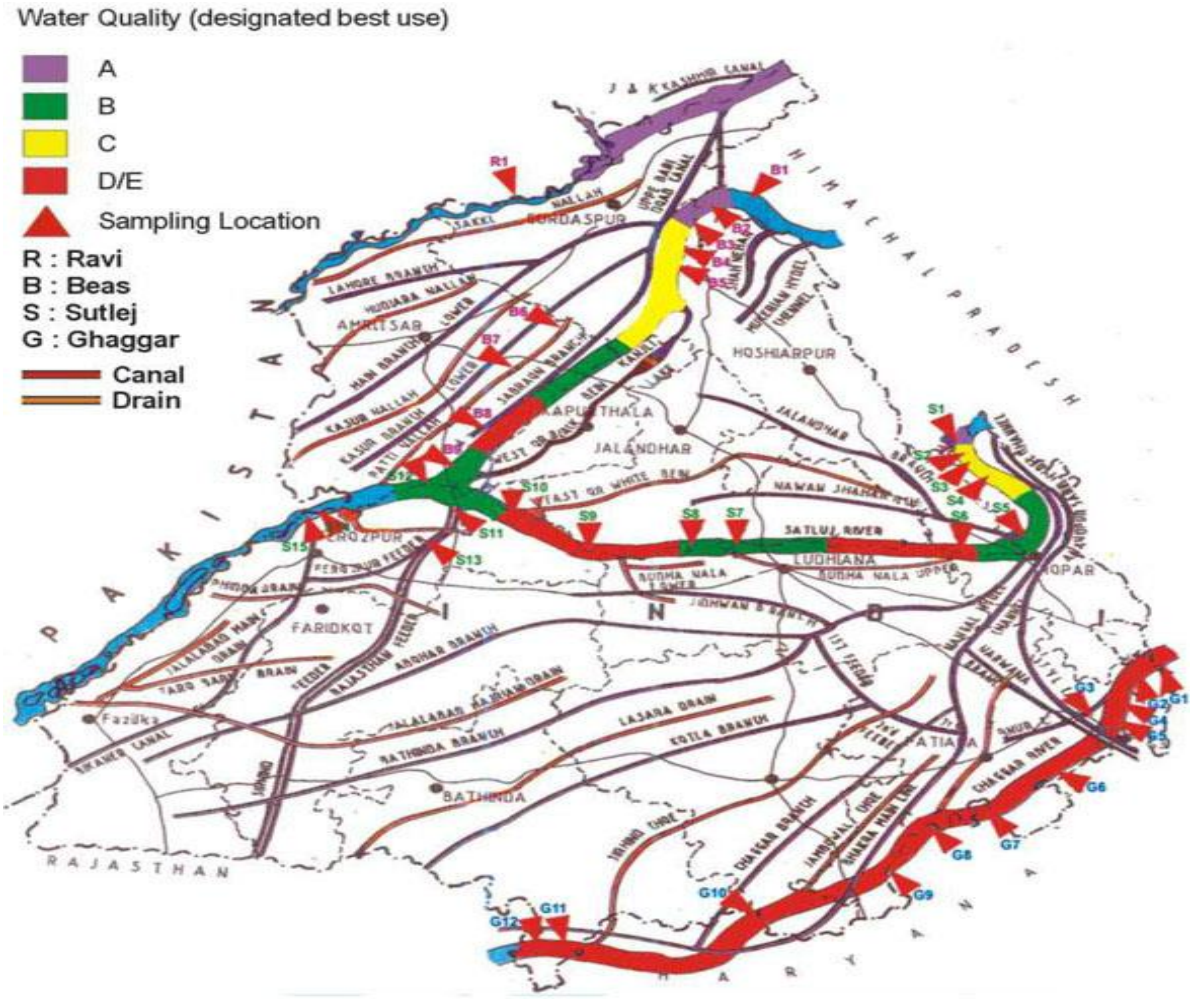
Table 3.17: River Water Quality in Punjab (Year 2010-2011)

Sr. No.	River	Sampling Locations	District	Parameters		
				D.O. (mg/l)	B.O.D. (mg/l)	Total Coliform (mg/l)
1	Beas	At Talwara H/W		8.0	0	50
2	Beas	U/S Pathankot		7.0	1	500
3	Beas	U/S Pathankot		7.0	1	600
4	Beas	At Mirthal Bridge	Gurdaspur	8.0	0.5	662
5	Beas	1km. D/S of Effluent Dis. Point, Mukerian		7.0	1	738
6	Beas	At G.T. Road Under bridge	Kapurthala	7.0	0.8	567
7	Beas	U/S Goindwal		7.0	1	650
8	Beas	100m D/S Industrial Dis., Goindwal		7.0	0.7	725
9	Beas	At Harike		7.0	1	550
10	Satluj	100m U/S of Head-works, Nangal		8.0	2.7	703
11	Satluj	100m D/S, Nangal		8.0	2.7	703
12	Satluj	1km D/S of Zenith		7.0	11.0	4150
13	Satluj	D/S Kirtapur Sahib		7.0	2.0	503
14	Satluj	U/S Ropar Head-works		7.0	3.3	9000
15	Satluj	D/S NFL		7.0	2.4	803
16	Satluj	U/S Budha Nallah		7.0	2.0	23625
17	Satluj	100m D/S Budha Nallah Confluence	Ludhiana	4.0	22.0	64000
18	Satluj	Boat Building, Dharmkotnakodar Road	Jalandhar	6.0	2.7	8375
19	Satluj	D/S East Basin		4.0	5.0	40333
20	Satluj	U/S Hussainiwala Head-works	Ferozepur	7.0	2.5	500
21	Satluj	Bridge Harike	Amritsar	7.0	2.0	950
22	Ravi	U/S of Madhopur Head-works	Gurdaspur	8.0	0.7	50
23	Ghaggar	At Mubarkpur Rest House	Patiala	5.8	8.5	4838
24	Ghaggar	100m D/S Confluence with Saraswati	Patiala	5.6	15.3	41500
25	Ghaggar	Bankarpur	Mohali	5.4	10.0	8975
26	Ghaggar	D/S of Patiala Nadi		5.7	14.3	52500
27	Ghaggar	D/S of Chhatbir		5.7	24.0	17625
28	Ghaggar	U/S Dhakansu Nallah		3.5	20.0	14500
29	Ghaggar	D/S Dhakansu Nallah		3.2	27.3	40250
30	Ghaggar	D/S Jharmal Nadi		4.7	32.8	42875

Sr. No.	River	Sampling Locations	District	Parameters		
				D.O. (mg/l)	B.O.D. (mg/l)	Total Coliform (mg/l)
31	Ghaggar	U/S Jharmal Nadi		4.8	16.0	8025
32	Ghaggar	At Moonak		5.3	18.3	63500
33	Ghaggar	D/S Sardulgarh		5.6	34.5	60000
34	Ghaggar	D/S Sardulgarh		5.4	22.0	35000

Source: Central Pollution Control Board

Figure 3.15: Water Quality Map of Major Rivers in Punjab



Source: ENVIS Centre, Punjab

3.4.3.5 Ground Water Quality

The physio-chemical characteristics of the shallow waters of the State have indicated wide variations in mineral contents. About 60% of the well waters are fresh and of good quality. Such waters are generally found in northern and north-eastern parts. Nearly 30% of the well waters are generally found in central parts of the state. About 10% of the well waters are saline and are not safe for use. Such waters are generally found in isolated patches in southern and south-western parts of the state.

In many cases, salinity problems in groundwater are worsened due to water-logging, as the dissolved salts in irrigation return flows are slowly percolated into groundwater. The districts where aquifers are adversely affected with salinity, include Fazilka, Ferozepur, Patiala, SAS Nagar, Sangrur & SBS Nagar

Presence of Fluoride and Iron in groundwater is also related to natural causes. However, over-exploitation of aquifers often results in increase in Fluoride concentrations and districts adversely affected by only fluoride include Patiala, Fatehgarh Sahib and Sangrur. The incidence of unacceptable levels of Iron is severely found in Amritsar, Ferozepur, Rupnagar, Gurdaspur and Hoshiarpur.

Apart from the basic parameters, major concerns with regard to quality are emerging due to presence of heavy metals in shallow aquifers in the state. With the exception of salinity and fluoride which are naturally occurring in groundwater of the state, the deep aquifers of Punjab are expected to be relatively free from the pollution issues that affect the shallow aquifers, because of their relative hydrogeological isolation from the shallow aquifers, from which they are usually separated by thick impervious clay layers. However, these emerging concerns about the water quality of shallow aquifers and increasing reliance on deep aquifers is leading to over exploitation.

The uranium mineralisation in the Shiwalik of the north western Himalaya occurs in the form of lenses having small extent mostly associated with poorly sorted immature grey sandstone, essentially along middle – upper Shiwalik transition zone and to a lesser extent along the transition zone between lower and middle Shiwalik. Uranium mineralisation in the Shiwalik is epegentic, remobilised and controlled by hydrodynamic gradient and organic matter in the zone of local and regional paleo ground water divide occurring in association with redox form.

Due to the overexploitation of ground water with almost 110 blocks out of 142 blocks in the zone of over exploitation, alternative surface water sources for drinking water need to be explored. As deeper layers of aquifers are tapped, the mineral content in the water will increase leading to excessive natural contaminants like fluorides, TDS, Iron and Manganese.

The incidence of various water quality concerns in different districts of the state in terms of total number of habitations affected is shown in Table 3.19 and Table 3.20.

Table 3.18: Ground Water Quality Problems

Contaminants	Districts Affected (in Parts)
Salinity (EC > 3000 µS/cm at 25 °C)	Fazilka, Ferozepur, Patiala, SAS Nagar, Sangrur, SBS Nagar
Fluoride (> 1.5 mg/l)	Amritsar, Barnala, Bathinda, Fatehgarh Sahib, Fazilka, Ferozepur, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Mansa, Muktsar, Pathankot, Patiala, SAS Nagar, Sangrur, Tarn Taran
Iron (> 1.0 mg/l)	Amritsar, Barnala, Fatehgarh Sahib, Fazilka, Ferozepur, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Mansa, Moga, Pathankot, Patiala, Rupnagar, SAS Nagar, Sangrur, SBS Nagar, Tarn Taran
Nitrate (>45 mg/l)	Amritsar, Bathinda, Fatehgarh Sahib, Ferozepur, Hoshiarpur, Jalandhar, Ludhiana, Moga, Pathankot, Patiala, Rupnagar, SAS Nagar, Sangrur, SBS Nagar, Tarn Taran
Arsenic (>0.05 mg/l)	Amritsar, Barnala, Fazilka, Ferozepur, Gurdaspur, Patiala, Rupnagar
Uranium (>30 mg/l)	Barnala, Bathinda, Faridkot, Fazilka, Ferozepur, Gurdaspur, Kapurthala, Ludhiana, Mansa, Moga, Sri Muktsar Sahib, Patiala, Rupnagar, Sangrur, Tarn Taran

Source: Central Ground water Board

Based on Ministry of Drinking Water and Sanitation website, The summary of assessment is as given below:

- Iron – Amritsar, Ferozepur, Rupnagar, Gurdaspur & Hoshiarpur are worst affected.
- Fluoride – Patiala, Fatehgarh Sahib and Sangrur are mostly affected.
- Arsenic – Gurdaspur having major problem with Arsenic contamination
- Uranium –Ferozepur, Barnala and Moga are the worst affected districts.
- Nitrate – Ferozepur, Hoshiarpur, Fatehgarh Sahib and Jalandhar are the severely affected districts.
- Aluminium – Rupnagar, Pathankot, Hoshiarpur, Moga and Patiala are having major problems with Aluminium contamination.
- Lead – Patiala, Jalandhar and Ludhiana are affected.
- Selenium – Jalandhar, Ludhiana and Kapurthala are worst affected.

Table 3.19: District-wise Contaminated Habitations (Year 2014-2015)

Sr. No.	District	Total Habitations	Arsenic	Fluoride	Iron	TDS	Nitrate
1	Amritsar	880	1	3	143	1	13
2	Barnala	152	0	4	8	0	0
3	Bathinda	532	0	2	0	0	2
4	Faridkot	451	0	0	1	0	0
5	Fatehgarh Sahib	461	0	28	23	2	14
6	Fazilka	444	0	7	10	7	0
7	Ferozepur	960	0	7	119	4	53
8	Gurdaspur	1216	3	4	117	0	0
9	Hoshiarpur	1517	1	2	112	0	23
10	Jalandhar	1085	0	2	11	0	14

Sr. No.	District	Total Habitations	Arsenic	Fluoride	Iron	TDS	Nitrate
11	Kapurthala	757	0	2	19	0	2
12	Ludhiana	1089	0	1	22	2	7
13	Mansa	301	0	5	0	0	0
14	Moga	421	0	0	82	0	4
15	Sri Muktsar Sahib	408	0	0	0	0	0
16	Pathankot	588	0	0	31	0	4
17	Patiala	1150	0	160	72	6	3
18	Rupnagar	806	0	0	205	0	10
19	SAS Nagar	423	0	3	5	0	1
20	Sangrur	626	0	26	13	5	10
21	SBS Nagar	485	0	0	1	0	0
22	Tarn Taran	618	0	4	23	0	5
	Total	**15370**	**5**	**260**	**1017**	**27**	**165**

Source: Ministry of Drinking Water and Sanitation Website

Table 3.20: District-wise Newly Emerged Contaminated Habitations (As on 01/04/2014)

District	Aluminium	Mercury	Uranium	Lead	Cadmium	Chromium	Selenium	Silica
Amritsar	18	0	0	19	0	0	5	0
Barnala	7	0	58	2	1	0	0	0
Bathinda	7	3	15	6	0	0	3	0
Faridkot	1	0	4	3	0	0	0	0
Fatehgarh sahib	3	0	0	11	0	0	11	0
Fazilka	11	0	17	1	8	0	2	0
Ferozepur	40	0	66	24	5	0	15	0
Gurdaspur	19	0	10	35	0	1	13	0
Hoshiarpur	67	0	0	19	0	34	9	0
Jalandhar	10	0	0	116	1	0	85	0
Kapurthala	13	0	2	45	7	0	42	0
Ludhiana	21	5	14	74	1	1	41	44
Mansa	5	5	3	0	0	0	0	0
Moga	47	4	38	32	3	0	4	0
Muktsar	2	0	10	0	0	0	1	27
Pathankot	123	0	0	9	0	0	3	0
Patiala	45	1	6	167	84	1	28	0
Rupnagar	281	0	4	32	0	5	19	0
SAS Nagar	20	0	0	1	0	0	0	1
Sangrur	39	0	15	15	0	0	8	0
SBS Nagar	12	8	0	5	0	0	16	0

District	Aluminium	Mercury	Uranium	Lead	Cadmium	Chromium	Selenium	Silica
Tarn Taran	9	0	4	22	1	1	24	0
Total	**800**	**26**	**266**	**638**	**111**	**43**	**329**	**72**

Source: Ministry of Drinking Water and Sanitation Website, As on 3rd December 2014

Table 3.21: Water Quality Testing with Field Testing Kits (FTK, Year 2013-2014)

Sr. no.	Districts	Total Sources	FTK Procure and Distributed				Target no. of Water Samples to be tested with FTK			Achieved No. of Water Samples Tested
			Target Chemical Kits	Target Bact Kits	Achieved Chemical Kits	Achieved Bact Kits	Bacteriological	Chemical	Total	
1	Amritsar	2033	709	4066	54	740	4066	2033	6099	1427
2	Barnala	393	116	786	26	410	786	393	1179	1007
3	Bathinda	1385	279	2770	8	270	2770	1385	4155	2020
4	Faridkot	698	159	1396	16	360	1396	698	2094	1161
5	Fatehgarh sahib	1085	430	2170	27	320	2170	1085	3255	769
6	Fazilka	918	296	1836	13	130	1836	918	2754	814
7	Ferozepur	1735	673	3470	69	780	3470	1735	5205	767
8	Gurdaspur	2634	1156	5268	65	650	5268	2634	7902	1197
9	Hoshiarpur	3043	1275	6086	40	400	6086	3043	9129	833
10	Jalandhar	2224	907	4448	20	200	4448	2224	6672	1548
11	Kapurthala	1316	494	2632	85	850	2632	1316	3948	1499
12	Ludhiana	4632	845	9264	205	2050	9264	4632	13896	1456
13	Mansa	957	237	1914	100	960	1914	957	2871	964
14	Moga	1301	303	2602	85	850	2602	1301	3903	780
15	Muktsar	939	229	1878	55	550	1878	939	2817	2054
16	Pathankot	1067	369	2134	60	600	2134	1067	3201	780
17	Patiala	2989	909	5978	15	150	5978	2989	8967	807
18	Rupnagar	2159	544	4318	15	150	4318	2159	6477	1284
19	SAS Nagar	526	387	1052	9	90	1052	526	1578	1200
20	Sangrur	1457	559	2914	65	200	2914	1457	4371	1648
21	SBSNagar	1692	417	3384	20	200	3384	1692	5076	1288
22	Tarn Taran	1541	480	3082	26	260	3082	1541	4623	2479
	Total	36724	11773	73448	1078	11170	73448	36724	110172	27782

Source: Ministry of Drinking Water and Sanitation, MM Analysis

3.4.4 Current Water Supply and Treatment Practices

The existing rural water supply schemes essentially have three sources – tube well, canal and hand pumps.

As per the Department of Water Supply and Sanitation, according to the latest status on November 2014, out of the total schemes of 9,302; 6,807 are tube well based; 1,659 schemes are India Mark II hand pumps and only 836 schemes are canal based.

With this, about 73% schemes are tube well based. The tube well schemes constitute a bore well connected to a submersible pump. A Chlorination unit / Silver Ionization plant is connected to the pumping main for the disinfection of water. The water, after being chlorinated, is pumped to the overhead tank where it is stored and subsequently supplied to the users through the distribution network.

Canal based schemes are about 9%. The raw water is transmitted through an intake point on the canal to a raw water tank / S&S Tank with water retention period of 15-30 days. Water treatment is provided by filtration units followed by disinfection through chlorination and finally to the clear water sump, which is then pumped to overhead tank and subsequently to the distribution network. The canal based water schemes are dependent on Irrigation department for release of water.

The remaining 18% schemes are hand pump based.

3.5 Sanitation

3.5.1 Incidence of Water and Sanitation Related Diseases

The various water and sanitation related diseases occurring in Punjab are given in Table 3.22 along with their linkages to water and sanitation situation.

Table 3.22: Water and Sanitation Related diseases in Punjab

Sr. No.	Disease and Transmission	Linkage to Water Supply and Sanitation
1	Amoebiasis (hand to mouth)	Sewage Contamination, untreated drinking water, flies in water supply
2	Diarrhoea / Gastroenteritis (oral-faecal)	Sewage contaminated water, inadequately disinfected drinking water
3	Cholera (oral-faecal)	Untreated water, sewage contamination, poor hygiene, crowded living conditions with inadequate sewage facilities
4	Hepatitis A (oral-faecal)	Raw sewage, untreated drinking water, poor hygiene
5	Shigellosis (oral-faecal)	Sludge, untreated wastewater, ground water contamination, poorly disinfected drinking water
6	Typhoid fever (oral-faecal)	Raw sewage, poorly disinfected drinking water

- As per the assessment, over the years (2008-2013), Jalandhar and Patiala are the worst affected districts with 1,58,437 and 88,918 acute diarrhoea cases respectively.
- Jalandhar, Ludhiana and Gurdaspur are the districts having 31,477; 21,621 and 20,472 enteric fever cases in last six years.
- Ludhiana, Sangrur and Moga are the worst affected districts with 1,577; 902 and 890 Hepatitis A & E cases.

Figure 3.16: Year-wise Acute Diarrhoea Cases in Punjab (2008-2013)

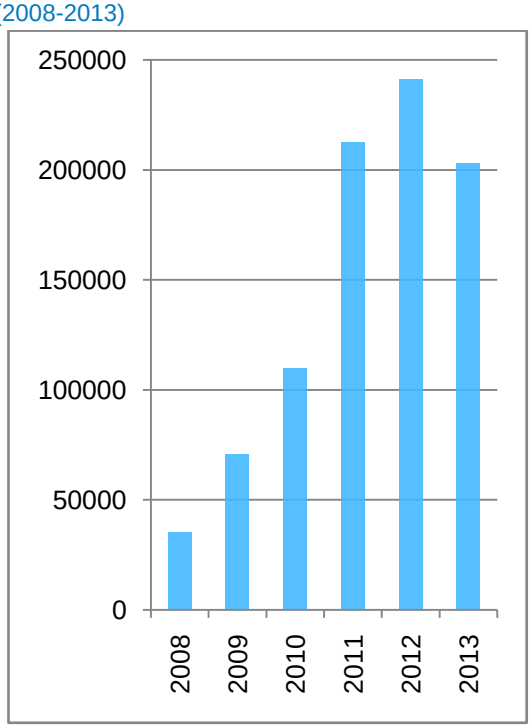
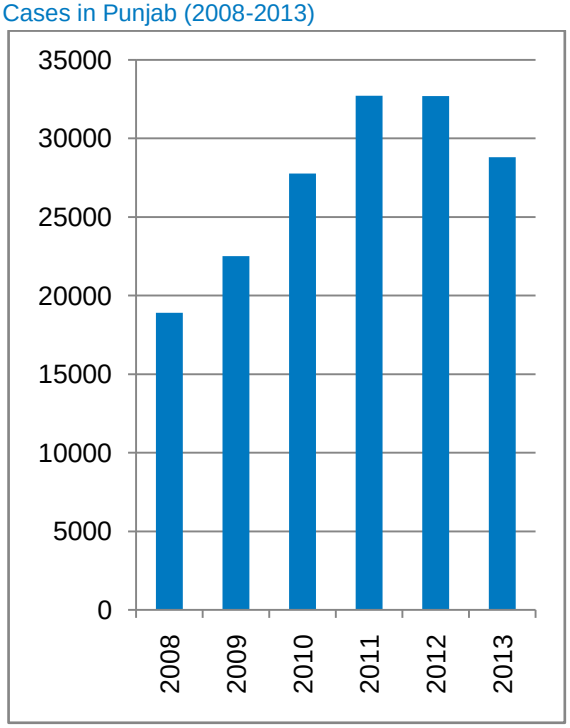
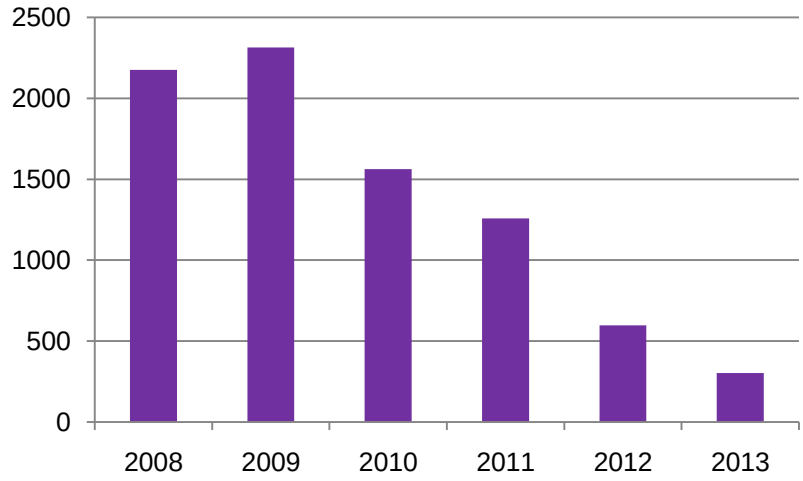


Figure 3.17: Year-wise Distribution of Enteric Fever Cases in Punjab (2008-2013)



Source: Integrated Disease Surveillance Programme (IDSP)

Figure 3.18: Year-wise Distribution of Hepatitis A & E Cases in Punjab (2008-2013)



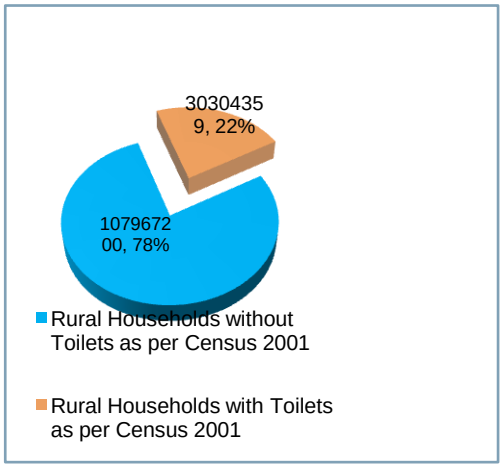
Source: IDSP

3.5.2 Status of Toilet Construction

Habitually sanitation in rural India relied heavily on high levels of subsidies for latrine construction. Focus on "Triggering" behaviour change for the collection, and not simply for individuals is necessary. Increasing trend has been observed with the achievement of the sanitation facility for the households. Details of households with/without "Individual Household Latrines (IHHL) are as furnished in the Figure 3.23 below. The baseline data for the toilets Schools, Anganwadis & Sanitary Complex is as given in Table 3.23 below. From the baseline data, below observations have been made. According to Baseline Survey data conducted by DWSS in 2012, out of total rural households of 31,92,091 across entire Punjab state, 23,99,641 households (i.e. 75.17%) are having IHHLs.

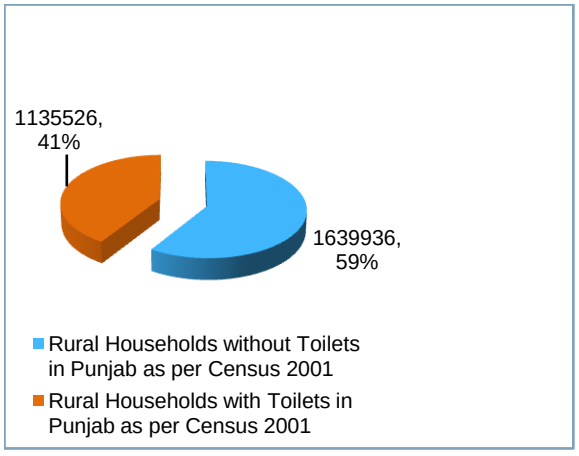
- Moga and Ludhiana are the districts where more than 90% households are having IHHLs, whereas in Bathinda, Faridkot, Jalandhar, Patiala and Sangrur it is more than 80%.
- Amritsar is the only district where only 50% households are having IHHLs.
- As far as BPL households are concern, special attention to be given in Amritsar, Nawansher, Kapurthala and Tarn Taran districts where less than 50% households are having IHHLs.
- In terms of APL households, care to be taken in Amritsar, Barnala, Ferozepur, Hoshiarpur, Nawansher and Tarn Taran districts where only 60% to 70% households are having IHHLs.
- Actions to be taken to construct school toilets in the districts of Gurdaspur & SAS Nagar
- To construct Anganwadis toilets in the districts of Amritsar, Ferozepur, Ludhiana & Sangrur.
- To construct Sanitary Complex in the districts of Barnala, Ludhiana, Mansa and Sri Muktsar Sahib.

Figure 3.19: Status of Households Sanitation across India as per Census 2001



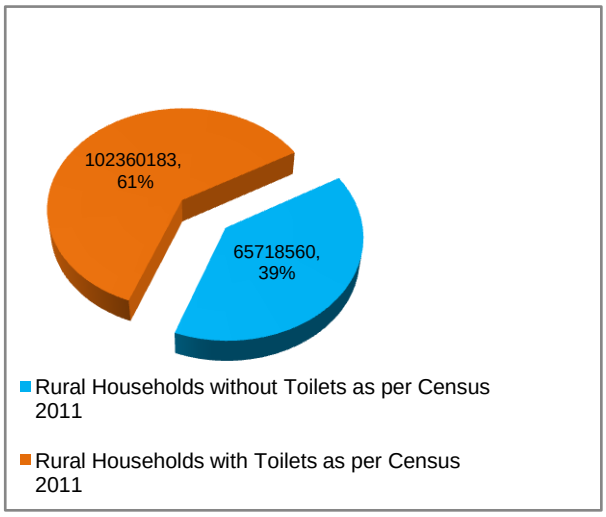
Source: Total Households as per Census 2001, Total IHHL based on data from Ministry of Drinking water & Sanitation, MM Analysis

Figure 3.20: Status of Households Sanitation across Rural Punjab as per Census 2001



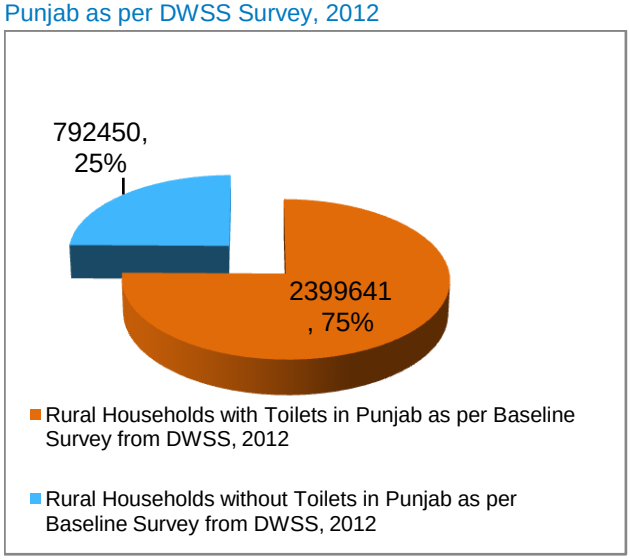
Source: Total Households as per Census 2001, Total IHHL based on data from Ministry of Drinking water & Sanitation, MM Analysis

Figure 3.21: Status of Household Sanitation across India as per Census 2011



Source: Total Households as per Census 2001, Total IHHL based on data from Ministry of Drinking water & Sanitation, MM Analysis

Figure 3.22: Status of Households Sanitation across Rural Punjab as per DWSS Survey, 2012



Source: Total Households & Total IHHL based on Baseline Survey data from SPMC, 2012, MM Analysis

Table 3.23: District wise Toilets for Schools, Anganwadis and Sanitary Complex (NBA Programme) [2]

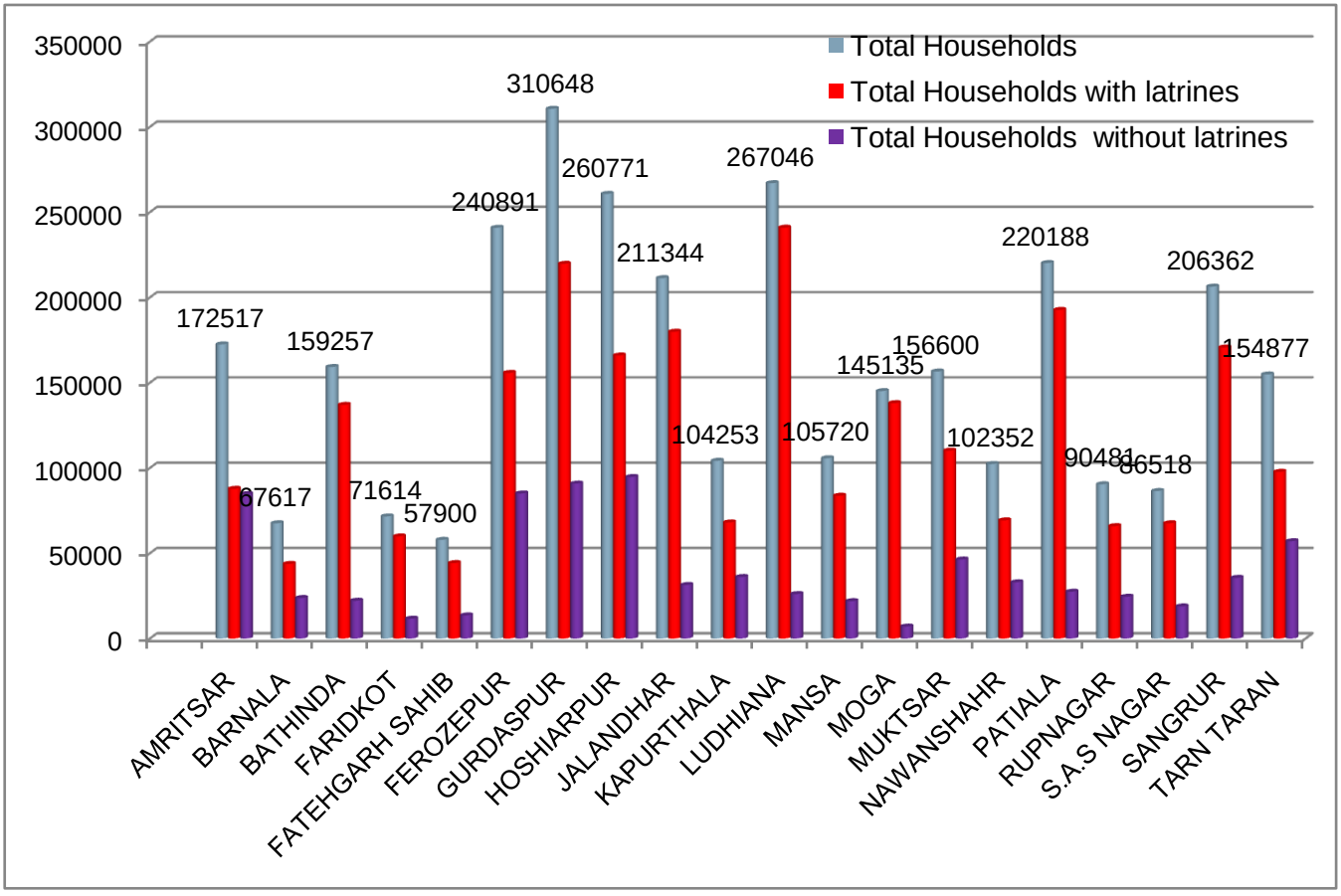
Sr. No.	District	School Toilets			Toilets for Anganwadis			Sanitary Complex		
		Approx.	Status	%age	Approx.	Status	%age	Approx.	Status	%age
1	AMRITSAR	599	650	100	378	50	13.23	0	1	0
2	BARNALA	54	58	100	123	100	81.3	35	3	8.57
3	BATHINDA	442	422	95.48	0	652	0	14	9	64.29
4	FARIDKOT	410	368	89.76	0	117	0	0	0	0
5	FATEHGARH SAHIB	363	363	100	0	402	0	0	0	0
6	FEROZEPUR	326	326	100	604	150	24.83	0	0	0
7	GURDASPUR	600	110	18.33	0	56	0	0	0	0
8	HOSHIARPUR	839	1730	100	0	0	0	0	0	0
9	JALANDHAR	1200	1200	100	0	256	0	0	0	0
10	KAPURTHALA	500	627	100	0	155	0	0	0	0
11	LUDHIANA	156	146	93.59	311	62	19.94	50	8	16
12	MANSA	240	240	100	391	625	100	75	5	6.67

[2] Data Shown in this Table changes frequently due to online entry of GP-baseline data

Sr. No.	District	School Toilets			Toilets for Anganwadis			Sanitary Complex		
		Approx.	Status	%age	Approx.	Status	%age	Approx.	Status	%age
13	MOGA	210	333	100	0	353	0	10	6	60
14	SRI MUKTSAR SAHIB	193	195	100	0	162	0	200	45	22.5
15	NAWANSHAHR	330	330	100	0	160	0	0	0	0
16	PATIALA	0	0	0	417	417	100	2	7	100
17	RUPNAGAR	52	72	100	228	522	100	0	0	0
18	S.A.S NAGAR	504	104	20.63	0	303	0	0	0	0
19	SANGRUR	306	358	100	372	90	24.19	25	16	64
20	TARN TARAN	140	499	100	450	265	58.89	0	0	0
	Total	7464	8131	108.93	3274	4897	149.57	411	100	24.33

Source: Ministry of Drinking Water & Sanitation, MM Analysis

Figure 3.23: Total Number of Individual Household Latrines (IHHLs)



Source: Baseline Survey data of DWSS, 2012

3.5.3 Status of Sewerage Schemes

According to Department of Water Supply and Sanitation and status as on November 2014, there are currently 97 sewerage schemes in 18 districts of Punjab State for which either work is in progress or they are commissioned. Out of 97 schemes, 82 schemes are already commissioned and for remaining 154 schemes work is in progress. District-wise sewerage schemes are as given in Table 3.24.

Table 3.24: Status of Sewerage Schemes

Sr. No.	District	Total No. of Schemes	Sr. No.	District	Total No. of Schemes
1	Rupnagar	4	10	Gurdaspur	3
2	SAS Nagar	7	11	Hoshiarpur	4
3	Patiala	8	12	SBS Nagar	7
4	Fatehgarh Sahib	5	13	Ludhiana	10
5	Faridkot	3	14	Amritsar	6
6	Sri Muktsar Sahib	5	15	Tarn Taran	6
7	Moga	5	16	Sangrur	3
8	Jalandhar	10	17	Barnala	1
9	Kapurthala	6	18	Ferozepur	4

3.5.4 Status of Solid & Liquid Waste Management

Effective solid and liquid waste management is the key to achieve this and create a clean environment. Effective management of SLWM includes management of biodegradable and non-biodegradable waste, management of all grey water generated in the village and general cleanliness of the village.

Table 3.25: SLWM Programmes in 22 districts of Punjab as per NBA Programme,

Districts	IHHLs	No. of Solid & Liquid Waste Management Programmes (SLWM)
Amritsar	157072	0
Barnala	24137	9
Bathinda	51602	15
Faridkot	6000	7
Fatehgarh Sahib	18677	0
Ferozepur	125655	3
Gurdaspur	114310	0
Hoshiarpur	11112	1
Jalandhar	22593	0
Kapurthala	14846	0
Ludhiana	54378	31
Mansa	69004	3

Districts	IHHLs	No. of Solid & Liquid Waste Management Programmes (SLWM)
Moga	37170	1
Sri Muktsar Sahib	33148	2
Nawansher	43167	0
Patiala	136542	11
Rupnagar	49150	0
SAS Nagar	20682	0
Sangrur	45926	4
Tarn Taran	132397	0
Total	1167568	87

Source: Ministry of Drinking Water & Sanitation

4 Field Surveys & Study

4.1 Sample Selection

Based on the discussions with the client, six districts i.e. SAS Nagar, Sangrur, Sri Muktsar Sahib, Moga, Amritsar & Hoshiarpur geographically spread districts in Punjab, were demarcated; and one village in each of these districts was selected to take up field study.

4.1.1 Selection of Six Villages

As per the discussion with the client, it has been decided to consider one village each from the selected 6 districts (SAS Nagar, Sangrur, Sri Muktsar Sahib, Moga, Amritsar & Hoshiarpur considered as the representative districts). Based on the primary data collected in these villages and secondary data collection from SPMC and other sources, the preparation of the report on Environmental Assessment and Environmental Management Framework for the project area has been done.

4.1.2 Sample Details

The sample villages from the 6 representative districts selected for the studies are as follows:

Table 4.1: List of Sample Villages

Sr. No.	District	Block	Village
1	SAS Nagar	Majri	Bhajouli
2	Sangrur	Malerkotla	Jhuner
3	Sri Muktsar Sahib	Malout	Bhangchari
4	Moga	Dharamkot	Sangla
5	Amritsar	Ajnala	Hararkhurd
6	Hoshiarpur	Hoshiarpur II	Badial

4.1.3 Methodology of Field Study

During the field visit, the existing information about environmental issues of RWSS sector, from the sector institutions and other sources like report of the surveys conducted in the past, the report of the relevant studies done earlier, official records of various concerned departments / organizations etc. were collected.

4.2 Analysis of Peoples' Perception and Present Status

4.2.1 General

Table 4.2: General Remarks in 6 selected districts

District	Block	Village	Population	No. of HH	Remarks[3]
SAS Nagar	Majri	Bhajouli	1,101	186	No Historical Important structures were found.
Sangrur	Malerkotla II	Jhuner	2,714	430	No Historical Important structures were found.
Sri Muktsar Sahib	Malout	Bhangchari	4,134	562	No Historical Important structures were found.
Moga	Dharamkot	Sangla	899	113	No Historical Important structures were found.
Amritsar	Ajnala	Hararkhurd	1,039	160	No Historical Important structures were found.
Hoshiarpur	Hoshiarpur II	Badial	827	181	No Historical Important structures were found.

Source: Sample Field Survey

4.2.2 Baseline Environment

Table 4.3: Baseline Environment Status in 6 selected districts

District	Block	Village	Field Observations
SAS Nagar	Majri	Bhajouli	• Plain Topography • Low Rainfall intensity. Normal Average Annual Rainfall is 397.8mm. • Water Table is very deep (>20m) • Pond within the village but is not utilized • No water logging problems within village • Road is partly paved. C.C. road, RCC & Bituminous • Average width of roads < 3m
Sangrur	Malerkotla II	Jhuner	• Plain Topography • Moderate Rainfall intensity. Normal Average Annual Rainfall is 416.1mm • Water table is very deep (> 20m) • Pond is existing water body, where wastewater is being disposed. • Water Bound Macadam road • No water logging problems within area • Average width of roads < 3m

[3] Historical Importance represents the importance of the village as Archeologically, Religiously etc.

District	Block	Village	Field Observations
Sri Muktsar Sahib	Malout	Bhangchari	• Plain Topography • Moderate Rainfall Intensity. Normal Average Annual Rainfall is 351.2mm • Water table is shallow in the range of 0 to 5m • Canal and Pond are existing water bodies. • Pond is only used for Cattle washing • If it rains heavily, water logging problem occurs • Paved road, Pre-mix & bricks • Average width of roads < 3m.
Moga	Dharamkot	Sangla	• Plain Topography • Moderate Rainfall Intensity. Normal Average Annual Rainfall is 399.2mm • Sandy Clay Soil • Water body - Satluj River is nearby • No water logging problems within area • Paved roads • Average width of roads < 3m
Amritsar	Ajnala	Hararkhurd	• Plain Topography • Moderate Rainfall intensity. Normal Average Annual Rainfall is 679.3mm • Pond is used for cattle washing • Water table is very deep (> 20m) • Brick paving road, mostly metal • Average width of roads < 3m
Hoshiarpur	Hoshiarpur II	Badial	• Plain Topography • Moderate Rainfall intensity. Normal Average Annual Rainfall is 635.8mm • Water table is very deep (> 20m) • Pond is existing water body with no utilisation • No un-paved road. Metal and brick roads • Average width of roads < 3m

4.2.3 Public Health Issues

Table 4.4: Public Health Issues in selected 6 districts

District	Block	Village	Remarks
SAS Nagar	Majri	Bhajouli	• No incidence of water borne diseases in the past • No vector borne diseases
Sangrur	Malerkotla II	Jhuner	• No incidence of water borne diseases in the past • No vector borne diseases
Sri Muktsar Sahib	Malout	Bhangchari	• No incidence of water borne diseases in the past • No vector borne diseases
Moga	Dharamkot	Sangla	• No incidence of water borne diseases in the past • No vector borne diseases
Amritsar	Ajnala	Hararkhurd	• No incidence of water borne diseases in the past • No vector borne diseases
Hoshiarpur	Hoshiarpur II	Badial	• No incidence of water borne diseases in the past • No vector borne diseases

4.2.4 Existing Water Supply Scheme

Table 4.5: Existing Water Supply Scheme in 6 selected districts

District	Block	Village	Remarks
SAS Nagar	Majri	Bhajouli	• Single village World Bank assisted water supply scheme • Ground water is the source of safe drinking water supply @ 70-75 lpcd • Daily duration of water supply - 2 hrs. in morning and 2 hrs. in evening • Each household is with water connection with water meters installed • 4 no. of stand post. • Silver Ionization plant is fitted • GPWSC is responsible for O&M • Monthly water testing is done by GP & department. • Water charge – INR 50 /month, basic with INR 5 / 1000 litre • This scheme is operated by GPWSC since 2010. Even though, revenue

District	Block	Village	Remarks
			generated by water charges is less than O&M expenses, the scheme observed to be financially sustainable due to surplus funds available with Panchayat.
Sangrur	Malerkotla II	Jhuner	• Single village water supply scheme • Current safe source of drinking water is Ground water with supply being 70 lpcd • Daily duration of water supply – 1.5 hrs. in morning and 1.5 hrs. in evening • 300 households out of 430 are having water connection • Remaining households uses submersible pump set – No stand post. • Monthly water testing is done by GP & department • Disinfection practice – Silver Ionization • Gram Panchayat Water Supply Committee (GPWSC) is responsible for O&M • Water charge – Fixed INR 100 /month per household • This scheme is operated by GPWSC. As revenue generated by water charges is more than O&M expenses, this scheme is found to be financially sustainable.
Sri Muktsar Sahib	Malout	Bhangchari	• Single Village World Bank assisted water supply scheme • Canal based (Dobra Minor), water comes through Irrigation Department • Current drinking water situation is Safe with water being supplied at 70 lpcd • Daily duration of water supply – 3 hrs. • Total 562 households are having water connections • Water charge – Fixed 100 Rs./month per household • This scheme is operated by GPWSC since 2010. As revenue generated by water charges is more than O&M expenses, this scheme is found to be financially sustainable. • No household is using Public stand post /

District	Block	Village	Remarks
			hand pumps • Every month, department is doing water quality analysis. Also, GP is having Field Test Kit (FTK). • No major water quality problem. • Silver Ionization plant is fitted • Gram Panchayat suggested, electricity is the major issue and during the failure of power supply, they struggle to get sufficient water supply.
Moga	Dharamkot	Sangla	• Single village water supply scheme • GPWSC is responsible for providing water supply • Tube well based water supply @ 70 lpcd • Daily duration of water supply – 6 hours • Each households are having water connection • No stand post. • Disinfection arrangement through Chlorinator • District head quarter does water quality analysis. GP is having Field test kit (FTK) • No water quality problem • Water charges – INR100 per connection per month • This scheme is operated by GPWSC since 2010. As revenue generated by water charges is more than O&M expenses, this scheme is found to be financially sustainable.
Amritsar	Ajnala	Hararkhurd	• Single village water supply scheme with old hand pumps are used in some of the households • GP is very active and has received District Level Best Performance Award. • Ground water is source of safe drinking water with 70 lpcd • 100% households are having water connection • No stand post. • Daily duration of water supply – 3 hours

District	Block	Village	Remarks
			• Water meters are to be installed • Silver Ionization disinfection • No potential risk of contamination of source due to industrial contaminants, human waste discharge or solid waste dumping. • Water charges – INR 100 per household per month • This scheme is operated by GPWSC. As revenue generated by water charges is more than O&M expenses, this scheme is found to be financially sustainable.
Hoshiarpur	Hoshiarpur II	Badial	• Single village water supply scheme • GPWSC has planned the entire scheme • Water currently supplied as 70 lpcd with occasionally it crosses 100 lpcd • Daily duration of water supply 2 times. • 100% households are having water connection • No stand post. • Currently no disinfection unit. • District head quarter perform water testing twice a year. • No major water quality problem • Water charges – INR 80 per HH per month • This scheme is operated by GPWSC since 2008. As revenue generated by water charges is more than O&M expenses, this scheme is found to be financially sustainable.

4.2.5 Existing Sanitation Facilities

Table 4.6: Existing Sanitation Facilities in 6 selected districts

District	Block	Village	Remarks
SAS Nagar	Majri	Bhajouli	• Sanitation practice – Septic tank as well as Latrine with soak pit • STP is already constructed and in near future connections will be given. Individual household disposes livestock dung nearby to their house and eventually uses it as manure. • Liquid waste disposal (wastewater from kitchen and bath) in open drains and eventually gets deposited in natural depression. It is also observed due to improper design (not maintaining gradient) of drain water gets stagnated in drain itself. • No open defecation
Sangrur	Malerkotla II	Jhuner	• Sanitation Practice – Leach pit is made. No open defecation • Level of awareness – Camp, workshop is being held • Current Drainage pattern – open • STP is already constructed of 0.222 MLD. • Liquid waste(wastewater from kitchen and bath) disposal in open drain and eventually gets deposited in natural depression. It is also observed, due to improper design (not maintaining gradient) of drain water gets stagnated in drain itself.
Sri Muktsar Sahib	Malout	Bhangchari	• Sanitation practice – Toilets are constructed in each household. Septic tank are also there • Current Drainage pattern – Open • Liquid waste disposes in open drains and eventually gets deposited in natural depression. It is also observed, due to improper design (not maintaining gradient) of drain water gets stagnated in drain itself. • Solid waste disposal: Nearby their house.

District	Block	Village	Remarks
			They use in the field as Manure once the dump is composted. • STP is already constructed and will be commissioned shortly. • No open defecation.
Moga	Dharamkot	Sangla	• Sanitation practice – Toilets and septic tanks • No open defecation. • Current drainage pattern – underground sewer lines are commissioned • STP is constructed • Individual household dumps livestock dung in front of their houses and uses it as manure.
Amritsar	Ajnala	Hararkhurd	• Sanitation practice – Septic tank in general • No open defecation • Sewerage lines are already laid. STP is constructed and ready for commissioned • Livestock dung disposal nearby house and ultimately they use it as manure.
Hoshiarpur	Hoshiarpur II	Badial	• Sanitation Practice – 100% toilet and septic tank in each connection • No open defecation • Current Drainage pattern – Open • Solid waste disposal – GP allotted space and villagers dump it there. • Liquid waste disposal on open drains (in absence of sewer connections) and eventually gets deposited in natural depression. It is also observed due to improper design (not maintaining gradient) of drain water gets stagnated in drain itself. • STP is already being constructed of 0.177 MLD with 50 households are having sewerage connection. • GP has hired a person who cleans the drains

4.3 Observations on the basis of Field Visit

The village level survey and group discussions with Sarpanch and villagers were carried out during the field visits; key findings observed w.r.t. water supply and sanitation are summarized below:

4.3.1 Water Supply – Key Issues

- In the Northern and central districts of the state, water is available in shallow / deep aquifers but shallow aquifers are not suitable for drinking water due to the possibility of contamination from untreated industrial / polluted waste water.
- Since the supply of canal water is not available all 365 days in a year, required storage is to be maintained to provide regular water supply during canal closure period. Due to high turbidity in canal water, slow sand filters get clogged up frequently and require the provision of pre-treatment.
- It is envisaged that the coverage of habitations with contaminant removal units could be affected, once the O&M responsibility of these units by the contractor ends. In those habitations, piped water supply schemes with safe and sustainable source can be a better option, where people come forward to bear the costs of O&M of the scheme.
- Safe disposal of reject water from R.O plants is an issue.
- Operation of Pumps: Insufficient power supply affects the desired water supply coverage to the villagers.
- Use of individual submersible pumps at household level could lead to over draft of ground water.
- Use of small (Tullu) pumps to draw more water from the piped water supply scheme could affect other users.

4.3.2 Sanitation – Key Issues

- Where the sewer lines are already constructed, people are not willing to get connected; Lack of awareness and cost of connection (i.e, construction of septic tank, if required, provision of intercepting chamber and connecting wastewater from Kitchen and Bath).
- No plantation surrounding STP and space constraint for plantation.
- Improper disposal of solid and liquid wastes.

5 Lessons learnt from the Past Project

5.1 Lessons learnt

The experience from the World Bank funded 1st Punjab Rural Water Supply and Sanitation (PRWSS) project has demonstrated effectiveness of the community driven development approaches in improving safe drinking water and sanitation services. During the course of the past project, some experience and key lessons learned are as follows:

5.1.1 Institutional Reforms

Punjab's ownership and keen desire for reforms is evident from a number of reform initiatives already taken by the State. Further, despite being a relatively prosperous state, Punjab needs improvements in the quality of rural water and sanitation service delivery requiring both additional investments and reforms.

In the current Institutional set up, it has been observed that due to their dual role in RWSS activities and routine department activities, they are overloaded with work, and may not provide adequate attention to the implementation of the environmental measures in the project. To remedy this, it has been proposed to reinforce current institutional set up with the provision of Environmental specialists/managers at State, zone, circle, division and field level with Regular employee of DWSS of Executive Engineer cadre at state level will act as Focal Point for Environment. With this strengthening of the institutional arrangement, it is envisaged that implementation of environmental measures with proper monitoring of RWSS schemes will be achieved in addition to the improved service level with safe drinking water and better sanitation facilities across the rural areas.

5.1.2 Sewer Connections

Assessment of existing sewer schemes reveals that, villagers are hesitant in taking up the sewer connections partly due to the cost implication and partly due to the lack of awareness of personal hygiene and information on diseases. The issue is where sewer lines are laid all the houses do not have septic tanks as the small bore sewer system can only take supernatant water from septic tanks and septic tanks need to be constructed. Connection to the sewer system from the kitchen and bath also need to be provided. To remedy, Department is facilitating construction of these for underprivileged sections. For other sections of the village, awareness creation is important to encourage connections.

Sewerage schemes may be taken up in the villages where septic tanks are widely used, so that connection to the sewer system will be easy.

Further, more public awareness programs to be conducted to provide information to villagers on the importance of personal hygiene and subsequent health benefits, prior to taking up the scheme.

Conversion of small bore sewer system (solids free) may be explored so that the conventional sewer system with sewage with solids, thus avoids provision of septic tanks in the households to get connected to small bore sewer system.

5.1.3 Capacity Building

Capacity Building of all the stakeholders on a continuous basis is critical to accomplish the social and environmental objectives – Safe sanitation, improved hygiene for maximizing health benefits, gender, equity and operation and maintenance. Engineering Staff College of India, Hyderabad has established training programs involving water supply and sanitation and the departmental engineers can be trained to build their capacities in this respect.

5.1.4 Water Quality Monitoring

It is reported that, there are 30 laboratories (with one at state level, 21 at district level and 8 at block level across the state for water quality monitoring. In addition, there are 3mobile water testing labs for testing samples on field.Number at block level needs to be increased to improve the frequency and number of samples to be tested. With more number of labs, the time consumed to take the samples to the lab can be reduced and water samples can be tested and reported in the same day.This will help in taking immediate action in case of contamination.

5.1.5 Waste Water Quality Monitoring

It is reported that, there are no exclusive labs in the Department for testing wastewater samples. For testing, the Department is sending samples to private laboratories. The department may procure wastewater testing equipment and establish wastewater analysis wing within the existing water laboratories, wherever sewerage schemes were taken up and completed.

5.1.6 Regulation of Ground water abstraction

Based on the field visits and secondary data, it is observed that ground water is being over exploited for irrigation leading to sustainability problem for drinking water sources. It is suggested to have legislation on ground water regulation and recharge to control over exploitation.Regulation of extractions from the groundwater aquifers, change in cropping pattern (from water intensive to crops requiring less water) and ground water re-charge measures to be ensured by having relevant legislation, if required.

5.1.7 Empower Communities to participate in Decision making

Though the participation of community in the planning and implementation process of water supply schemes is being ensured, the same level of participation in case of sewerage schemes is not observed. This participation is required for sustainable management of the scheme with monitoring the work of the contractor during the implementation and O&M phase to ensure the effluent standards of the STPs. Community participation also facilitates in increasing accountability of the government.

5.1.8 Technology options for STP

Based on the field visits, it is observed that only one type of treatment option (waste stabilisation ponds) is considered. Other low cost options suitable to rural areas need to be explored and considered for effective and sustainable operation and maintenance.

5.1.9 Fencing and green buffer zone for STP

It is observed that fencing is not provided for STPs and due to limited availability of land no buffer zone with plantation could be maintained. This issue need to be considered while acquiring the land. Regarding plantation local species, which can be grown around the STP need to be identified and planted.

5.1.10 Develop appropriate Environment Monitoring System

Appropriate information, monitoring and learning system on environmental issues and measures must be in place before the bidding of scheme in order to prepare the DWSS, Environmental staff and local communities to avoid unnecessary delay in project implementation.

6 Environmental Concerns and Management Proposals

6.1 Planning Phase or Pre-construction Stage

6.1.1 Key Environmental Issues and Mitigation measures for Water Supply

6.1.1.1 Water Availability / Water Quantity

Ground water has been the major source of rural drinking water and irrigation in Punjab. Owing to large scale extraction of ground water for irrigation, combined with increasing demands in other sectors due to population and industrial growth, the aquifers are prone to be under stress and some of the sources have become either unsustainable or contaminated. For a large number of rural households which are covered by public piped water supply schemes with ground water as source and others dependent on hand pumps or tube wells, the declining and fluctuating ground water levels could affect the water supply.

About 91% of DWSS schemes in Punjab are based on ground water sources. The remaining 9% of the water supply schemes are based on surface water sources. The RWSS project in 22 districts of Punjab will involve implementation of Single Village Schemes (SVS) and Multi Village Schemes (MVS), to tackle the expected problems w.r.t. safe and sustainable sources.

With regard to source sustainability/ water availability issues, the proposed mitigation measures are:

- Augmentation of existing water supply schemes through rehabilitation/upgrading should be on priority wherever feasible.
- The existing resources should be conserved and augmentation by maximizing retention, eliminating pollution and minimizing losses.
- Distant surface sources could be tapped to augment water supply with treatment preferably conventional Rapid Sand Filters, chlorination or appropriate amalgamation of ground water and treated surface water to achieve the desired quality/ standards of drinking water.
- In case where water supply from canal-based schemes is unreliable during the canal shutdown periods, the schemes should be designed either with enhanced storage commensurate with the shutdown periods, or with other sources which may be more distant but more reliable.
- In cases, where the drinking water supply sources involve extraction from a critical or overexploited aquifer, the emphasis must be on water conservation.
- Regulation of extractions from the groundwater aquifers, change in cropping pattern (from water intensive to crops requiring less water) and ground water re-charge measures to be ensured by having relevant legislation, if required.
- Appropriate blending of ground water and treated canal water to obtain a drinking water of derived quality standards.
- Efficient use of water should be promoted through education, regulation, incentives and disincentives.
- Increase ground water recharge to sustain the demand.
- Promote aquifer management groups and educate communities in water resources management.

6.1.1.2 Water Source Protection

The drinking water receives from local drinking water utilities or an individual well comes from either from ground water, streams, rivers or lakes in a watershed. Although most of the water requires some kind of treatment before use, protecting sources of water is an important part of providing safe drinking water to the public. Protecting drinking water sources usually requires the combined efforts of many stakeholders such as communities, GPWSCs, DWSS and last but not the least an individual.

Suggested mitigation measures are:

- Post signs along the border of the source protection area to notify people that any pollution in the surrounding area would affect drinking water quality of that source.
- Use and dispose harmful materials properly Since hazardous waste that is dumped in or buried in the ground can contaminate the soil and contaminants can leach into the ground water or nearby surface water sources by way of runoff during rainfall.
- Do not overuse pesticides or fertilizers.
- Delineate the source water assessment area. For each ground water well or surface water intake that supplies public drinking water, DWSS should delineate or map the land area that could contribute pollutants to the water supply.
- Identify potential sources of pollutants that could contaminate the source of water supply.

6.1.1.3 Water Quality

1. Surface Water Quality

The major canal networks of Punjab are relatively free of industrial or municipal discharges, and the irrigation drainage flows are seldom routed into the canal system. The water quality in the main canals is generally better than that of the river courses. The quality problems with respect to surface water sources are more acute in the locations and during the periods when the flow in the river is not sufficient to cause acceptable level of dilution of the discharge effluents.

- **Environmental Issues**
  - Agricultural runoff containing fertilizers and pesticides, washing, bathing and other human activities in rivers are considered non-point sources of pollution to the water supply sources.
  - Discharge of inadequately treated municipal and industrial wastes in receiving water bodies or on land.
  - Inefficient and irregular disinfection of drinking water supplies.
  - Breakage/leakage in rising main, distribution lines and valve chambers.
  - Improper collection, storage and handling of water at the individual household level.

2. Ground Water Quality

The ground water quality in Punjab is poor owing to natural presence of salinity, arsenic, iron and fluoride at concentrations exceeding the permissible levels for drinking water use. In addition, the ground water quality may also indicate bacteriological and chemical contamination due to inadequate treatment and disposal of sullage, effluent from septic tanks, use of pesticides or industrial discharges.

3. Mitigation Measures on Surface and Ground Water Quality

The siting, planning, design and operation of the schemes should ensure that source selection is done with due regard to water quality of the source, and that water quality at household delivery level meets the drinking water norms.

- The selection of water sources should be after thorough investigation of both surface and ground water sources. The water quality testing should be done prior to source selection of water supply schemes.
- Water quality testing for industrial and agricultural chemical contaminants shall be conducted by the DWSS, as suggested by the phased approach based on an initial sampling of deep groundwater and canal water in all the districts of the state. Cost of testing should not be sited as a constraint, nor should the cost be borne by the beneficiary community.
- In case quality of available ground water is very poor, a distant safe and sustainable surface water source for a cluster of quality affected habitations should be opted.
- In case quality of available water is very poor and no other alternative source is available, advance treatment options like de-fluoridation units, iron removal units, Reverse Osmosis units and other filtration units can be adopted based on the type of pollutants and corresponding treatment required.
- Effective and regular disinfection, as well as preventive and corrective maintenance of water distribution systems should be ensured.
- Institutional arrangements should be put in place for preventive and corrective maintenance of water distribution system and for preparedness in crisis management during breakdowns.
- A set of rules for regular water quality testing and control measures should be developed and implemented through the operations phase of the water supply schemes.
- Provide limited quantity of fresh water for drinking, and use poor quality water for other purposes.

6.1.1.4 Clearances

- All the environmental clearances required shall be obtained for the schemes before tendering the works for execution.

6.1.2 Key Environmental Issues and Mitigation Measures for Sewerage Schemes

6.1.2.1 Household Sanitation options and issues

There are no provisions of sanitation facilities in 25% of rural households in Punjab. Amongst the 75% households who have access to a sanitary facility, about 94% have a toilet within their house, 4% households share a toilet with other households while about 2% households use a public toilet. Those who do not have access to a toilet, practice open defecation.

- **Environmental Issues:**
  - Practice of open defecation due to households without latrines, low usage of latrines and low level of awareness
  - Without adequate arrangements for treatment and disposal, the wastewater often seeps into hand pumps, open dug wells and pipelines, and the village ponds leading to contamination of aquifers and loss of productive uses.

- The presence of stagnant water in the surface drains combined with poor personal hygiene leads to the incidence of malaria and other vector borne diseases, diahorreal diseases, etc.
- Solid wastes of decomposable and non-decomposable class are collected together and disposed by mere dumping along streets and depressed lands in the village leading to stinking and vector breeding.
- Wastewater generated by the households, including the waste water from the cattle sheds, flow into open surface drains leading to stagnation in the lanes and by-lanes.

- **Mitigation Measures:**
  - Construction of latrines and awareness creation for increased usage at personal, household and community level.
  - Efficient design of surface sullage drains and adoption of good construction practices, along with a system of regular maintenance can ensure that stagnant pool of sullage are eliminated.
  - Installation of small bore sewer systems for conveyance of sewage can eliminate environmental and public health hazards associated with open drain system.
  - Adequate treatment and gainful utilization of the treated effluent/sullage is possible in agriculture, aquaculture and agro forestry.
  - Vector control measures should be provided to the ponds and drains carrying sullage by way of avoiding stagnation and spraying with non-hazardous insecticides.
  - The project will need to ensure that the benefits of improved water supply are not compromised by poor personal hygiene standards, by supporting sustained sanitation campaign to create and enhance awareness on hygiene aspects pertaining to hand washing, safe water collection, storage and handling practices.
  - Solid waste management including segregation of wastes at source, collection at door step, recycling of non-degradable wastes, composting of biodegradable wastes, safe disposal of hazardous wastes, demarcated land fill sites, etc may be advocated through IEC campaigns.
  - Adopting the recommend practice of laying water and sullage lines on different sides of the road reduces the risk of cross contamination.

6.1.2.2 Septic Tanks

All the wastewater from the home should flow to the septic tank. Even waters from the shower or washing machine can contain disease causing germs or environmental pollutants. As wastewater flows into the tank, the heavier solid materials settle to the bottom, the lighter grease and fats float to the top and liquid flows out of the tank. Mitigation measures:

- Periodically have the solids pumped out of the septic tank.
- Restrict the use of garbage disposal.
- Do not plan any building additions, or other construction work near the septic tank.
- Do not pour cooking greases, oils and fats down the drain.

6.1.2.3 Site Selection for STP

Site selection of a waste water treatment facility should be based on careful consideration on development patterns as well as social, environmental and engineering constraints. It is important to understand that the

selection of a site for sewage treatment plant will have long lasting social, environmental and economic repercussion on the affected community and neighbourhood. Therefore, public intervention in decision making is also useful.

- A waste water treatment plant shall be located at lower elevation in order to permit gravity flow.
- The site should be fairly isolate from presently built up areas or areas that have potential for future developments.
- All plants should be designed with aesthetic considerations and odours in mind.
- A site on a large land area is helpful in maintaining isolation and fulfils the need for future expansion.
- Provide opportunity for local disposal of end products such as effluent, grit, screenings and sludge.
- The site should be near a large body of water or irrigable land capable of accepting the treated effluents.

6.1.2.4 Tree Plantation and Development of Buffer Zones

Not in all the treatment plants visited by the consultant during their field visit of sample villages, there was tree plantation. It is suggested that the tree plantation and development of buffer zones should be done which would not give ugly and unsightly looks of the treatment plant; it would also prevent the bad odour flowing with air.

Suggested mitigation measures are:

- Buffer zones of a minimum width of 4-5m shall be provided around the STP and it should be fenced to prevent tress passing.
- Provision for reuse of treated wastewater in maintaining tree plantation should be done.

6.1.2.5 Clearances

All the environmental clearances required shall be obtained for the schemes before tendering the works for execution.

6.2 Construction Phase Environmental Issues for Water Supply and Sewerage Schemes

6.2.1 Site Clearance

The site clearance is required to setting up the construction activities of the project. The activity involves the clearance of shrubs and bushes from the construction site.

Suggested mitigation measures are:

- No illegal felling of trees
- Debris should be stored properly and disposed off to the low lying areas as identified by the GPWSCs / GPs or the DWSS.

6.2.2 Public Safety

The proposed project activities like pipe laying, construction of water tanks, etc. need to be carried out in the residential areas and the Contractor has to give utmost care to minimize the inconvenience to the public.

Suggested mitigation measures are:

- Excavated pits should be kept open for the minimum possible time;
- Temporary fences should be provided near construction sites especially around deep excavated areas, located in the vicinity of schools, Gurdwara, etc.
- Uses and movement of heavy and mobile equipment should be monitored. All the drivers and operators should have valid license for operating such equipment.
- Warning sign boards and signals in appropriate locations preferably 100m from the construction sites should be placed. The warning sign boards should be in Punjabi and Hindi.

6.2.3 Preservation of Top Soil

Loss of topsoil is a long term impact along the route of water supply and sewerage schemes due to site clearance, temporary construction activities, and development of borrow areas, etc. It should be the responsibility of the Contractor to strip the top soil at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by either DWSS. The stockpiles for storing the topsoil should be designed such that the slope does not exceed 1:2 and height of the pile is restricted to 2m. In cases, where the topsoil has to be preserved for more than a month, the stockpile has to be stabilized within 7 days.

6.2.4 Access Management

During construction especially in residential areas, contractor should plan their works in such a way that vehicular and human movements are not disturbed.

Suggested mitigation measures are:

- Special safety measures in case of Gurdwara and public places for access;
- Special safety measures for access for children to schools;
- Special safety measures for access of patients to hospitals.

6.2.5 Storage of Construction Materials

The requirement for storing the construction materials during execution phase for different activities has to be confined appropriately inside the premises/storage yard. In any case, waste materials should not be allowed to dump in haphazard way inside the construction sites. Suggested mitigation measures are:

- Storage of Petrol/Oil/Lubricants: Brick or sand flooring should be provided at the storage places of petrol/oil/lubricants to avoid soil and water contamination due to spillage;
- Storage of cement: Damp-proof flooring, as per IS Codes would be required.
- Storage of blasting materials: It should be as per the specific provisions of law.
- Minimum period of temporary storage in public space;
- No disturbance to existing access;
- No residual material shall be allowed to be left at site after consuming the same.

6.2.6 Construction Camp

Construction camps should be maintained free of litter and in hygienic condition. It should be kept free from spillage of oil, or grease; any spillage should be cleaned immediately to avoid pollution of soil, water or adjacent water bodies. Following precautions need to be taken in construction camps:

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place;
- Waste water should not be disposed into water bodies;
- Regular collection and safe disposal of solid wastes to be undertaken;
- All consumables such as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped promptly.

6.2.7 Water Pollution

Dumping of construction debris or solid waste in the water body and improper drainage in and around the construction sites may be one of the sources of the water pollution during implementation phase. Suggested mitigation measures are:

- No washing of vehicles or equipment should be permitted near the water source.
- Construction debris should not be disposed to/near the water sources.

6.2.8 Noise Pollution

Various construction activities generate high noise levels and would be a source of noise pollution especially in rural residential areas. Suggested mitigation measures are:

- Machineries as well as equipment should be maintained properly;
- No loud noise generating equipment should be allowed at construction sites;
- Generator should be properly enclosed, and proper padding should be placed below such machinery to reduce vibration.
- Special care must be taken near religious structures, schools, hospitals, etc.
- Machineries/equipment/vehicles should meet the emission standards as stipulated by the State Pollution Control Board, Punjab;

Table 6.1: CPCB Noise Ambient Standards

Area Code	Category of Area	Limit in dB (A)	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone[4]	50	40

Source: Environmental Standards for Ambient Air, Automobiles, Fuels, Industries and Noise

[4]Silence zone defined as areas up-to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones to be declared by the competent authority.

6.2.9 Air Pollution

The source of air pollution at sites may be due to vehicle movement, fugitive dust emission from the construction sites, loading and unloading of construction material, etc.

Suggested mitigation measures are:

- Properly maintained vehicles and equipment should be used;
- Construction debris should not be allowed to remain unattended at construction sites;
- Workers working in dusty areas such as concrete mixing equipment should stringently use nose masks;
- Sprinkling of water in dusty areas;
- Machineries/equipment/vehicles should meet the emission standards as stipulated by the State Pollution Control Board, Punjab;

Table 6.2: Ambient Air Quality Standards

Pollutants	Time – Weighted Average	Concentration in Ambient Air		
		Industrial Areas	Residential, Rural & Other Areas	Sensitive Areas
Sulphur Dioxide (SO2)	Annual Average*	80 µg/m^3	60µg/m^3	15µg/m^3
	24 hours **	120 µg/m^3	80µg/m^3	30µg/m^3
Oxides of Nitrogen as NO2	Annual Average*	80 µg/m^3	60µg/m^3	15µg/m^3
	24 hours **	120 µg/m^3	80µg/m^3	30µg/m^3
Suspended Particulate Matter (SPM)	Annual Average*	360µg/m^3	140µg/m^3	70µg/m^3
	24 hours **	500 µg/m^3	200µg/m^3	100µg/m^3
Respirable Particulate Matter (RPM)	Annual Average*	120µg/m^3	60µg/m^3	50µg/m^3
	24 hours **	150µg/m^3	100µg/m^3	75µg/m^3
Lead (Pb)	Annual Average*	1µg/m^3	0.75µg/m^3	0.50µg/m^3
	24 hours **	1.5µg/m^3	1.0µg/m^3	0.75µg/m^3
Ammonia	Annual Average*	0.1µg/m^3	0.1µg/m^3	0.1µg/m^3
	24 hours **	0.4µg/m^3	0.4µg/m^3	0.4µg/m^3
Carbon Monoxide (CO)	8 hours*	5µg/m^3	2µg/m^3	1µg/m^3
	1 hour	10µg/m^3	4µg/m^3	2µg/m^3

Source: Environmental Standards for Ambient Air, Automobiles, Fuels, Industries and Noise

*Note: * Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a weak 24 hourly at uniform interval.*

*** 24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.*

6.2.10 Occupation Health and Safety Aspects

The safety and health of the workers and public is impacted due to hazards created during the construction. This section describes the measures to be taken to mitigate the impacts:

- Personal Safety Equipment (such as footwear, gloves, eye protection wears, helmets, nose masks and ear plugs) should be provided to the workers;
- Adequate lighting arrangement should be provided;
- Adequate drainage system should be provided to avoid stagnation of water;
- Facilities for administrating first aid should be made available.

6.2.11 Good Housekeeping at Construction Sites

The Contractor has to maintain good housekeeping at construction sites. Some of the suggested mitigation measures are as follows:

- Construction sites should be kept free of clutter and debris;
- Limited quantity of material should be stored at construction sites;
- Remove combustible material such as wood and paper from the site promptly;
- Remove or bend over protruding nails prior to disposal and storage;
- Keep storage, staging and work areas, along with walkways on the construction site, free of obstructions and debris;
- First aid box and firefighting equipment should be provided at site;
- Proper drinking and sanitation facilities should be provided at site.
- Construction sites should be kept free of water logging or stagnation of water;
- Place protective guards across areas where workers could fall or could face an impalement hazard;
- Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous waste, if any, in covered, segregated waste containers.

6.2.12 Managing Impacts from Collection, Storage and Disposal of Households Wastewater

The households having septic tanks may pose problem during construction phase; and wastewater from these households should be collected, stored and disposed of properly. In the houses, where only cesspits are in use, need to be converted to septic tanks as per the technical requirement of the project. The wastewater handling should be done carefully and its spill to the nearby areas should be minimized. Some of the suggested mitigation measures are as follows:

- Connect the household with the temporary collection system;
- Proper storage of wastewater if required;
- The solid waste from soakage pits should be disposed to the identified sites or may be used as manure by the consumers, if fulfilling the criteria. Transportation of such wastes shall be done during night time.
- Laying and connecting sewer network to households should be carried out during the low flow periods.

6.3 Operational Phase Environmental Issues for Water Supply

6.3.1 Leakage from Water supply

Water is often wasted through leaking pipes, joints, valves and fittings of water supply system either due to bad quality of material used, poor workmanship, corrosion, age of installations, or through vandalism as well; this leads to reduction in supply and loss of pressure. The leakages could either be visible or invisible. In the case of invisible leaks, sections of pipeline should be isolated and search to be carried out for location of leaks. Also, the lack of maintenance of pipeline may cause leakages in long run which has negative impact on the various attributes due to water stagnation in the village roads/streets/low lying areas. Proposed mitigation measures are:

- Leakage should be controlled at the point of house connection and in the consumer pipe by adopting correct plumbing practices and strict quality control on pipe material used for house connection;
- To reduce or avoid any leakage or consequent contamination in reservoirs, the reservoirs should be periodically tested for water tightness, drained, cleaned and visually inspected.
- Water auditing/leakage control through metering, improved O&M practices and awareness intervention.
- Check the water tank periodically for leakage or damage.
- All valves installed on the water supply system should be inspected thoroughly.

6.3.2 Maintenance of Water Disinfection System

Drinking water is disinfected to kill bacteria, viruses and parasites which may exist in the water and may cause illness and few diseases. These organisms usually get into drinking water supplies when source of waters are contaminated either by animal waste or human sewage. The disinfection of potable water is almost universally accomplished by the use of gaseous chlorine of chlorine compounds. Other methods of disinfection are also available such as ozone, ultra-violet light, chlorine dioxide, silver ionization etc. Proposed mitigation measures are:

- Due to accumulation of positive and negative ions on the anodes and cathodes of the electrolyser, the efficiency of electrolyser process gets reduced and as such the electrodes requires cleaning every 25 to 30 days with water jet;
- The staff should be given training for routine maintenance; and annual maintenance contract should be given to a specialised agency for trouble free maintenance of the system;
- Plumbing arrangements should be cleaned from time to time;
- The GPWSC must arrange and ensure supply of safe drinking water during all emergency situations. However, the disinfection of water by boiling or using more chlorine dosages or chlorine tablets should be practiced.

6.4 Operational Phase Environmental Issues for Sewerage Schemes

6.4.1 Maintenance Problems

Lack of co-operation and co-ordinated efforts among the community due to differences of opinions could affect severely the maintenance of the system. Further to this, technology options and unavailability of skilled workers

causes maintenance problem especially in the villages where electro-mechanical systems are to be provided. Inadequate maintenance arrangements of the electro-mechanical treatment systems further deteriorates surrounding environment leading to the odour nuisance and mosquitoes and houseflies breeding grounds. Proposed mitigation measures are:

- Public awareness covering various issues such as tariff collection for meeting the O&M costs of treatment plant, health and hygiene issues, should be done periodically during initial years of the operations;
- Spare parts should be easily available with the GPWSCs.
- Routine maintenance of the system must be carried out.

6.4.2 Effluent Disposal and utilisation

The effluent disposal of STP and its utilization should be planned at designs stage otherwise its accumulation in the nearby areas gives un-aesthetic view as well as provides mosquito breeding grounds. The effluent from the STP may be discharged in the water bodies such as ponds, streams or on land provided that it meets the PPCB criteria. But, the criteria of effluent standards of PPCB are stringent than CPCB standards. DWSS need to seek relaxation for the standards as per CPCB norms, as the PPCB norms are difficult to achieve in view of the prosed low-cost sewage treatment technologies in the rural context.

Table 6.3: STP Effluent Standards

Sr. No.	Effluent Standard	PPCB Limit	CPCB Limit
1	BOD	≤ 10 mg/l	≤ 30 mg/l
2	Suspended Solids	≤ 20 mg/l	≤ 100 mg/l

Source: PPCB Notification dated 2nd May 2012

The replacement of fresh water with reclaimed effluent for agricultural irrigation permits the supply of additional drinking water to the population, while maintaining environmental quality by reducing the ecological damages caused by wastewater. Proposed mitigation measures are:

- While selecting the STP location this aspect must be studied. The treated effluent disposal should not create stagnation on the streets or roads;
- Awareness raising programs for workers in treatment facilities, farmers using the reuse water and consumers of the crops grown and wider environmental and health benefits.
- Re-use in wildlife habitats and wetlands. Where of suitable quality, effluent disposal may be utilised to support wildlife.

6.4.3 Impact due to Sewer Overflows

Provision of inspection chambers in the houses are made to collect the grey water, black water and waste water from cattle sheds. Ultimately the waste water collected from the different waste water generating points will convey the same to sewer through a trap. Systems that are not routinely cleaned and repaired, experience more frequent clogged and collapsed lines due to root growth and accumulation of debris, sediment, oil and grease. Proposed mitigation measures are:

- Public awareness programs in the form of IEC campaign should be undertaken in the project area;
- Routine inspections of sewers and inspection chambers should be done;

- To block the entry of solid waste into the sewers, provision of trap at the outlet of interception chamber should be made. This would also prevent the entry of gases into the inspection chamber.
- Regular cleaning of sewerage system and interception chamber should be done to remove any blockages, debris etc.

6.4.4 Impact due to malfunctioning of the Sewage Lift Pump

Sewage pumping stations are designed to pump sewage from one place to another and are usually used for conveying raw sewage to sewage treatment plant, or conveying treated effluent to water receiving bodies. The malfunctioning of lift pumps or power failure will cause negative impact on the visual as well as environmental health. Proposed mitigation measures are:

- Alternate source of energy such as generators would be provided for running the lift pumps.
- If the provision of generator is not feasible due to economic ground or site constraint, temporary storage is another alternative.
- Regular inspection on the pumping station should be conducted. Inspection should cover the essential equipment in the pumping station such as switchboard, pump, motor, etc.
- Regular maintenance of the pumps should be carried out by GPWSCs/DWSS. To assure maximum reliability of operation and maximum efficiency in performance, the maintenance procedures outlined in the O&M manual should be performed as scheduled.
- Adequate spare parts should be stocked for planned maintenance and urgent repair.
- The arrangement of the duty pumps and of the standbys should be planned in such a way that all pumps are in ready to run condition.
- Training to the operators for maintaining the pumps and other accessories, should be provided
- Once the pumping station is commissioned, contingency plan for each pumping station should be ready, which should cater for emergency scenarios such as power supply failure, total breakdown of pumps, flooding of pumping station, etc.

6.5 Identified Hotspots for Water Supply within the Project Area

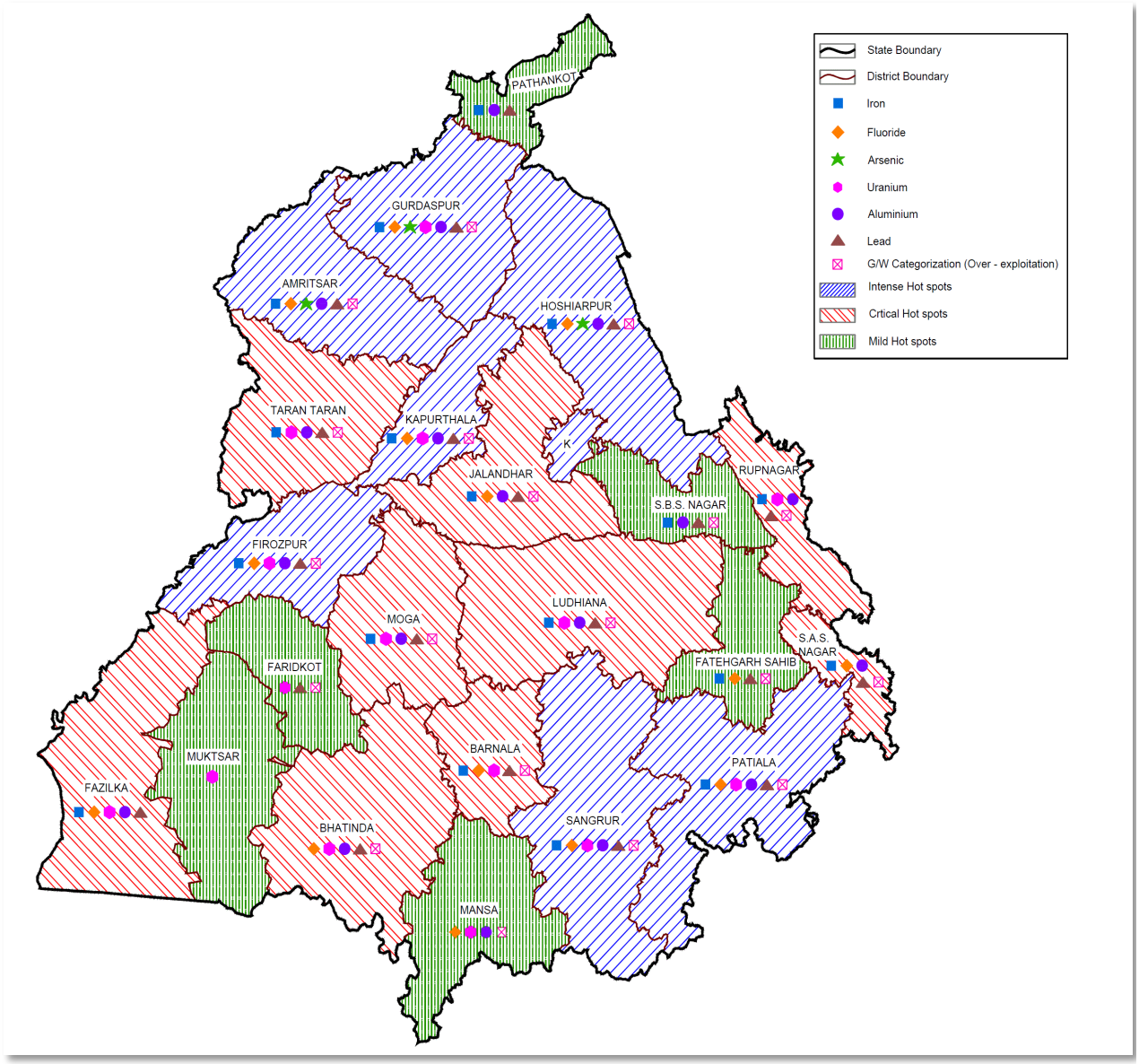
A district/place has been categorised as an environmental hotspot, if any of the environmental problems viz. ground water categorization, levels of Uranium, Arsenic, Fluoride, Iron, and Aluminium are beyond the prescribed drinking water standard. Hotspots have further classified into Intense, Critical and Mild Hotspots depending upon the most number of environmental issues which do not meet the criteria.

As per the analysis,

- 7 districts (Amritsar, Gurdaspur, Hoshiarpur, Ferozepur, Sangrur, Kapurthala and Patiala) have been categorised as intense hotspots;
- 9 districts (SAS Nagar, Rupnagar, Barnala, Bathinda, Fazilka, Tarn Taran, Moga, Ludhiana and Jalandhar) have been categorised as critical hotspots;
- 6 districts (Fatehgarh Sahib, SBS Nagar, Pathankot, Faridkot, Sri Muktsar Sahib and Mansa) have been categorised as mild hotspots.

Map showing identified hotspots within project area is given in Figure 6.1.

Figure 6.1: Identified Hotspots for Water Supply in the Project Area



Source: Mott MacDonald Analysis

6.6 Identified Hotspots for Sanitation within the Project area

Based on analysis, hotspots are identified in terms of sanitation coverage and diseases.

- Amritsar is the only district which is affected by poor Sanitation coverage (approximately 50%), Acute diarrhoea and Enteric fever.
- Hoshiarpur is the district having sanitation coverage of 63% and severely affected by Enteric Fever cases.
- Tarn Taran, Ferozepur and Barnala are the districts where sanitation coverage is 63%, 64.68% & 64.80% respectively which is less than State average of 75%
- Ludhiana, Gurdaspur and Jalandhar are the districts severely affected by both Acute Diarrhoea and Enteric Fever.

7 Environmental Management Framework

7.1 Environmental Management Framework

An Environmental Management Framework (EMF) is an integral part of the project. It establishes the outline for how the mitigation measures should be implemented during different stages of project namely, pre-planning stage, planning, implementation and post implementation phase. A benchmark environmental management framework for both water supply and sanitation scheme is developed as good environmental practices for its enhancement at scheme level under this project. The provision of these measures should be incorporated in the scheme during planning stage and be implemented during implementation and post implementation phase. The environmental enhancement measures should be executed by the prospective contractor under the direct supervision of GPWSC, DWSS. The present section describes common framework likely to be adopted at scheme level.

An analysis of the baseline environmental situation, discussions with state, district and GP level functionaries as well as the stakeholders' consultation meetings have identified the key environmental issues. These issues mainly relate to:

- Inadequate and disrupted water supply
- Chemical and bacteriological contamination of water
- Presence of Uranium, Iron, Arsenic, Fluoride and Nitrate concentrations exceeding the permissible levels in drinking water
- Lack of sanitation facilities
- Inadequate solid and liquid waste management
- Where the sewer lines are already constructed, lack of awareness among the people to get connections in order to improve the hygiene and cleanliness.
- Insufficient or no plantation in and around STP in order to eliminate the foul smell.

In order to mainstream environmental management and to ensure that EMF is systematically implemented for all the project sponsored schemes, EMF needs to be integrated in the project cycle. The Figure 7.1below provides an overview of various EMF activities in the pre-planning, planning, implementation and O&M phases of the proposed project cycle for the project sponsored schemes.

7.1.1 Objectives of EMF

The proposed project will finance investments in rural water supply and sanitation improvement schemes to serve the rural population in 22 districts of Punjab. The project interventions are, therefore, expected to result in public health benefits in the rural communities through improved quality and delivery levels of RWSS services. Some of the main environmental health benefits expected under the project are:

- Increased and better quality of water supply – especially for drinking and cooking purpose
- Time and energy savings through providing water supply in homes
- Improvements in personal hygiene, village sanitation levels and sewage treatment
- Reduced faecal oral contamination of drinking water resulting in lower occurrence of diseases.

While the proposed project interventions are expected to result in overall environmental and public health improvements in the state, potential adverse environmental impacts can occur if the schemes are not properly

designed, sited, implemented and maintained. In order to ensure that the environmental issues are systematically identified and addressed in the various stages of the implementation of schemes, an EMF has been developed with the following objectives:

- To design a set of procedure, delineate the roles and responsibilities of various stakeholders and institutional structure in the implementation of schemes along with the proposed capacity building and staffing requirements for mainstreaming environmental management in project implementation processes.
- To provide a systematic approach for identifying the various possible environmental impacts at the different stages of a scheme cycle.
- To propose appropriate mitigation measures for addressing the identified environmental issues.

7.1.2 Key Elements of EMF

The key elements of the EMF as applied to the proposed sponsored scheme are discussed below:

7.1.2.1 Collection of Basic Environmental Data

The EMF requires the basic environmental data pertaining to the proposed schemes be compiled at the field data collection stage. For this purpose, a simple Environmental Data Sheet (EDS) has been formulated on water supply, sanitation, solid and liquid waste management. The formats for the EDSs for different types of schemes are furnished inAppendix C and Appendix D. The JE/AE ofDWSS, fill up the EDS with the facilitation support of the Environmental Officers/NGO/local clubs.

7.1.2.2 Environmental Categorization of Schemes

At the Detailed Scheme Report (DSR) preparation stage, the available environmental information in the EDS will be evaluated and based on the level of expected environmental and public health impacts, the proposed scheme would be classified as either Category I (basic) or Category II (detail environmental appraisal is required) and application/clearances of GoI/GoP Legislative and World Bank policies on the schemes interventions. The environmental categorization of schemes by using the screening tool shall be done by Environmental Officer/Environment Manager / Senior Environment Manager.

7.1.2.3 Environmental Appraisal and Approval

Based on the Environmental Categorization of the schemes for the proposed project, appraisals and approvals have to be obtained as mentioned in the subsequent section of Environmental Management Framework.With regard to land availability, as per World Bank guidelines land acquisition cost would not be financed through the World Bank, and land acquisition under this project should not be there. SPMC should ensure that the Gram Panchayat has the land required in their possession prior to conceiving a scheme.

7.1.2.4 Environmental Compliance Monitoring during Implementation and O&M phase

The EMF shall ensure that:

- The prescribed environmental mitigation measures (including construction stage measures) as identified through the environmental appraisal process are adequately implemented. The Implementation Completion Report (ICR) of each scheme shall be furnished with an Environmental Completion Certificate given by the GPWSC/SLC for SVS and DWSS/GPWSC/SLC for MVS indicating that the mitigation measures identified in the appraisal have been implemented.
- Periodic supervision and monitoring including an independent external audit is conducted as a part of the overall project monitoring program.
- Capacity building and IEC activities are undertaken to enable effective implementation of the EMF including procedures, supervision, monitoring etc. as well as for community awareness and sensitization on personal hygiene, environmental sanitation, water conservation etc.

7.1.2.5 Application of EMF to proposed project

In order to mainstream environmental management and to ensure that the EMF is systematically implemented for all the project schemes, the EMF needs to be integrated in the scheme cycle. The responsibilities are indicated in the Figure 7.1below, against the respective tasks.

A flowchart showing EMF activities to be implemented in a project cycle for water supply and sanitation along with responsibility is shown in Figure 7.1below.

Table 7.1: Environmental Management Framework for Water Supply Scheme

Phase	EMF Activity	Objectives	Process	Responsibility / Approval Authority	Result	ECoPs to be followed
Pre-planning / Planning	Environmental Data Sheet (EDS)	To collect basic information on environmental aspect of the proposed scheme	Discuss scheme with community and identify environmental issues Complete EDS with supplementary notes if required.	NGOs/SOs with assistance of JE/AE from DWSS Approval Authority: As per scheme sanctioning authority based on the cost of the scheme.	EDS prepared and attached to DSR.	• Identification of Sources for Water Supply • Identification of Quarry Sites / Borrow Areas • Selection of Community Toilet Location • Schemes in Forest Areas • Safe Sanitation Techniques at Individual Household & Community Level
	Environmental categorization of the scheme	To ensure that schemes with potentially significant environmental or public health issues are identified at an early stage for detail environmental appraisal.	Evaluate all the available information on environmental aspects as provided in the EDS, and based on the level of expected environmental and public health impacts, assess whether the proposed scheme is Category I or Category II	EE/AE of DWSS with District Level Environmental Specialist,	Scheme classified as Category I or Category II using the screening tools.	
	Environmental appraisal and approval required	To ensure that relevant environmental issues have been identified and appropriate mitigation measures have been designed to address them.	For Category I schemes, there shall be no separate environmental appraisal but environmental aspects shall be included in the normal appraisal and evaluation process for the proposed scheme, based on the EDS included in the DSR. For Category II schemes, a limited (depending upon the impacts of proposed project) a detail environmental appraisal including evaluation of environmental and public health impacts, risk assessment, and design of mitigation measures, should be undertaken through an environmental consultant.	District level Environmental Specialist, of DWSC. Approval Authority: For Category II schemes – Chief Engineer, based on the clearance of Zonal/State level Environmental personnel.	Environmental appraisal of the scheme is made of Category II schemes and approval of proposed scheme, with decision to (i) accept scheme as submitted, or (ii) accept scheme with modification suggested in the environmental appraisal.	

Phase	EMF Activity	Objectives	Process	Responsibility / Approval Authority	Result	ECoPs to be followed
Implementation	Implementation of Environmental mitigation measures	To ensure that the prescribed environmental mitigation measures (including construction stage) are implemented.	Implementation Completion Report (ICR) for scheme will need to include compliance certificate that all prescribed environmental mitigation measures have been implemented.	GPWSC for SVS & MVS/Prospective Contractor	ICR with environmental compliance information.	• Protection of Surface Water Supply source and ensuring its sustainability • Protection of Ground Water Supply source and ensuring its sustainability • Identification of Quarry Sites / Borrow Areas • Solid & Liquid waste Management at Individual Household & Community Level • Safe Sullage Disposal and Organic Waste Management • Management of Catchment Area • Rehabilitation of Construction / Supplementary Sites • Schemes in Forest Areas • Rain Water Harvesting Techniques
O&M	Environmental supervision, monitoring and evaluation. IEC and capacity building on hygiene and environmental issues	To ensure that environmental aspects are integrated in the O&M phase.	Environmental Audit shall be conducted according to Section 6.10.3 and 6.10.4.	District Level Environmental Specialist supported by State Level Environmental Specialist	Water quality monitoring reports. Periodic environmental supervision, monitoring, audit, training and IEC activity reports.	• Protection of Surface Water Supply source and ensuring its sustainability • Protection of Ground Water Supply source and ensuring its sustainability • Rain Water Harvesting

Phase	EMF Activity	Objectives	Process	Responsibility / Approval Authority	Result	ECoPs to be followed
						Techniques • Water Quality Monitoring and Surveillance. • Water and Waste water sampling procedure

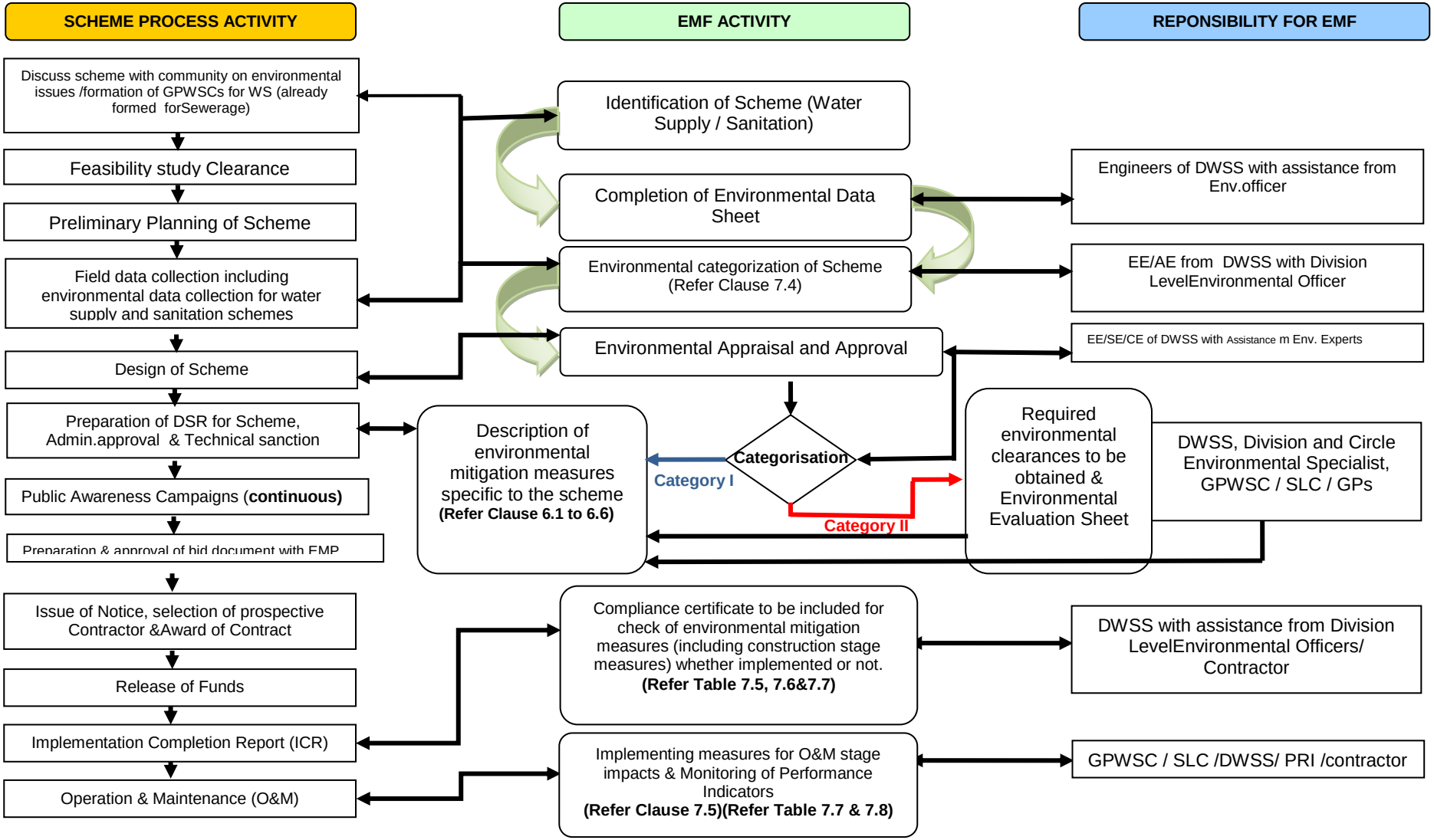
Table 7.2: Environmental Management Framework for Sewerage Scheme

Phase	EMF Activity	Objectives	Process	Responsibility	Result	ECoPs to be Followed
Pre-planning / Planning	Environmental Data Sheet (EDS)	To collect basic information on environmental aspect of the proposed scheme	Discuss scheme with community and identify environmental issues Complete EDS with supplementary notes if required.	NGOs/SOs with assistance of Engineers of DWSS Approval Authority: As per scheme sanctioning authority based on the cost of the scheme.	EDS prepared and attached to DSR.	• Site Selection for STP • Identification of Quarry Sites / Borrow Areas • Selection of Community Toilet Location • Schemes in Forest Areas
	Environmental categorization of the scheme	To ensure that schemes with potentially significant environmental or public health issues are identified at an early stage for detail environmental appraisal.	Evaluate all the available information on environmental aspects as provided in the EDS, and based on the level of expected environmental and public health impacts, assess whether the proposed scheme is Category I or Category II.	EE/AE (SDE) of DWSS with District Level Environmental Specialist,	Scheme classified as Category I or Category II using the screening tools.	
	Environmental appraisal and approval required	To ensure that relevant environmental issues have been identified and appropriate mitigation measures have been designed to address them.	For Category I schemes, there shall be no separate environmental appraisal but environmental aspects shall be included in the normal appraisal and evaluation process for the proposed scheme, based on the EDS included in the DSR. For Category IIschemes, a limited (depending upon the	District level Environmental Specialist, of DWSS. Approval Authority: For Category IIschemes – Chief Engineer, based on the clearance of Zonal/State level Environmental	Environmental appraisal of the scheme is made of Category IIschemes and approval of proposed scheme, with decision to (i) accept scheme as submitted, or (ii)	

Phase	EMF Activity	Objectives	Process	Responsibility	Result	ECoPs to be Followed
			impacts of proposed project) a detail environmental appraisal including evaluation of environmental and public health impacts, risk assessment, and design of mitigation measures, should be undertaken through an environmental consultant.	personnel.	accept scheme with modification suggested in the environmental appraisal.	
Implementation	Implementation of Environmental mitigation measures	To ensure that the prescribed environmental mitigation measures (including construction stage) are implemented.	Implementation Completion Report (ICR) for scheme will need to include compliance certificate that all prescribed environmental mitigation measures have been implemented.	GPWSC / SLC/Prospective Contractor	ICR with environmental compliance information.	• Site Selection for STP • Protection of Surface Water Supply source and ensuring its sustainability • Protection of Ground Water Supply source and ensuring its sustainability • Identification of Quarry Sites / Borrow Areas • Selection of Community Toilet Location • Safe Sanitation Techniques at Individual Household & Community Level • Solid & Liquid waste Management at Individual Household & Community Level • Safe Sullage Disposal & Organic Waste Management • Management of Catchment Area • Rehabilitation of Construction / Supplementary Sites • Schemes in Forest Areas

Phase	EMF Activity	Objectives	Process	Responsibility	Result	ECoPs to be Followed
						• Rain Water Harvesting Techniques
O&M	Environmental supervision, monitoring and evaluation. IEC and capacity building on hygiene and environmental issues	To ensure that environmental aspects are integrated in the O&M phase.	Environmental Audit shall be conducted according to Section 6.10.3 and 6.10.4.	District Level Environmental Specialist supported by State Level Environmental Specialist	Water quality monitoring reports. Periodic environmental supervision, monitoring, audit, training and IEC activity reports.	• Protection of Surface Water Supply source and ensuring its sustainability • Protection of Ground Water Supply source and ensuring its sustainability • Rain Water Harvesting Techniques • Water Quality Monitoring and Surveillance. • Water and Waste water sampling procedure

Figure 7.1: EMF Implementation Process throughout a Scheme Cycle



7.2 Collection of Environmental Data

The baseline environmental status would be established by studying various significant environmental parameters which might be affected by the project interventions. The significance of environmental impacts would vary from one scheme to another scheme, one location to another location as well as design, and accordingly the environmental parameters will also get changed. Therefore, to address the wide spectrum of environmental aspects of water supply or sanitation interventions, EMF requires that basic environmental data pertaining to the proposed scheme to be compiled at the field data collection stage. For this purpose, simple Environmental Data Sheets for Detail Scheme Report (DSR) are presented in Appendix D. These environmental sheets will assist the engineers in carrying out environmental scoping of the project schemes. The data sheet shall be signed by the JE and the Environmental Officer at division level.

7.3 Classification of Water Supply and Sewerage Schemes

At the Detail Scheme Report (DSR) preparation stage, the available environmental information in the EDS will be evaluated and based on the level of expected environmental and public health impacts, the proposed scheme would be classified as either Category I (environmental data sheet to be prepared) or Category II (detail environmental appraisal required) for water supply schemes with Category I having minimal Impact not requiring EMP and Category II having Significant Environmental Impacts requiring EMP.

In case of sewerage schemes, the proposed scheme would be classified as either Category I (environmental data sheet to be prepared) or Category II (detail environmental appraisal required) with Category I having Insignificant Impact, Category II having moderate Environmental Impact.The categorisation sheet shall be signed by the JE and the Environmental Officer and countersigned by the sub divisional engineer.

7.4 Environmental Appraisal and Approval

For all category I schemes, there shall be no separate environment appraisal but the environment aspects shall be included in the normal environmental data sheet for the proposed scheme as per the format in the DSR. For category II schemes, an independent environmental appraisal of the proposed scheme is required, which will include evaluation of environmental and public health impacts, risk assessment if needed, and design of mitigation measures by the environmental officer at the division level and shall be signed by environmental officer and accepted by EE, for further submission to circle level for checking and for approval at chief Engineer's level. In specific cases, where the district level expertise is not sufficient for conducting the environmental appraisal and designing the appropriate mitigation measures, support from state level environmental specialists need to be provided. The environmental appraisal for category II Water Supply and sewerage schemes shall be approved at chief engineer's level.

The EDS and Appraisal formats are given inAppendix C and Appendix D.

7.4.1 Water Supply Schemes

The envisaged activities under schemes are:

- Land Availability (Forest /Community/Private land)
- Location and type of source
- Sufficient water available at source (even in summer)
- Testing of water quality at the water source
- Competitive uses of the water source
- Preferred water source should be river or canal or deep tube wells

Table 7.3: Categories of Water Supply Schemes

Category I (Minimal Impacts where EMP not required))	Category II (Significant Impacts where EMP required))
• Water Supply involving pumping, construction of storage tanks and piped distribution networks, with source as tube well/bore well. • Water Supply with water source requiring minimum treatment such as disinfection.	• Water Supply involving pumping, construction of storage tanks and piped distribution networks, with Surface water as a source. • Water Supply with water source requiring "Advance Treatment" for removal of arsenic, iron, fluoride, salinity, etc.
• Single Village Scheme (SVS) with either surface water or ground water source.	• Multi Village Scheme (MVS) based on either surface water or ground water source.
• Water Supply with source in shallow aquifer in safe and semi-critical zone and with source in deep aquifer located in safe zone of exploitation.	• Water Supply with source located in/very close to natural habitat/sensitive eco-systems such as National Parks, Wild Life Sanctuaries (requiring forest permission/clearance)
• No water quality issues with regard to ground water source.	• Water Supply with water source from critical aquifers/over exploited zones. Ground water based scheme, if the water quality testing for deep groundwater source indicates unacceptable levels of pesticides or heavy metals.

7.4.2 Sewerage Schemes

Similar to water supply, the DSR for sewerage system will also study the environmental attributes through environmental data sheet, along with the screening of the sewerage schemes. The sewerage schemes will be categorized depending on the type, location, sensitivity, and scale of the project interventions and the nature and magnitude of its potential environmental impacts. The sewerage schemes will be categorized in Category I and Category II.

Table 7.4: Categories of Sewerage Schemes

Category I (Minimal Impacts where EMP not required))	Category II (Significant Impacts where EMP required))
• Sufficient land for STP is available easily	• Advance technology is to be provided as the available area is less than the requirement.
• Location of STP is more than 200 m away from school/hospitals and residential areas	• Location of STP is less than 200 m from school/hospitals and residential areas. • Water logged area.
• No major tree cutting is involved for sewerage system and STP	• Major tree cutting is involved for sewerage system and STP. • Clearance of Forest Department is required
• No industrial/chemical effluent being discharged to the proposed sewerage system	• Industrial/chemical effluent is mixing with sewage.
• No effluent disposal problem, i.e., disposal by gravity to nearby drain or water body	• Effluent disposal problem requiring pumping for disposal.

7.5 Water Quality Monitoring

Water Quality Monitoring is defined here as the sampling and analysis of water constituents and conditions. Water quality monitoring was generally considered the primary way of identifying water quality problems, both in water supply as well as in sewerage schemes. Water quality monitoring can be used for many purposes, such as:

- To identify whether waters are meeting designated uses.
- To identify specific pollutants and sources of pollution.
- To identify excessive levels of one or more chemical constituents
- Chemical parameters that are properly monitored can be analysed for trends over time.

Water Quality Monitoring program along with frequency and responsible agency for water supply and sewerage schemes are as defined in Table 7.5 and Table 7.6.

Table 7.5: Water Quality Parameters Monitoring for Water Supply Schemes

Sr. No.	Water Quality Parameter	Frequency	Monitoring Agency
1	pH	Monthly	GPWSC / SLC / Environmental Staff
2	Turbidity	Monthly	GPWSC / SLC / Environmental Staff
3	Total Hardness	Monthly	GPWSC / SLC / Environmental Staff
4	Dissolved Solids	Monthly	GPWSC / SLC / Environmental Staff
5	Calcium	Monthly	GPWSC / SLC / Environmental Staff
6	Fluorides	Monthly	GPWSC / SLC / Environmental Staff

Sr. No.	Water Quality Parameter	Frequency	Monitoring Agency
7	Iron	Monthly	GPWSC / SLC / Environmental Staff
8	Nitrates	Monthly	GPWSC / SLC / Environmental Staff
9	E Coli	Monthly	GPWSC / SLC / Environmental Staff
10	Arsenic	Monthly	GPWSC / SLC / Environmental Staff
11	Uranium	Monthly	GPWSC / SLC / Environmental Staff
12	Lead	Monthly	GPWSC / SLC / Environmental Staff
13	Mercury	Monthly	GPWSC / SLC / Environmental Staff

Table 7.6: Wastewater Quality Parameters Monitoring for Sewerage Schemes

Sr. No.	Water Quality Parameter	Frequency	Monitoring Agency
1	Influent Characteristics such as pH, BoD, CoD, SAR, EC, TSS & Faecal Coliform	Quarterly	GPWSC / SLC / Environmental Staff
2	Effluent Characteristics such as pH, TSS, BoD, CoD, SAR, EC, Faecal Coliform	Quarterly	GPWSC / SLC / Environmental Staff
3	Sludge quality and Compost quality such as pH, BoD, CoD, Sodium, Potassium, Nitrogen, Phosphorous and heavy metal	Six Monthly	GPWSC / SLC / Environmental Staff
4	Industrial Waste Discharge	Monthly	GPWSC / SLC / Environmental Staff

7.5.1 Standards for Physical and Chemical Parameters

The Bureau of Indian Standards specification IS: 10500-2012 governs the quality of drinking water supplies in India by public agencies. These are based on international standards for drinking water quality issued by the WHO and the manual of standards of quality for drinking water supplies, ICMR, 1971.

Table 7.7: Physical and Chemical Parameters

Sr. No.	Characteristics	Acceptable Limits[5]	Undesirable effect outside the Desirable Limits	Permissible Limits in the absence of alternate source
1	Turbidity, NTU	1	Above 5, consumer acceptance decreases	5
2	Dissolved Solids, mg/l	500	Beyond this, palatability decreases and may cause gastro intestinal irritation	2000
3	pH	6.5 to 8.5	Beyond this range, the water will affect the water supply system	No Relaxation
4	Total Hardness, mg/l	200	Encrustation in water supply structure and adverse effects on	600

[5]It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under “Acceptable” render the water is not suitable, but still may be tolerated in the absence of an alternative source but up-to the limits indicated under “permissible limit in the absence of alternate source”, above which the sources have to be rejected

Sr. No.	Characteristics	Acceptable Limits[5]	Undesirable effect outside the Desirable Limits	Permissible Limits in the absence of alternate source
			domestic use	
5	Calcium, mg/l	75	Encrustation in water supply structure and adverse effects on domestic use	200
6	Magnesium, mg/l	30	Encrustation in water supply structure and adverse effects on domestic use	100
7	Chlorides, mg/l	250	Beyond this, taste, corrosion and palatability are affected	1000
8	Sulphates, mg/l	200	Beyond this, causes gastro intestinal irritation	400
9	Fluorides, mg/l	1.0	High fluoride may cause fluorosis	1.5
10	Nitrates, mg/l	45	Beyond this it is indicative of pollution	No Relaxation
11	Iron, mg/l	0.3	Total Concentration of Manganese as Mn and Iron as Fe shall not exceed 0.3mg/l	No Relaxation
12	E Coli or Thermo tolerant Coliform • All water intended for Drinking • Treated water entering the distribution system • Treated water in the distribution system		Shall not be detectable in any 100ml sample.	
13	Arsenic, mg/l, Max.	0.01	Beyond this, water becomes toxic	0.05
14	Aluminium, mg/l	0.03	Cumulative effect is reported to cause dementia	0.2
15	Mercury, mg/l	0.001	Beyond this, water becomes toxic	No Relaxation
16	Cadmium	0.003	Beyond this, water becomes toxic	No Relaxation
17	Lead, mg/l	0.01	Beyond this, water becomes toxic	No Relaxation
18	Chromium, mg/l	0.05	May be carcinogenic above this limit	No Relaxation
19	Selenium	0.01	Beyond this, water becomes toxic	No Relaxation

Source: IS 10500 – 2012, Drinking Water – Specification (Second Revision)

7.6 Risk & Assumptions

In managing the water supply sub-projects, the major risk factors along with some proposed management measures from the environmental point of view are given in table below, which are as follows:-

S. No	Risks	Management Proposals
1	Less yield from water sources	▪ Preventing water wastage ▪ Draw out only planned quantity ▪ Water augmentation ▪ Water harvesting ▪ Catchment area treatment ▪ Alternative sources be explored
2	Natural Calamities like Flash Floods, Droughts & Earthquakes	▪ Installation of electrical & mechanical equipment above flood level. ▪ Cordoning off the source works with protection walls (wherever possible to do so), prone to floods ▪ Establishing diversions within the flood routes in order to protect the source at the downstream.
3	Lack of awareness in the community, especially regarding water quality and environmental sanitation	▪ Intensive awareness creation program. ▪ Distribution of FTKs and ensuring its usages. ▪ Identify convenient water quality testing centres.
4	Unsuitable location for STP and layout of STP	▪ Selected site should not pollute the downstream or nearby water supply source. ▪ .Proper design, construction and maintenance of STP should be ensured. ▪ Treated effluent should be discharged in to natural drain by gravity
5	Absence of Proper waste management in the community	▪ Proper training regarding use of compost and garbage pits ▪ Intensive IEC activities.

7.7 Standards for Sewage Treatment

The provision of STP will help reduce the pollution load on the existing environment. Waste stabilization ponds or other suitable technology will be provided for the treatment of wastewater. Typical characteristics of sewage are given in Table 7.8.

Table 7.8: Typical Characteristics of Domestic Wastewater

Sr. No.	Parameter	Range
1	pH	7.5-7.9
2	BoD	100-200 ppm
3	CoD	250-350 ppm
4	TSS	100-400 ppm
5	TDS	200-1600 ppm
6	Faecal Coli Form (per 100 ml)	1.5×10^5 to 1.4×10^7 MPN

Sr. No.	Parameter	Range
7	Arsenic	0.2 mg/l
8	Mercury	0.01 mg/l
9	Selenium	0.05 mg/l
10	Nickel	10 mg/l
11	Fluoride	2 mg/l
12	Lead	0.1 mg/l

The sewerage schemes will only carry wastewater from domestic use and no industrial effluent is likely to be mixed. Therefore, treated effluent shall meet at least the BoD and CoD limits as stipulated in the below Table 7.9.

Table 7.9: Limit for discharge of Treated Effluent from STP

Sr. No.	Parameter	Effluent Characteristics at the Final Outlet of STPs
1	pH	5.5-9.0
2	BOD	≤10 mg/l
3	COD	≤50 mg/l
4	TSS	≤20 mg/l
5	Faecal Coliform	≤1000 MPN / 100 ml
6	SAR	≤3.5 mg/l
7	EC	≤2000 us/cm
8	RSC	≤ 2.5 me/l.

Source: PPCB Notification dated 2nd May 2012

Table 7.10: Technology Options for STP

Sr. No.	Technology	Advantages	Disadvantages	Applicability
1	Waste Stabilisation Pond (WSP)	• The Inherent simplicity of construction offers low cost technology option • High quality effluent at least operating costs • Low skill requirement for operation of the plant. • Fish yield from aquaculture ponds around 4-7 MT/ha/year	• Large land requirement of 0.8 to 1.5 ha / MLD • High cost of lining • Risk of odour nuisance and mosquito breeding • Risk of ground water contamination in porous and fractured strata	• Suitable under warm climatic conditions • For areas with easy availability of land • In areas with social preference for aquaculture • In areas with low, unreliable or expensive power supply.
2	Duckweed Pond System (DPS)	• Less sensitive to low temperature, high nutrient levels, pH fluctuations, pests and diseases compared to other aquatic plants • Simultaneous significant nutrient removal • Yield of highly protein containing vegetative material as animal feed. • Realization of tangible economic returns from sale of raw or processed weed or fish	• Low pathogen removal due to reduced light penetration • Duckweed die off in cold weather conditions • Large land requirement of 1.5 to 2 ha / MLD	• Low strength domestic wastewater or after primary sedimentation • Rural settlements with easy land availability
3	Facultative Aerated Lagoon (FAL)	• Simple operation of the plant requiring lower skilled manpower. • Minimum civil, electrical and mechanical installation • Lower energy costs compared to other aerobic processes • Lower O&M cost • Land requirement is only 0.27 to 0.4 ha / MLD	• Possibility of groundwater contamination in porous and fractured strata • High cost of lining	• Stand-alone system for sewage treatment • As an up-gradation option for overload WSPs
4	Activated Sludge Process (ASP)	• Performance is not significantly affected due to normal variations in wastewater characteristics and seasonal changes. • Land requirement is only of 0.15 to 0.25 ha / MLD.	• Performance is adversely affected due to interruption in power supply even for a short period • Foaming problem may occur. • Requires elaborate sludge digestion/drying/disposal arrangement	• Most widely used option for treatment of domestic wastewater for medium to large towns where land is scarce.
5	DEWATS (Decentralised Wastewater Treatment Systems).	• Provides treatment for domestic and industrial wastewater	•	• In rural areas, where the land availability is a problem

Sr. No.	Technology	Advantages	Disadvantages	Applicability
	The applications are designed with four basic technical treatment modules which are combined and configured to provide a custom solution for a given sanitation/wastewater challenge: **Primary treatment**: sedimentation and floatation **Secondary anaerobic treatment in fixed-bed reactors**: baffled upstream reactors or anaerobic filters **Tertiary aerobic treatment** in sub-surface flow filters **Tertiary aerobic treatment** in polishing ponds	• Low initial investment costs as no imported materials or components are needed • Efficient treatment for daily wastewater flows of up to 1000m3 • Modular design of all components • Tolerant towards inflow fluctuations • Reliable and long-lasting construction design • Low maintenance costs •		and Require low maintenance meeting higher effluent standards.

7.8 Provisions of Lawns and Tree Plantation in water works premises and at STP site

As an environmental enhancement measure, the plantation will be carried out at STP site or inside the water works. The total costs may be allocated approximately 0.25% of the water supply and 0.50% of sewerage scheme cost.

The choice of plant species and plantation design is done on the basis of site conditions like topography, climatic conditions, availability of species and ecology of the area. The selected plant species include shrubs, climbers and trees. Dense plantation of large trees and green belt including creepers around the STP will ensure dilution and diffusion of odour which emanates from STP as well as it give a visual barrier.

Pits dug a few days in advance of actual planting shall be allowed to weather and be filled with topsoil mixed with manure. Only one tree shall be planted in each pit. Spacing between the two rows of trees shall be 3 m center to center. Three rows of plants are to be planted in the area earmarked within the STP site unless otherwise directed.

Table 7.11: List of Plant Species Recommended around STP and Water Logging Areas

Sr. No.	Scientific Name	Vernacular Name
1	Acacia Catechu	Khair
2	Eucalyptus Eucalyptus	Safeda
3	Terminalia arjuna	Arjun
4	Terminalia bellerica	Bahera
5	Vinca rosea	Sadabahar
6	Delonix regia	Gulmohar

Table 7.12: List of Plant Species suggested near Settlements

Sr. No.	Scientific Name	Vernacular Name
1	Cassia fistula	Amaltas
2	Dalbergia sissoo	Shisham
3	Saraca indica	Ashoka
4	Azadirachta indica	Neem
5	Bauhinia purpurea	Kachnar

7.9 Provisions under Environmental Cost

Provision of 2% of capital cost of water supply and sewerage schemes towards EMP is notional. If the cost of implementation of EMP is more than 2% then the actual cost to be factored in the cost of the scheme.

Table 7.13: Approximate Provision of 1% Environmental Cost

Sr. No.	Description of Environmental Enhancement Measures	Budgetary Cost in % of Scheme	Implementations Agency
A.	**Water Supply Schemes**		
1	Provision forair, noise and water quality testing during construction / Rain water Harvesting structures	1.75%	Prospective Contractor
2	Provision of Lawns and Tree plantation in water works	0.25%	Prospective Contractor
B.	**Sewerage Schemes**		
1	Minor Repair and Cleaning of Drains	0.50%	Prospective Contractor
2	Provision forair, noise and water quality testing during construction/Rain water harvesting structures	1.00%	Prospective Contractor
3	Provision of Lawns and Tree Plantation around the STP sites	0.50%	Prospective Contractor

7.10 Institutional Arrangement

The project envisages to build on the existing institutional model that enables demand driven community action. The following is a brief description of the model.

7.10.1 Village Level GPWSC

GPWSC is a standing committee of the Gram Panchayat which is expected to shoulder full responsibilities for all activities including planning, implementation, operation, maintenance and management related to RWSS at the village level. The main functions of GPWSC are:

- Providing facts and figures to the Gram Panchayat for reviewing water and sanitation issues.
- Ensuring community participation and decision making in all phase of scheme activities.
- Commissioning and takeover of completed water supply and sanitation works through a joint inspection with department staff.
- Collecting household contributions and user fees opening and managing a bank account.
- Preparing annual budgets and recommendations for user fee charges
- Organizing people to be vigilant about not wasting water and keeping water clean.
- A cadre of professionals would be developed within GPWSC to assist in scale up and long term sustenance.
- Ensuring the operators handling piped water supply systems are provided with adequate training to gain the technical skills needed to do the job.

- The GPWSC is also responsible for procurement of goods and services, supervising contracts and works and making payments.

The Divisional environmental officers of DWSS at district level will support the GPWSC in the execution of these functions. The project will develop capacities of GPWSC through training and other information sharing measures to execute these functions effectively.

7.10.2 District Level

The district level arrangement consists of establishing District Water Sanitation Committee (DWSC). It is envisaged DWSC to ensure all RWSS plans follow and are in conformity with the EMF, and to ensure proper planning and monitoring of EMF activities at the district level, and coordination between the district and DWSS. The functions of DWSC will be as follows:

- Formulation, management and monitoring of projects and progress on drinking water security and total sanitation in rural areas;
- Scrutiny and approval of the schemes submitted by the DWSS/GPWSC and forwarding them to Head Office, DWSS if required, where necessary.
- Selection of agencies and/NGOs and enter into agreements for social mobilisation, capacity development, communication, project management and supervision;
- Sensitising the public representatives, officials and the general public;
- Engaging institutions for imparting training for capacity development of all stakeholders, and undertaking communication campaign.
- Coordination of matters relating to water and sanitation between district representatives of health, education, forests, agriculture, rural development etc.
- Interaction with DWSS, State Government and the GoI.

7.10.3 State Level

At the state level the DWSS (Head Office) prepares the environment policy and sets the guidelines for the EMF implementation, monitoring and evaluation. This Office also liaises with other departments with regard to environment issues.

The State level officer, DWSS will be responsible will be responsible for ensuring the implementation of the EMF across the state. At State level to assist State level Officer, there will be an Executive Engineer and an Environmental Specialist, who will ensure that environment management activities are in conformity with the EMF and that necessary guidance and budget is provided to implement these plans.

Table 7.14: Institutional Arrangement Structure and Functions

Entity	Position	Functions
State Level	Environment (Executive Engineer Cadre)	• Monitor environmental activities of the project and ensuring compliance with EMF. • Assist DWSS in Environmental monitoring of the completed RWSS schemes/auditing of 15% of completed Category I RWSS schemes, Category II water supply schemes and Category II sewerage schemes • Assist in Environmental Capacity Building
	Environmental Specialist	• Assist DWSS in Environmental assessment and appraisal of RWSS schemes • Assist DWSS in obtaining approvals from other departments • Assist DWSS in monitoring activities of Environmental staff of the department • Assists DWSS in Environmental monitoring of the completed RWSS schemes/ auditing of 15% of completed Category I RWSS schemes, Category II water supply schemes and Category II sewerage schemes • Assist DWSS in water and wastewater quality monitoring of the completed RWSS schemes • Organize state/ circle level training programs
Zone Level	One Executive Engineer and one Environmental Expert	• Assist DWSS in Environmental assessment and appraisal of RWSS schemes • Assist DWSS in monitoring activities of circle level Environmental Managers • Assist DWSS in Environmental monitoring of the completed RWSS schemes/ auditing of 15% of completed Category I RWSS schemes, Category II water supply schemes and Category II sewerage schemes • Train Circle / Division level Environmental staffs and operational staff of DWSS in implementing/supervising environmental mitigation measures and water& wastewater quality monitoring for completed RWSS schemes
Circle Level	Environmental Manager	• Assist DWSS in Environmental assessment and appraisal of RWSS schemes • Assist DWSS in monitoring activities of division level Environmental Officers • Assists DWSS in Environmental monitoring of

Entity	Position	Functions
		the completed RWSS schemes • Train Division level Environmental officers and operational staff of DWSS and GPWSCs in implementing/supervising environmental mitigation measures and water & wastewater quality monitoring for completed RWSS schemes
Division Level	Environmental Officer	• Assist DWSS in monitoring and implementation of mitigation measures at village level for RWSS schemes. • Assist DWSS in preparation of environmental appraisals for clearances. • Train GPWSCs, community members and other stakeholders at village level in implementing activities under EMF. • Propose/Report mitigation measures in case of any environmental issues encountered during execution.
Field Level / GP level	GPWSC members / SLC Community members	• Awareness on environmental mitigation measures related to water supply and sewerage schemes in the GP • Create environmental awareness among community members

7.11 Responsibility Matrix

7.11.1 EMP for Planning and Design Stage Impacts (Pre-construction stage) of RWSS Project

The DWSS together with the community, with assistance from the Environmental staff, shall set up an Environmental Management Plan based on issues identified during the planning stage of the proposed project and necessary preventive and mitigation measures should be considered in the design and be provided in the scheme costing. The contractor shall provide an undertaking for execution of the activities identified in the Environmental Management Plan.

There are no direct impacts expected to occur during the planning and design phase of the proposed project. However, prior to construction, a number of preparations should be made to ensure minimal impacts to the environment. Table 7.15 and Table 7.18describes the Environmental Management Plan for planning and design phase and mitigation measures to be considered by the implementing agency to mitigate the environmental

impacts of the project. The EMP shall be initiated at the planning & design stage of project and the process shall involve addressing relevant environmental issues ranging from household to village level with appropriate detail.

7.11.2 EMP for Construction Stage Impacts in RWSS project

The DWSS together with the community, with assistance from the project executing agency shall set up an Environmental Management Plan (EMP) based on issues identified during the construction phase of the proposed project. The EMP will be initiated at the community mobilisation stage of project cycle and the process shall involve addressing relevant environmental issued ranging from household to village level with appropriate detail.

The EMP shall give particular attention to project sustainability issues such as protection of intake points, catchment areas, prevention of pollution of water ways, water quality monitoring, user conflicts, selection of proper latrine design and siting. In addition, the EMP shall also address proper drainage facilities around the households and water points, and any construction related impacts. The EMP for Construction stage shall be finalized during planning stage and it shall be monitored at defined intervals by DWSS/GPWSC/SLC. Also, provision of 2% of capital cost of water supply and sewerage schemes towards EMP is notional. If the cost of implementation of EMP is more than 2% then the actual cost to be factored in the cost of the scheme. Table 7.16 and Table 7.19 below provides an EMP with suggested mitigation measures for construction stage environmental impacts for proposed RWSS project in 22 districts of Punjab state. This detail is to be included in Bid document and to be implemented by the prospective Contractor.

7.11.3 EMP for O&M Stage Impacts in RWSS Project

Table 7.17 and Table 7.20 provides an environmental management plan with suggested mitigation measures for operation and maintenance stage environmental impacts for proposed RWSS projects in 22 districts of Punjab. The appropriate mitigation measures shall be implemented by the prospective Contractor as identified according to the project context. This detail is to be included in Bid document and to be implemented by the prospective Contractor.

Table 7.15: Environmental Management Plan for Pre-Construction Stage Impacts – Water Supply Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Selection	• The location of treatment plant site should be at least 200 m away from the nearest settlement • The site should be isolated from the presently built-up areas or areas that have potential for future development. Large enough area for locating the plant will be helpful in maintaining the buffer area and fulfilling the needs for future expansion. • The treatment plants should not be located within flood zones.	DWSS/GPWSC /SLC		
2	Tree Cutting	• Necessary clearance for cutting of trees should be obtained by SE prior to start work from the Forest Department • A joint inspection of Forest Department officials and representative GPWSCs should be organized to identify the trees to cut for clearing the site. Trees to be cut should be clearly marked.	DWSS		
3	Establishment of Contractor's Camp and site office	• It should be located away from the residential areas/schools/hospitals/river banks/canals. • Layout of construction camps if any should be approved from GPWSCs • Construction camps, if any should have separate toilets for male and female workers, drinking water, cooking fuel and first aid facilities.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
4	Construction water	• Contractor will make his own necessary arrangement for procuring construction water – In case of community water source, Contractor should carry out consultations with GPs and obtain written permission for the utilization of water – In case of private source, Contractor should not utilize the water unless written consent is obtained from other owners of the land parcel. – In case of new bore wells, permits should be obtained as per requirements of State Ground Water Board regulations. – In case of surface water bodies, necessary permission from concerned department or administrative clearances should be obtained. • Water requirement for curing concrete should be optimized by pooling of water over concrete or covering it with gunny bags.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS
5	Disposal sites	• In consultation with GPs, disposal sites should be identified and got approved by SEin consultation with DWSS.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS

Table 7.16: Environmental Management Plan for Construction Stage Impacts – Water Supply Schemes

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Clearance	• No illegal tree chopping should be allowed. • Vegetation clearance activity should be closely monitored	Prospective Contractor	Once in a week	SLC/GPWSC
2	Excavation, laying and jointing of pipes	• Loose soil should be compacted properly after finishing the work • Damage to the roots should be prevented during trenching, placing, backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plan health • Excavation must be done during the lean season near water bodies, to avoid erosion and siltation of canals or other water bodies in the area. • Ensure prompt refilling of trenches and proper management and use/disposal of soil cover and wastes.	Prospective Contractor	Daily	SLC/GPWSC
3	Public Safety	• Excavated areas should be clearly demarcated • Proper barricading should be placed along the excavated trenches • Warning sign boards should be provided along the construction sites in Hindi as well as local language • Tress passing of the construction sites should not be allowed	Prospective Contractor	Twice in a month	SLC/GPWSC/ / Engineers of DWSS/ Environmental Officer
4	Access Management	• Proper access to the residents should be provided near the residential areas, schools, hospitals, and religious structures such as mosque, temples, etc.	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS
5	Storage of Construction Materials	• All construction materials should be stored in secured places • Contractor should not be allowed to store the material at construction sites for more than 1 week. • No hazardous material should be allowed to store near the construction sites.	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS
6	Construction Sites	• It should be kept free of water logging • Protective guards should be provided across the areas where workers may fall or could face an impalement hazard. • Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous wastes, if any, in covered, segregated waste containers • Keep form and scrap lumber with protruding nails cleared away from work areas, passageways	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		• No loose material should be allowed to leave unattended, and sites should be properly finished after completing the work • Good housekeeping should be maintained at construction sites			
7	Noise Pollution	• Machineries as well as equipment should be maintained properly • No high noise generating equipment which is not meeting SPCB requirements should be allowed at construction sites • Generator etc. should be properly enclosed, and proper padding should be placed below such machinery to reduce vibration. • Special care must be taken near religious structures, schools, hospitals etc. • Machineries/equipment/vehicles should meet the noise emission requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
8	Air Pollution	• Properly maintained vehicles and equipment should be used • In dusty areas, sprinkling of water should be done and especial care must be given during summer season • Construction debris should not be allowed to remain unattended at construction sites for longer time • Workers working in dusty areas such as concrete mixing equipment should use stringently nose masks. • Machineries/equipment/vehicles should meet the Air Pollution requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
9	Water Pollution	• No washing of vehicles or equipment should be permitted near the water source • Construction debris should not be disposed to the water bodies • Contractor should arrange its own water for carrying out construction activities.	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS
10	Soil Quality	• Excavated areas should be properly compacted • Loose earth should not be left unattended near the construction sites	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS
11	Construction Camps	• Proper cooking fuel should be provided to the labour residing in the camps. In any case, woods should not be used for cooking. • Proper sanitation facilities should be provided in the construction camps.	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		• Potable drinking water should be provided to the workers. • Water logging conditions should not be allowed inside the camp. • For establishing construction camps, contractor should obtain NOC from the State Pollution Control Board			
12	Occupational Health & Safety	• Safe access to the job sites should be provided to all workers • Passage ways, walkways, and stairways should be kept free of materials, scraps or obstructions • First Aid box should be readily available at construction sites • Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site • A vehicle should be readily available at construction site to meet emergency situation • The contractor should comply with all the precautions as required for the safety of the workmen as per the International Labour Organization as far as those applicable to this project • The contractor should strictly follow the statutory child labour act • Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the workers.	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS

Table 7.17: Environmental Management Plan for Operation & Maintenance Stage Impacts – Water Supply Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Hand Pumps	• Routine inspections of hand pumps • Source protection + treatment for arsenic/iron/fluoride etc. • Regular cleaning and back washing of treatment units/filters in lined with hand pumps should be ensured. • Enforce ground water act + monitor regularly ground water level	Prospective Contractor / DWSS / GPWSC	Monthly	GPWSC/SLC/ Engineers of DWSS
2	Piped Water Supply Schemes	• Chlorination level of water supply to ensure minimum residual chlorine of 0.5mg/l	Prospective Contractor / Engineers	Daily	GPWSC/SLC/ Engineers of DWSS

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
			of DWSS/ GPWSC		
		• Regular water quality testing		Monthly	GPWSC/SLC/ Engineers of DWSS/ Environmental Officer
		• Preventive and corrective maintenance of water distribution system including checking of leakages.		Quarterly	GPWSC/SLC/ Engineers of DWSS

Table 7.18: Environmental Management Plan for Pre-Construction Stage Impacts – Sewerage Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Selection	• The location of wastewater treatment plant site should be at least 200 m away from the nearest settlement • The site should be isolated from the presently built-up areas or areas that have potential for future development. Large enough area for locating the plant will be helpful in maintaining the buffer area and fulfilling the needs for future expansion. • Enough area for local disposal of end products such as treated effluents, sludge should be available at the selected site. • The treatment plants should not be located within flood zones. • The site should be selected near a large water body or irrigable land capable of accepting the treated effluents.	DWSS/GPWSC /SLC		
2	Tree Cutting	• Necessary clearance for cutting of trees should be obtained by SE prior to start work from the Forest Department • A joint inspection of Forest Department officials and representative GPWSCs should be organized to identify the trees to cut for clearing the site. Trees to be cut should be clearly marked.	DWSS		
3	Establishment of Contractor's Camp and site office	• It should be located away from the residential areas/schools/hospitals/river banks/canals. • Layout of construction camps if any should be approved from GPWSCs • Construction camps, if any should have separate toilets for male and female workers, drinking water, cooking fuel and first aid facilities.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
4	Construction water	• Contractor will make his own necessary arrangement for procuring construction water – In case of community water source, Contractor should carry out consultations with GPs and	Prospective Contractor	One Time	SLC/GPWSC/

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		obtain written permission for the utilization of water – In case of private source, Contractor should not utilize the water unless written consent is obtained from other owners of the land parcel. – In case of new bore wells, permits should be obtained as per requirements of State Ground Water Board regulations. – In case of surface water bodies, necessary permission from concerned department or administrative clearances should be obtained. • Water requirement for curing concrete should be optimized by pooling of water over concrete or covering it with gunny bags.			Engineers of DWSS
5	Disposal sites	• In consultation with GPs, disposal sites should be identified and got approved by SE in consultation with DWSS.	Prospective Contractor	One Time	SLC/GPWSC/ Engineers of DWSS

Table 7.19: Environmental Management Plan for Construction Stage Impacts – Sewerage Schemes

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Site Clearance	• No illegal tree chopping should be allowed. • Vegetation clearance activity should be closely monitored	Prospective Contractor	Once in a week	SLC/GPWSC
2	Excavation, laying and jointing of pipes	• Loose soil should be compacted properly after finishing the work • Damage to the roots should be prevented during trenching, placing, backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plan health • Excavation must be done during the lean season near water bodies, to avoid erosion and siltation of canals or other water bodies in the area. • Ensure prompt refilling of trenches and proper management and use/disposal of soil cover and wastes.	Prospective Contractor	Daily	SLC/GPWSC
3	Public Safety	• Excavated areas should be clearly demarcated • Proper barricading should be placed along the excavated trenches • Warning sign boards should be provided along the construction sites in Hindi as well as local language • Tress passing of the construction sites should not be allowed	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
4	Access Management	• Proper access to the residents should be provided near the residential areas, schools, hospitals, and religious structures such as mosque, temples, etc.	Prospective Contractor	Twice in a month	SLC/GPWSC/Engineers of DWSS
5	Storage of Construction Materials	• All construction materials should be stored in secured places • Contractor should not be allowed to store the material at construction sites for more than 1 week. • No hazardous material should be allowed to store near the construction sites.	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS
6	Construction Sites	• It should be kept free of water logging • Protective guards should be provided across the areas where workers may fall or could face an impalement hazard. • Store tools and materials neatly and out of the way in storage bins or lockers and keep flammable or hazardous wastes, if any, in covered, segregated waste containers • Keep form and scrap lumber with protruding nails cleared away from work areas, passageways • No loose material should be allowed to leave unattended, and sites should be properly finished after completing the work • Good housekeeping should be maintained at construction sites	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
7	Noise Pollution	• Machineries as well as equipment should be maintained properly • No high noise generating equipment which is not meeting SPCB requirements should be allowed at construction sites • Generator etc. should be properly enclosed, and proper padding should be placed below such machinery to reduce vibration. • Special care must be taken near religious structures, schools, hospitals etc. • Machineries/equipment/vehicles should meet the noise emission requirement of the State Pollution Control Board, Punjab	Prospective Contractor	Twice in a month	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
8	Air Pollution	• Properly maintained vehicles and equipment should be used • In dusty areas, sprinkling of water should be done and especial care must be given during summer season • Construction debris should not be allowed to remain unattended at construction sites for longer time • Workers working in dusty areas such as concrete mixing equipment	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		should use stringently nose masks. • Machineries/equipment/vehicles should meet the Air pollution requirement of the State Pollution Control Board, Punjab			
9	Water Pollution	• No washing of vehicles or equipment should be permitted near the water source • Construction debris should not be disposed to the water bodies • Contractor should arrange its own water for carrying out construction activities.	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
10	Soil Quality	• Excavated areas should be properly compacted • Loose earth should not be left unattended near the construction sites	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS
11	Construction Camps	• Proper cooking fuel should be provided to the labour residing in the camps. In any case, woods should not be used for cooking. • Proper sanitation facilities should be provided in the construction camps. • Potable drinking water should be provided to the workers. • Water logging conditions should not be allowed inside the camp. • For establishing construction camps, contractor should obtain NOC from the State Pollution Control Board	Prospective Contractor	Once in a week	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer
12	Occupational Health & Safety	• Safe access to the job sites should be provided to all workers • Passage ways, walkways, and stairways should be kept free of materials, scraps or obstructions • First Aid box should be readily available at construction sites • Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site • A vehicle should be readily available at construction site to meet emergency situation • The contractor should comply with all the precautions as required for the safety of the workmen as per the International Labour Organization as far as those applicable to this project • The contractor should strictly follow the statutory child labour act • Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the	Prospective Contractor	Daily	SLC/GPWSC/ Engineers of DWSS/ Environmental Officer

Sr. No.	Potential Environmental Impacts	Mitigation Measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
		workers.			

Table 7.20: Environmental Management Plan for Operation & Maintenance Stage Impacts – Sewerage Schemes

Sr. No.	Potential Environmental Impacts	Mitigation measures	Implementing Agency	Monitoring Frequency	Monitoring Institution
1	Drain/Sewer Condition Assessment	• Routine inspections of drains and sewers • Regular cleaning of interception chambers/drains (removal of blockages, debris etc.) should be ensured	Prospective Contractor / DWSS	Quarterly	SLC/GPWSC/ Engineers of DWSS
		• Leakages in sewers		Yearly	SLC/GPWSC/ Engineers of DWSS
2	Sewage Treatment Plant	• Routine maintenance of plants should be organized.	Prospective Contractor / DWSS	Twice in a month	SLC/GPWSC/ Engineers of DWSS
		• Influent & Effluent quality testing		Quarterly	SLC/GPWSC/ Engineers of DWSS/Environmental Officer
		• In case of ponds, – Its characteristic changes in colour and odour should be observed. – The ponds should be cleared of floating mats of algae at the corners and sides. – All marginal growth of weeds and vegetation should be removed. It also helps prevent mosquito breeding. – The overgrown and dead grass should be removed.		Every six months	SLC/GPWSC/ Engineers of DWSS

7.12 Environmental Supervision, Monitoring, and Evaluation Plan

Project implementation involves various interventions to achieve the objectives of providing safe, clean and adequate drinking water on sustainable basis and improving health and sanitation conditions in the villages. Simultaneously, to protect and improve the environmental conditions to achieve the goal, various mitigating measures would be taken up. For evaluating and monitoring environmental issues a set of Performance Indicators have been identified along with the monitoring agencies responsible at different levels as given in Table 7.21 and in Table 7.22.

Table 7.21: Performance Indicators for various Project Interventions / Components for Water Supply Scheme

Sr. No.	Project Intervention / Component	Performance Indicators	Frequency	Monitoring Agency
1	Water Availability / Water Quantity	• Access to safe drinking water supply of a minimum of 70 lpcd to the target communities.	Monthly	State level Executive Engineer in-charge of environment cell and Environment Specialist
2	Water Quality	• Regular DWSS water quality testing	Monthly	GPWSC/SLC/Environmental Officers
		• Water Quality Surveillance	Yearly	At district laboratories by the state level Environment cell
3	Ground Water Tables	• Need to be monitored in the schemes where ground water is the source of water supply.	Yearly	Independent consultant

Table 7.22: Performance Indicators for various Project Interventions / Components for Sewerage Scheme

Sr. No.	Project Intervention / Component	Performance Indicators	Frequency	Monitoring Agency
1	Sanitation	• Increased access of household to common sewerage / sanitation system.	Half Yearly	State Environment Specialist
2	Sewer Condition Assessment	• Interception chambers / manholes / leakage in sewers etc.	Yearly	GPWSC/SLC/Environmental Officers
3	Influent Characteristics	• pH, BOD, COD, TSS, SAR, EC, RSC and Faecal coliform	Quarterly	GPWSC/SLC/ Environmental Officers
4	Effluent Characteristics	• pH, TSS, BOD, COD, SAR, EC, RSC and Faecal coliform	Quarterly	GPWSC/SLC/Environmental Officers
5	Sludge quality and compost quality	• pH, BOD, COD, Sodium, potassium, nitrogen, phosphorous, alkalinity/acidity, and heavy metals such as Cd, Ag, Zn and Cu.	Six Monthly	GPWSC/SLC/Environmental Officers
6	Industrial waste discharge	• Checking of pre-treatment of waste and its characteristics	Monthly	GPWSC/SLC/Environmental Officers
7	Sewage flow measurement	• Check for leakages, additional flows if any	Daily	Operator/GPWSC/SLC /Environmental Officers

"Environmental Monitoring describes the processes and activities that need to take place to characterise and monitor the quality of the environment." Monitoring and evaluation is primarily required to ensure proper and timely implementation of mitigation measures identified in the planning stage, based on the EMF. Monitoring at regular intervals during implementation and for a specified period in the post implementation stages is necessary to identify and implement any change / improvement needed in the execution of the activity or in the mitigation measures.

Monitoring and Evaluation (M&E) by Environment cell to be created at state level under the supervision of an official (Executive Engineer) familiar with environmental issues of the proposed scheme. In specific situations, one may consider appointing external agencies to carry out the monitoring and evaluation activities and report to the supervising official.

The feedback received from monitoring and evaluation will be discussed with the implementing officials and the contractor and corrective actions shall be taken, where necessary. The EMF requires detailed supervision, monitoring and evaluation of the impact of the project on the environment. This shall include:

7.12.1 Environmental Supervision

Environmental Supervision is required in order to achieve the mitigation minimizing the negative environmental impacts of the project in accordance to Environment Management Plan given in bid documents. Supervision is to ensure that the suggested mitigation measures are implemented and if any other issues are found corrective measures are proposed.

A sample of 10% of the completed schemes shall be visited at six monthly intervals by Environmental personnel at state and circle level to check if all safeguard requirements are met and to identify any issues that need to be addressed. All the completed schemes shall be internally audited by the Environmental staff at division level and circle level based on the category of the scheme.

7.12.2 Environmental Audit

"Environmental Audit is an assessment of the extent to which an organization is observing practices which minimize harm to the environment."

Based on the environmental audit reports of the schemes, the following points are proposed for consideration in the respective formats.

- **Water Supply Scheme**

1. Frequency of cleaning of the Overhead tank
2. Water charges collected and their sufficiency to meet O&M costs. (With this information, we can assess whether the scheme is being maintained properly or not. If charges are not collected to the extent of expenses, there could be delay in attending to leakages/repairs leading to environmental issues).
3. Time taken to rectify pipe line leakages reported, if any.

- **Sewerage Scheme**

1. Frequency of testing of treated effluent

2. Charges collected and their sufficiency to meet costs of sewer lines maintenance and O&M costs of STP. If funds are insufficient, O&M will get affected leading to environmental degradation.
3. Time taken to attend blockages reported, if any.

Once every year, the DWSS shall appoint an external agency to undertake an independent audit of the environmental performance of the project apart from 100% internal audit of water supply and sewerage schemes. An external audit shall take place with below governing criteria:

- 15% of completed water supply schemes to be audited by third party
- 100% completed sewerage schemes to be audited by third party
- 100% completed water supply schemes based on surface water source to be audited by third party.

7.12.3 Third Party Environmental Review

DWSS shall appoint an external agency to undertake an independent mid-term and end term reviews of the environmental performance of the RWSS project in the project implementation period.

7.13 Training and Capacity Building Programs

The state currently has limited capacity for environmental management. The training and capacity building program developed for the project aims at building environmental awareness and environmental management capacity in the project administration structure as well as in the intended targeted communities. The training programs for the staff in the project agencies at various levels as well as for the village communities will be organized. The capacity building for environmental management shall be integrated with overall capacity building component of the project with the following objectives:

- To build and strengthen the capability of rural water and sanitation agency/institutions and other partners to integrate sound environmental management in water and sanitation services.
- To orient the service delivery of staff and GP representatives to the requirements of the projects' Environmental Management Framework.
- Systematic capacity building initiatives shall be introduced only after the completion of training needs assessment.
- The training shall be plummet mode. All the trained staff and other shall in turn conduct further trainings at District and Gram Panchayat levels for improved service delivery.

7.13.1 Training Modules/Training Programs

The various training programs along with the details are presented in Table below.

Table 7.23: Training Programmes

Sr. No.	Training	Purpose of the Training	Participants	Duration	Resource Persons/Agencies
1	Introduction to Environmental Management in Proposed RWSS project including EMF	Filling of EDS, procedural & technical aspects of Environmental Assessment To equip with knowledge and skills necessary for undertaking environmental appraisal as per the requirements of the EMF. To undertake periodic supervision of environmental performance of schemes To prepare for planning and monitoring implementation of environmental mitigation measures identified through the appraisal process. To equip with skills necessary for water quality testing using the field testing kits under the community based system for water quality monitoring and surveillance.	Field Staff – EEs. SDEs & JEs) SEs, EEs, SDEs, Environmental Experts – Lab Technicians	Orientation Workshop – 1 day at circle level	Services of the experts from outside agencies such as PPCB and its affiliated Training and Research Institute, National Productivity Council (NPC) Delhi/ ESCI, Hyderabad etc., may be engaged.
2	Training on Environment Management Framework	To equip with knowledge and skills necessary for undertaking environmental assessment, appraisal, practices, water quality testing as per the requirements of the EMF	SEs, EEs, SDEs, Environmental Experts	Training Programme – 5 days	Outside agencies such as National Productivity Council (NPC) Delhi/ ESCI, Hyderabad etc.,
3	Environmental Awareness and Sensitization	To build awareness on safe drinking water, water conservation, judicious use of water sources for competing demands, environmental sanitation and personal hygiene.	Environmental Staff/ GPWSC/SLC members	One day workshop at the village level One day workshop organized annually Total training programs will be about 176 for the project duration.	
4	Orientation for Water Quality monitoring for PRIs	To build awareness on water quality monitoring amongst implementation agencies.	Field Staff – EEs. SDEs & JEs) Environmental Staff GPWSC/SLC members	One day training at the circle level One day training to be organized annually.	

7.13.2 Budget for Training and EMP

The estimated cost of training on environment management for members of SLC/GPWSC, Engineers of DWSS, under the proposed RWSS project is presented in the Table 7.24 below. It is proposed to have 1 no. of training programme on "Introduction to Environmental Management in Proposed RWSS project including EMF". In each of the 22 districts in the first year on the launch of the project in the district two times. While 8 nos. of training programmes on "Environmental Awareness and Sensitization" and on "Orientation for water quality monitoring for PRIs" in each of the 22 districts over the project period depending on the phasing of the project.

Table 7.24: Budgetary Provisions for Training and Capacity Building Programs

Sr. No.	Training	No. of Programmes	Estimated Unit cost in Rs.	Total Cost in Rs.
1	Introduction to Environmental Management in Proposed RWSS project including EMF	44	50,000	22,00,000
2	Training on Environment Management Framework	10	9,00,000	90,00,000
3	Environmental Awareness and Sensitization	176	50,000	88,00,000
4	Orientation for Water/ wastewater Quality monitoring	176	50,000	88,00,000
	Total			***2,88,00,000***

Table 7.25: Budgetary Provisions for Engagement of Environmental Staff

Sr. No.	Position	Entity	Total Nos.	Salary per Month	Total Cost
1	Environmental Specialist	State Level	1	75,000	54,00,000
2	Environmental Expert	Zone Level	3	60,000	1,29,60,000
3	Environmental Manager	Circle Level	15	45,000	4,86,00,000
4	Environmental Officer (1 no.)	Division Level	60	30,000	12,96,00,000
	Total				**19,65,60,000**

The total expected budget for Training and Environmental Management Plan (EMP) is as given in Table 7.26 below.

Table 7.26: Budgetary Cost estimates for Training and EMP

Sr. No.	Activity	Amount in Rs.
1	Water Quality testing for incidence of Industrial and	1,74,30,000

Sr. No.	Activity	Amount in Rs.
	agricultural chemical contamination in water supply sources in Punjab (pesticides / heavy metals)	
2	Budgetary Provisions for Training and Capacity Building programs	2,88,00,000
3	Environment Audit by External Agency, once in a year for 6 years (6 nos. @ 15,00,000 each)	90,00,000
4	Third Party Environment Review during mid-term and End term (2 nos. @ Rs. 30,00,000 each)	60,00,000
5	Budgetary Provisions for Engagement of Environmental Staff	**19,65,60,000**
	Total Budgetary cost estimates for Training and EMP	***25,77,90,000***

Appendix A. Environmental Codes of Practices (ECoPs)

A.1 Identification of Sources for Water Supply

The identification and selection of source determines the adequacy, reliability and quality of the water supply. The raw water quality dictates the treatment requirements. For example, most ground water that are free from objectionable mineralisation are both safe and potable and may be used without treatment, provided the wells or springs are properly located and protected. Surface water on the other hand, are exposed to direct pollution and treatment is usually a pre-requisite for their development as a drinking water supply. The location of the source also defines the energy requirement for raw water pumping, which can directly affect recurrent operational costs.

Whenever possible, the raw water source of highest quality economically available should be selected, provided that its capacity is adequate to furnish the water supply needs of the community.

With a new supply, an assessment should be made in conjunction with the collection of engineering data covering the development of a given source and its capacity to meet existing and future needs. The assessment should include the detection of all health hazards and their present and future importance. Persons trained and competent in public health engineering and the epidemiology of waterborne diseases should conduct the assessment. In the case of an existing water supply, the assessment should be made at a frequency compatible with the control of the health hazards and the maintenance of a good sanitary quality.

The following outline covers the essential factors which should be investigated or considered in the assessment. Not all of the items are pertinent to any one water supply and in some cases items not in the list would be important additions to the survey list.

1. Ground Water Supplies
    a. Local geology; slope of ground surface
    b. Nature of soil and underlying porous strata; whether clay, sand, gravel, rock; coarseness of sand or gravel; thickness of water bearing stratum, depth to water table.
    c. Slope of water table, preferably as determined from observational wells
    d. Extent of drainage area likely to contribute water to the supply.
    e. Nature, distance and direction of local sources of pollution.
    f. Possibility of surface water entering the supply and of wells becoming flooded; methods of protection
    g. Methods used for protecting the supply against pollution by means of sewage treatment, waste disposal.
    h. Well construction – Total depth of well
    i. Casing: diameter, wall thickness, material and length from surface.
    j. Screen or perforations: diameter, material, construction, locations and lengths.
    k. Disinfection: equipment, supervision, test kits, or other types of laboratory control.
2. Surface Water Supplies
    a. Nature of surface geology: character of soils and rocks
    b. Character of vegetation, forests, cultivated and irrigated land, including salinity, effect on irrigation water etc.
    c. Population per sq.km. of catchment area
    d. Methods of sewage disposal, whether by diversion from watershed or by treatment

e. Character and efficiency of sewage treatment works
f. Proximity of sources of faecal pollution to intake of water supply
g. Proximity, sources and character of industrial wastes, mine waters, etc.
h. Character and quality of raw water: Coliform organisms (MPN), algae, turbidity, colour, objectionable mineral constituents
i. Nominal period of detention in reservoir or storage basin
j. Probable minimum time required for water to flow from sources of pollution to reservoir and through reservoir intake.
k. Protective measures in connection with the use of watershed to control fishing, boating, swimming, wading, permitting animals on marginal shore areas and in or upon the water etc.

3. Distances to sources of contamination

All ground water sources should be located at a safe distance from sources of contamination. In cases where sources are severely limited, however, a ground water aquifer that might become contaminated may be considered for a water supply if treatment is provided. Because many factors affect the determination of “safe” distances between ground water supplies and sources of pollution, it is impractical to set fixed distances. Where insufficient information is available to determine the “safe” distance, the distance should be the maximum that economics, land ownership, geology and topography will permit.

Since safety of a ground water source depends primarily on considerations of good well construction and geology, these factors should be the guides in determining safe distances for different situations. The following criteria apply only to properly constructed wells. There is no safe distance for a poorly constructed well.

The following table is offered as a guide in determining distances.

Table A.1: Criteria to determine Minimum acceptable distance from Pollution source

Formation	Minimum Acceptable Distance from Pollution Source
Favourable	50 feet. Lesser distances only on health department approval following comprehensive assessment of proposed site and immediate surroundings.
Unknown	50 feet only after comprehensive geological survey of the site and its surroundings has established, to the satisfaction of the health agency that favourable formations do exist.
Poor	Safe distances can be established only following both the comprehensive geological and comprehensive assessment. In no case, should the acceptable distance be less than 50 feet.

A.2 Site Selection for STP

The site selection for treatment plant location is an important activity and need careful considerations for future development activity. The sample visit of sewer villages shows that the treatment plants, which are constructed, are fairly away from built up areas or from the residential houses. In cases, where STPs are located near locality, it could experience odour nuisance and breeding of mosquito aggravates the problem of local residents. Mitigation measures to be adopted during the selection of STP site are as stated below:

- Location of STP site shall be at least 200m away from the nearest settlement.
- The site should be isolated from the presently built-up areas or areas that have potential for future development.

- The STP shall be located at low elevation to prevent backflow into the sewers.
- Large enough area for locating the plant will be helpful in maintaining the buffer area and fulfilling the needs for future expansion
- Enough area for local disposal of end products such as effluents, sludge shall be available at the selected site
- The treatment plant shall not be located within flood zones.
- The site shall be selected near a large water body or irrigable land capable of accepting the treated effluents.
- Site selection of sewerage schemes should be strengthened with the layout of STP

A.3 Identification of Quarry Sites / Borrow Areas

Embankment fill material is to be procured from borrow areas designated for the purpose. Scope of this ECoP extends to measures that need to be incorporated during borrow area location, material extraction and rehabilitation.

Design measures for reduction in quantity of earth work need to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. The DSR shall contain:

- Guidelines for locating site of borrow areas
- The arrangements to be worked out with land owner / community for the site
- Sample designs for redevelopment of borrow areas

Measures to be carried out while selecting borrow area site are as given below:

- The contractor needs to identify the borrow area locations in consultation with the individual owners in case of private lands and the Gram Panchayat. This is to be done after assessing the suitability of the material.
- The suitable sites shall be selected and finalized in consultation with Engineers of DWSS.
- The contractor needs to work out arrangements for borrowing with the land owner / Gram Panchayat, as is appropriate
- The Engineers of DWSS will approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner.
- Based upon the arrangement a contract with the land owner / Panchayat is made, The contract should include the redevelopment after completion of borrowing. The contract between the borrower and contractor leasing the site needs to include:
  - A written No Objection Certificate (NOC) from the borrower / leaser of land
  - Extent of land required and duration of time leased out
  - Photographs of site in original condition
  - Details of compensation
  - Details of site redevelopment, including a redevelopment plan
  - Dispute resolution procedure, in case of a dispute
- The redevelopment will include:
  - Land use objectives and agreed post borrowing activities
  - Physical aspects of the site in present form and planned development changes. These will include landform stability, erosion concerns, drainage and drainage needs, soil type etc.
  - Biological aspect of the site in present form and planned changes from development.

- Water quality
- Public safety issues

A.4 Selection of Community Toilet Location

The soil and water table conditions should be carefully investigated prior to selecting the site for the Toilet / latrine:

Table A.2: Considerations for Selection of Community Toilet location

Specific topic on which information / data is needed	Considerations
Type of soil stability	
Loose, sides of wall collapse	Line the pits. In very sandy soils, sink cement rings that are perforated or set on top of each other without cement.
Hard to dig	Use the pits. In very sandy soils, sink cement rings that are perforated or set on top of each other without cement.
Permeability	
Clay Soil	Test by pouring water into a hole and measuring how long it takes to be absorbed. Pits in dense clay may need back filling about 1.2 meters with more sandy soil.
Coarse Sand	Back fill around the rings with denser soil and/or locate the latrine pipes far from a well - used for drinking
Hard laterite	If there are cracks in the latrine, the latrine pits can pollute nearby drinking water sources. Place the latrine far from these sources.
Ground water level in wet season	
Water rises higher than one meter from bottom of the latrine pit, but never completely floods the latrine pits	Locate the latrine pit far from any well used for drinking purpose
Water rises to or above the ground level and sludge comes out the latrines	Raise the latrines above the ground level so that the top third of the pit is always above the water level. Place latrines far from drinking water sources
Distance to water sources	
Distance from latrines pit to drinking water sources	At least 15 meter

- Closeness to users: A latrine should be sited within or close to the compound to allow easy access to the users day and night. Community latrines should therefore be located centrally.
- Proximity to water supply services: The latrine should not be sited within a distance of 15 m from water sources such as springs, streams and wells.
- Accessibility: The site should be selected to allow easy removal of material excavated from the pit. These materials should be stacked sufficiently far to prevent it from falling back into the pit, especially if construction is done during the rainy season.

A.5 Protection of Surface Water supply source and ensuring its sustainability

The contamination, pollution and any degradation of the quality of water supply sources have damaging effects on health, well-being and economy, as well as on the general environment. The careful selection of the surface water supply source and its protection, are most important measures for preventing the spread of water borne diseases.

- Water, being an essential of life, is one of the most valuable resources of an individual. Therefore, everyone has a natural right to safe, acceptable quality water for drinking, culinary and other domestic uses.
- The water supplier, an individual, a utility or the municipality has a natural right to good quality raw water.
- The responsibility for preventing and abating pollution and contamination of raw water sources rests with those who discharge, directly or indirectly, waste products into the water sources or the land, as well as with those who cause unacceptable land use conditions within the watershed.
- All water and land users are responsible for taking effective action to identify and reduce to the lowest practical level pollution of surface water sources.
- Where reasonable access to other water bodies is available, public water supply source must not be used for recreational purpose.
- Primary body contact such as swimming and wading must not be allowed in water supply sources
- Sanitary Survey of Water supply source
- Distribution or equalizing reservoirs from which water is supplied directly to the public requires the strict controls and must under no circumstances be used for any type of recreation.

1. Surface Water Supply source Monitoring and Inspection Considerations

- Watershed Inspection
  - Physical conditions within the watershed, near reservoirs
  - Erosion, sedimentation, silt movement
  - Floating solids, debris, oil grease, algal mats
  - Excessive vegetative growth, unusually enriched growth of green grass
  - Changes to water course path or conditions
  - Slumping, terrain heaving, drift wood etc.
- Waste Disposal
  - Solid wastes dumping
  - Oil drums, large chemical containers,
  - Industrial and household materials, equipment, appliances and goods
  - Liquid waste discharges including septic tank effluents
- Land Use
  - Changes in site use (number of people, additions to buildings, repairs or additions to septic systems)
  - Activities in watershed recreation, waste disposal on land and injection wells, construction, forestry operations etc.
  - Industrial storage facilities for fuels or chemicals
  - Aerial spraying of pesticides or weed control agents within or surrounding the watershed
  - Condition of any road crossing, causeways, beaches, slopes etc.

A.6 Protection of Ground Water Supply Source and ensuring its sustainability

Same as surface water sources, the contamination, pollution and any degradation of the quality of ground water supply sources have also damaging effects on health, well-being and economy. The careful selection of the ground water supply source and its protection, are most important measures for preventing the spread of water borne enteric diseases.

The State Ground Water Department, Government of Punjab has implemented schemes involving several different types of water harvesting structures. These include:

- Check Dams
- Recharge Shafts
- Roof type Rain Water Harvesting Structures
- Percolation Tanks

1. Guidelines for Ground Water Recharge

The guidelines presented are based on the guidelines provided in the publication "Water Harvesting and Artificial Recharge" published by the Rajiv Gandhi National Drinking Water Mission.

a. Roof Top Harvesting Systems

Roof top water harvesting systems can provide good quality potable water with the design features outlined below are taken into account:

- The substances that go into the making the roof should be non-toxic in nature.
- Roof surfaces should be smooth, hard and dense since they are easier to clean and are less likely to the damage and release material / fibre into the water.
- Roof painting is not advisable since most paints contain toxic substances and may peel off.
- No overhanging tree should be left near the roof.
- The nesting of birds on the roof should be prevented.
- All gutter ends should be fitted with a wire mesh screen to keep out leaves etc.
- A first-flush rainfall capacity, such as detachable down pipe section, should be installed.
- A hygienic soak away channel should be built at water outlet and a screened overflow pipe should be provided.
- The storage tank should have a tight fitting roof that excludes light a manhole cover and a flushing pipe at the base of the tank (for standing tanks).
- There should be a reliable sanitary extraction device such as a gravity tap or a hand pump to avoid contamination of the water in the tank.
- There should be no possibility of contaminated wastewater flowing into the tank (especially for tanks installed at ground level).
- Water from other sources, unless it is reliable source, should not be emptied into the tank through pipe connections or the manhole cover.
- During the rainy season, the whole system (roof catchment, gutters, pipes, screens, first-flush and overflow) should be checked before and after each rain and preferably cleaned after every dry period exceeding a month.

- At the end of the dry season and just before the first shower of rain is anticipated, the storage tank should be scrubbed and flushed of all sediment and debris (the tank should be re-filled afterwards with a few centimetres of clean water to prevent cracking). Ensure timely service (before the first rains are due) of all tanks features, including replacement of all worm screened and servicing of the outlet tap or handpump.

b. Check Dams

Check Dams are constructed in the drainage course of narrow streams in low rainfall area to impound run-off rainwater. The following are some guidelines for construction of check dams.

- The total catchment of the nallah should normally be between 40 to 100 hectares though the local situations can be guiding factor in this
- The rainfall in the catchment should be less than 1000mm/ annum
- The Nallah bunds should be preferable located in area where contour or graded bunding of lands have been carried out
- The rock strata exposed in the ponded area should be adequately permeable to cause ground water recharge through ponded water
- Nallah bund is generally a small earthen dam with cut-off core wall of bricks work, though masonry and concrete bunds/plugs are now prevalent
- Dams should be built at sites that can produce relatively high depth to surface area so as to minimize evaporation loses.
- Rocky surface should not be fractured or cracked, which may cause the water to leak away to deeper zones or beneath the dam.
- Dam foundation must of solid impermeable rock with no soil pockets or fracture line
- No soil erosion in the catchment area
- Dams should be sited along the edges of depressions or directly across the lower ends of deep gullies into rock.

c. Percolation Tanks

- Percolation tanks should normally be constructed in a terrain with highly fractured and weathered rock for speedy recharges; in case of alluvium the boundary formations are ideal. However, the permeability shouldn't be too high that may result in the percolated water escaping the downstream.
- Submergence area should be uncultivated as far as possible.
- Rainfall pattern based on long-term evaluation is to be studied so that the percolation tanks get filled up fully during monsoon (preferably more than once).
- Soil in the catchment area should preferably be of light sandy type to avoid silting upon the tank bed.
- The location of the tank should preferably be downstream of runoff zone or in the upper part of the transition zone, with a land slope gradient of 3 to 5%.
- While designing, due care should be taken to keep the height of the ponded water column about 3 to 4.5m above the bed level.
- Construction–wise there is not much difference between a percolation tank and a minor irrigation tank, except for providing outlets for surface irrigation and the depth of the cut-off trench. The cut-off trench is to be provided below the earthen bund with depth limited to one fourth of the height between bed level and full storage level.

A.7 Safe Sanitation techniques at individual household and community level

Selection and installation of safe sanitation technologies to suit the local soil characteristics and hydrogeology is necessary so as to minimise ground water contamination. For selecting the most appropriate system for any location the following factors are to be considered:

- Number of people to be served
- Low cost sanitation systems like pour flush single / two pit latrines, conventional septic tanks could be installed.
- Revamping the existing deep pit latrines to prevent direct contact of human excreta with the ground water.
- Per capita water supply rate and the water availability for ablution and flushing.
- Extent of space available within the plot / street for sanitation facility.
- Hydro-geologic characteristics of the subsoil.
- Depth to groundwater table from the ground surface (summer and rainy season)
- Quality of groundwater in the vicinity and their present uses
- Locations of the existing water supply wells sources

Further the selection of the types of toilets shall mainly depend on the type of sub-soil within the location; thus appropriate type of toilet has to be selected as per the local soil characteristics and ground water table depth. Other factors to be considered;

- Hard to dig
- Clay soil
- Coarse sand
- Water rises higher than one meter from bottom of the latrine pit, but never completely floods the latrine pits
- Distance from latrines pit to drinking water source

Table A.3: Different Types of Sanitation Techniques

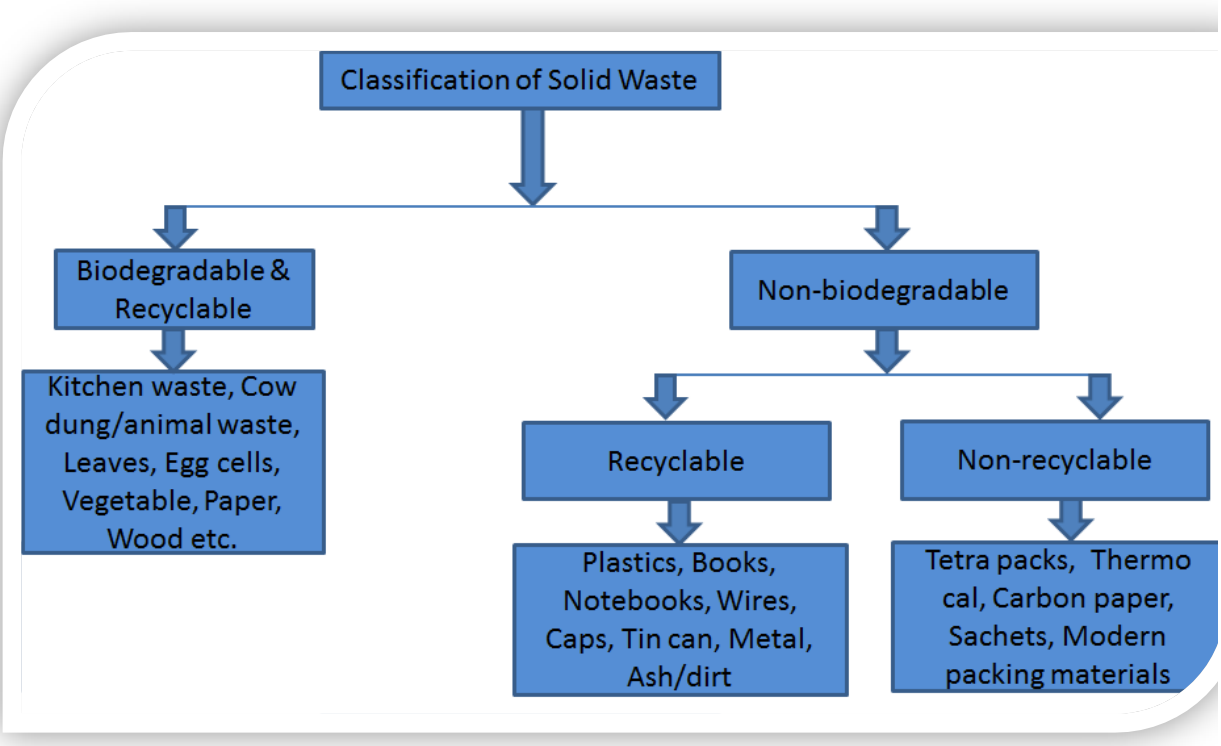
Latrine Type	Suitable for High Ground Water Table	Suitable for areas prone to floods or flushes	Suitable for loose soils	Suitable for soils of low permeability	Water Requirement	Ease of Construction	Ease of maintenance	Remarks
Direct Single Pit Latrine without Pour flush	Yes, if raised	Yes, if raised	Yes, if fully clay soils lined	Not for clay soils	No	Easy	Easy	Sludge unsafe
Direct Twin Pit Latrine without Pour Flush	Yes, if raised	Yes, if raised	Yes, for fully lined	Not for clay soils	No	Easy	Easy	Safe sludge
Offset Single Pit Latrine with Pour flush	Yes, if raised and with soak away	Yes, if raised	Yes, for fully lined	Yes, with soak away	Yes	Easy	Easy	Sludge unsafe
Offset Twin Flush Pit Latrine raised and with Pour flush	Yes, if raised and with soak away	Yes, if raised	Yes, for fully lined	Yes, with soak away	Yes	Fairly easy	Fairly easy	Safe sludge
Solar heated single vault eco-sanitary latrine with urine separation	Yes	Yes	Yes	Yes	No	Fairly Easy	Difficult	Safe dehydrated material
Single vault eco-sanitary latrines with urine separation	Yes	Yes	Yes	Yes	No	Easy	Difficult	Safe dehydrated material
Urinal	Yes	Yes	Yes	Yes	Very less	Easy	Easy	-

Source: Suggested by Mott MacDonald Pvt. Ltd.

A.8 Solid and Liquid Waste management at individual household and community level

The need for genuine and organized initiatives in the rural waste management has been regularly voiced in India. With the emerging concern on large quantity of the waste being produced both in the form of solid and liquid waste, the concept of waste management becomes one of the key focus of sustainable development principles which is based on policies, and practices that are resource conserving, follow standards that can be met in the long term and respect values of equity in human access to resources. In definitional terms solid and liquid waste management (SLWM) is the collection, transport, processing, recycling or disposal of waste materials, usually ones produced by human activity, in an effort to reduce their effect on human health or local aesthetics or amenity.

Figure A.1: Classification of Solid Waste



Source: Solid and Liquid Waste Management in Rural Areas, A Technical Note, Government of India in association with UNICEF

1. Approaches for Solid Waste Management

For effective management of solid waste in rural areas, focus should be on management at household level. That which cannot be managed at household level should be managed at the community level. In general, the following approach should be followed:

- Segregation of solid waste at the household level (Biodegradable and non-biodegradable)
- Reuse of non-biodegradable waste at the household level to the extent possible
- Household level treatment of biodegradable waste

- Collection and transportation of segregated waste at the household level to a place identified at the community level
- Community level treatment or recycling/reuse of waste
  - All the biodegradable waste should be composted at the community level
  - Non-biodegradable waste may be further segregated and sold or recycled
  - Waste which cannot be composted, reused or recycled may be disposed at the landfill sites following appropriate procedure.

2. **Composting as Technology option for Treatment of Biodegradable Waste**

- Household level composting – Household level composting pits may be constructed by adopting either lined or unlined pits as stated below:
  - Underground unlined manure pit or garbage pit
  - Underground brick lined manure pit or garbage pit
  - Over-ground heap
  - Over-ground brick lined compost tank
- Community level composting – Community level composting may be resorted to when management of solid waste at household level is not feasible.
  - Underground unlined manure pit or garbage pit
  - Underground brick lined manure pit or garbage pit
  - Over-ground heap
  - Over-ground brick lined compost tank

3. **Waste Water Management** – Disposal of waste water is a major public health problem in rural areas. Stagnant waste water smells bad and also acts as breeding place for mosquitoes resulting in spread of diseases like dengue, malaria, filarial etc.

- **Technological Options at Household level management**
  - Kitchen garden with piped root zone system
  - Kitchen garden without piped root zone system
  - Leach pit
  - Soakage pit
- **Technological options at Community Level Management at Public Places**
  - Plantation with Intercepting Chamber
  - Community Leach Pit
  - Soak-away Channel

Table A.4: Standards for Compost

Parameter	Maximum Acceptable Concentration Parts per million (ppm)
Arsenic	20
Cadmium	20
Chromium	300
Copper	500
Lead	500
Mercury	10

Parameter	Maximum Acceptable Concentration Parts per million (ppm)
Nickel	100
Zinc	2500

Source: CPHEEO Manual

A.9 Safe Sullage Disposal and Organic Waste Management

1. Introduction

The RWSS project will undertake the following sullage disposal activities during the project period:

- Drains and liquid waste disposal in villages
- Soak pits at household level in villages

2. Technical options for household level management

The village level water management system should be as simple as possible for a village level person to understand and implement and it should be decentralized. The technological options should be based on domestic (Household) level management and/ or community level management.

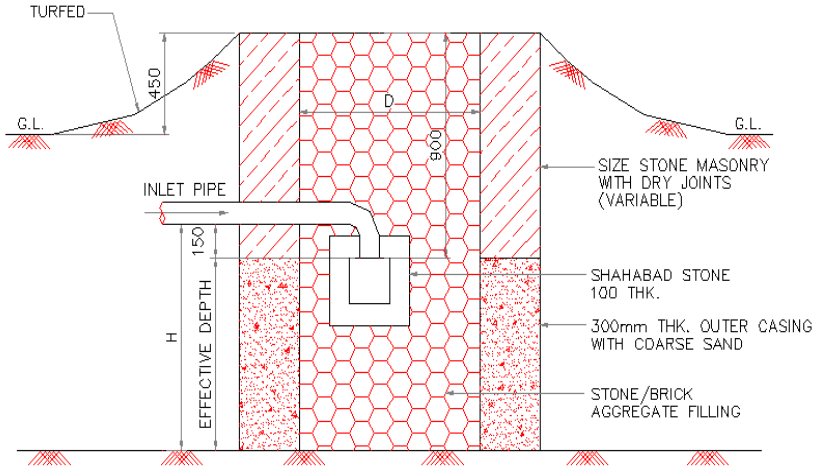
It will always be better to manage and treat domestic greywater generated in the house in the area/courtyard/land surrounding the house. The following technological options appear suitable for this purpose:

- Leach pit for sanitary latrines
- Soak pit for waste water

3. Soak Pit

Soak pit is a dug out pit filled with stones or preferably over burnt bricks. The large numbers of stones or bricks increase the surface area over which biological and chemical action takes place. The water seeps into the ground and reduces danger of polluting the ground water sources.

Figure A.2: Typical Details of Soak Pit Without Lining



Source: MMacDonald

Advantages

- This is the cheapest technology for management of water at household level
- Prevents grey water stagnation
- Prevents vector breeding.

Operation and maintenance (O&M)

- Filter to be cleaned every fortnight or month, depending on accumulation of dirt
- Make a hook of thick wire and pierce it in the filter and take filter media out and clean/wash it and dry and replace it in the earthen pot
- Soak pit loses its capacity within a period of 7 to 8 years of work. At that time take out the boulders from the pit, scrap the walls of the pit in order to remove the oily layer; let the pit dry for a period of 2 to 3 days and clean and dry the boulders and replace into the pit.

Limitations

- Soak pit is not suitable for rocky terrain and areas having impermeable soil strata.
- It will overflow if wastewater flow in the pit exceeds the design flow
- If suspended solids get into the pit, the choking of the pit will take place earlier.

4. Off Site Community Level Management:

For the community grey water of this type, the first step would be to establish a system for collecting and transporting this grey water for the treatment on a suitable location. It will be necessary to establish a suitable drainage system for this purpose. This drainage system could be of two types:

- Open drain with technically sound design, involving semi-circular base and trapezoidal cross section so as to maximize self-cleansing velocity for carrying away silt in grey water
- Closed drain-small bore grey water draining system with intercepting tanks at suitable points.

a. Open or Surface Grey water Drainage System

For collection and transportation of greywater flowing out from the houses, surface drain has been the simplest system, whereby, the community greywater is carried away from the village for treatment. This system can be established easily with available local mason at minimum cost.

Operation and maintenance (O&M)

- Gram Panchayat will have to establish a system for periodical cleaning and silt removal from the drain.
- Community will have to be educated to keep the drain free from garbage, so as to avoid blockages in drain.
- Care needs to be taken to avoid overflow water from flowing to the open drain. This effluent should be led to soak pit covered at the top.

b. Closed Drainage

Small bore grey water drainage system

In rural areas, closed drain system analogous to conventional sewerage systems will not be feasible because of the excessive capital & operation maintenance expenditure and the sophisticated maintenance requirements.

The small bore greywater drainage system which is laid close to the soil surface is suitable and appropriate as it is low cost and requires minimum maintenance which is easy.

Advantages:

- As the system is closed, materials like garbage, road side solid wastes, plastics, building materials etc. will not find access to the system.
- Operation and maintenance becomes easily manageable by Gram Panchayat.
- Construction cost is comparable to the cost for surface drain. It may be only marginally varying.
- Road space is fully utilized.

5. Treatment of Community Grey water

Once the community greywater is collected at one or multiple points outside the village, treatment is required to convert it into harmless and reusable water. The treatment technologies need to suit the following requirements.

- As low cost as possible
- O&M should be easy and low cost for Gram Panchayat
- Some cost recovery may be possible by the farmers
- Selling the treated water. Treated water could be used for public gardens or horticulture. The produce may be sold portably.
- Vector breeding is avoided
- Pollution of water from nallah or river is prevented.
- Some appropriate technologies easily manageable by Gram Panchayat/villagers could be as follows:
  - Sullage stabilization and reuse

- Systems like Decentralized Wastewater Treatment Systems (DEWATS).

Sullage Stabilization Ponds

The greywater collected via drainage system is passed to such ponds excavated at suitable land site and placed serially as a stabilization system in which greywater is stabilized, its pathogenicity is reduced and the stabilized water becomes useable.

a. Anaerobic ponds

The greywater reaching the pond via drain usually has high solid content. In the anaerobic pond, these solids settle at the bottom, where these are digested anaerobically. Thus, the partially clarified liquid is discharged onwards into a facultative pond for further treatment.

b. Facultative ponds

The partially clarified water is led to facultative pond. In this pond oxidation of greywater takes place. It is called 'facultative' because in this pond in the upper layer aerobic conditions are maintained while in the lower layer, anaerobic conditions exist.

c. Maturation pond

The stabilized water from facultative pond is led to a maturation pond. The main function of the maturation period is the destruction of pathogens. This pond is wholly aerobic.

Operation and maintenance

- It will be the responsibility of GP.
- Maintenance requirements are minimal. Regular cutting of grass on embankments and removal of any floating scum from pond surface are the only requirements
- Occasional anti mosquito spraying treatment may be necessary.

Reuse of Stabilized Water

Greywater stabilized and cleaned by the use of any of the above mentioned systems can be reused in many ways such as irrigation for agricultural use and irrigation for horticulture.

A.10 Rainwater Harvesting Techniques

Rainwater Harvesting (RWH) and recharging of groundwater is emerging as a sustainable strategy to cope with the increasing pressure on scarce freshwater resources. It is imperative that RWH practices have to be promoted nation-wide for a secure water future of our country. RWH refers to collection of rain falling on earth surfaces for beneficial uses before it drains away as runoff. RWH can be done at individual household level and

at community level in both urban as well as rural areas. At household level, harvesting can be done through roof catchments and at community level through ground catchments.

A cost effective way of storing the harvested rainwater would be to use it to replenish the groundwater adopting Artificial Recharge (AR) methods. AR is a process in which water is introduced into groundwater aquifers by anthropogenic means. AR methods for household RWS systems:

- **Abandoned dug wells:** Dry and unused wells in the residential houses can be used as rainwater recharge structure. If abandoned well is to be used, it is essential to clean the bottom surface of all fine deposits. The rooftop rainwater has to be guided through a pipe to the bottom of the well or below the water level to avoid scouring of the bottom and entrapment of air bubbles in the aquifer.
- **Abandoned hand pumps:** In this case, hand pump is adopted as the rainwater recharge structure. The rooftop rainwater is diverted to the suction pipe of the hand pump through a small diameter pipe. A gate valve would require to be fitted with the rainwater conveyance system to avoid entry of air into the suction pipe. A small collection tank in the rainwater conveyance system can act as silt trap as well as a balancing tank.
- **Recharge Pits:** Recharge pits are useful when the harvested rainwater is to be fed to shallow aquifer. The pits can be of any shape, i.e. circular, rectangular or square. After excavation, the pits are refilled with coarse gravel, pebbles and boulders. The fillings can function as a roughing filter to remove suspended impurities if any in the collected rainwater.
- **Recharge Trenches:**Recharge trenches can be adopted when a permeable soil stratum is available at shallow depths. As in recharge pits, the trenches also are filled with coarse gravel, pebbles and boulders. Recharge trenches are constructed along the boundary walls of households, or across the landscape where open space is available.

A.11 ECoPs on Management of Water supply System

1. Establish an enabling environment

To ensure an institutionally supportive environment that willfacilitate the implementation of the project process with particular emphasis on devolution ofresponsibilities to grass-roots levels and, in particular, user implementation, a demand-orientedapproach, and sustainability and management of the catchment area.

- **Public Awareness.** Implement a widespread public awareness campaign to promote water as an economic good and the need to charge cost-reflective prices and implement conservationactivities.
- **Give Priority to Drinking Water in Water Resource Use.** Strengthen and implement nationaland state policies giving priority to drinking water, and prepare state specific legislation to protect groundwater resources.
- **Redefine and Reduce Government Role.** Develop and implement national and state policies defining the role of public sector in the RWSS sector, and guidelines for sector operations regarding financial and institutional aspects.
- **Full Cost Recovery and Capital Cost Sharing.** Develop and implement national and state RWSS cost recovery and cost-sharing policy that defines situations in which the community will be eligible for matching government financing for new schemes and rehabilitation or replacement of existing schemes.
- **Decentralize Responsibilities.** Devolve management autonomy to local level administrations.

- **Institutional Strengthening.** Strengthen institutional capabilities, including development of MIS, financial systems, monitoring and evaluation systems, and training at all administrativelevels to facilitate the devolution process.

2. **Ensure Institutional sustainability**

Objective: Decentralize and strengthen RWSS agencies, defining clear mandates at each administrative level, devolvingfunctions to the lowest appropriate level, and encouraging participation of NGOs & the private sector.

- Enable Panchayat institutions and user community groups to assume the lead in decision making for RWSS.
- Enable, promote and facilitate participation of NGOs and the private sector; define appropriate roles of these non-government as well as external agencies.
- Strengthen institutional capabilities to undertake consumer orientation, policy development, planning, implementation, O&M, monitoring and evaluation, and promotion of health and sanitation.
- Reform public sector institutions.
- Strengthen operational guidelines and procedures for RWSS agencies.

3. **Protection of Water Sources**

- Characterize appropriate remedial measures to address water quality problems.
- Create a strategy for developing water supply schemes in areas with water quality problems that meet safe drinking water requirements and acceptability (preference) of users.
- Develop technology and other innovative options for solving water quality problems (fluoride, iron and arsenic) both at village and household level as well as for larger piped schemes.
- Develop groundwater legislation and regulations, and develop regulators' capabilities to manage and protect groundwater resources.
- Develop institutional capabilities for multi-sectoral water allocation, planning and management, including water pricing mechanisms, and features to prioritize allocation for drinking water and protection/mitigation against pollution.

A.12 ECoPs on Rehabilitation of Construction / Supplementary Sites

In order to mitigate and reduce environmental hazards of the sites used for the construction activities during the project implementation should be rehabilitated in the environmentally sound and controlled manner. The proposed RWSS project of Punjab envisages construction and laying of pipelines for water supply, sanitation facilities like toilets, drains, etc. It will be endeavoured to use excavated materials in compact fills as far as possible only remaining is to be disposed of in identified/approved dumping areas or to fill in the construction sites used during the project implementation phase. The proposed guidelines give the details of methods of rehabilitation of construction sites.

The construction activities involved in the proposed project are likely to generate an amount of construction trash. The excavation and dumping may lead to the various environmental hazards and adverse impacts on the water & land environment, if it is not treated with controlled manner. It increases the concentration of suspended

particulate matter in the air and suspended solids in the water bodies resulting in the health problem of people and damage of terrestrial and aquatic life.

The guidelines are formulated for rehabilitation of the construction/excavated sites through integrated approach and are to be followed by the prospective contractor are as following:

- The Contractor shall ensure that all temporary structures, equipment, materials, waste and facilities used for construction activities are removed upon completion of the project. The Contractor shall clear and clean the construction site upon completion of the project.
- The methodology for rehabilitation of construction sites shall have minimal environmental damage.
- To minimize the environmental damage, construction material like stones, gravels, earth, sand, etc. required for the construction shall be obtained mostly from the excavated material.
- After completion of construction activities, the subsoil must be replaced first and then compacted so as to match the original condition as closely as possible at the construction sites. The topsoil must then be put in place and must be similarly compacted.
- If possible, formulation of appropriate blends of organic waste and soil to enhance the nutrient status to support vegetation has to be made.
- Re-vegetation with native species may involve direct seeding, natural regeneration or any combination of these.
- Control measures should be implemented to prevent and minimize construction impacts in riparian zones and to ensure that appropriate remedy is undertaken.

A.13 ECOPs on Schemes in Forest Areas

Considering the planned activities by the project and the scale of these activities, it is expected that there will be minimal disturbance to forest lands. Also, the Forest Department has clearly identified procedures to minimize and mitigate impacts on forestland. It also identifies procedures and approvals required under the Forest (Conservation) Rules, 2003 for any forest land diversion. However guidelines are given below in case the project is in/near a forest area.

- Avoid forest areas and identify alternate route for laying pipeline or other infrastructure.
- Where there are no alternate options and there is a need to lay pipelines through a forest consider possibility of laying pipelines along the road and within the right of way of the road or right of way alternate infrastructure, if possible.
- Prior to finalizing the detailed design for work in the forest, discuss with Forest Department requirement and undertake a joint survey with them on proposed siting of infrastructure.
- Based upon discussions with the Forest Department, identify compensation and clearances for the project and submit the required documents as identified by the forest act and rules.
- After laying the underground pipelines in the forest, the soil should be compacted with adequate plantations.
- The project will also ensure that small cross-bunds (stone pitching) are made on excavated/compacted areas to prevent water runoff over it and any further soil degradation.
- Both during project design and construction minimize tree cutting.
- No construction activity should be undertaken at night time or during any high wildlife activity
- After construction is completed the area must be brought back as close to original as is possible

- Ensure that there are no construction camps near or in the forest areas and ensure that there is no firewood procured from the forest area.
- Ensure that machinery used during construction creates minimum disturbance to the area.
- Compensatory plantation at the ratio of 1: 3 should be undertaken, where for every tree cut, 3 trees should be planted at appropriate area identified for the activity should be 3 trees of indigenous and local species. The compensatory plantation plan should include a minimum of 3 years of management plan to ensure survival of trees.

A.14 Water Quality Monitoring and Surveillance (WQM&S)

1. Guidelines for WQM&S

The guidelines given are in line with the guidelines of the Community based Water Quality Monitoring and Surveillance system documents in the "Uniform Drinking Water Quality Monitoring Protocol" published in February 2013 by the Ministry of Drinking Water and Sanitation. These guidelines should be applied in the proposed RWSS project.

2. Community based systems for WQM&S

The actions planned for integrating a Community-based system for Water Quality Monitoring and Surveillance programme as part of the RWSS are:

- Identifying suitable user-friendly field testing kits for Water Quality Testing
- Initiating an action research on community based systems for Water Quality Monitoring and Surveillance in few villages.
- Using the piloting experience to develop a scaling up strategy for all the project villages.
- Implementing the community based systems for WQM&S programme in all the project villages through the use of user friendly water quality testing kits and by involving the GPWSC, GPs, local educational institutions etc.

3. WQM&S through Laboratory Infrastructure

The water to be supplied is tested at two stages:

- Firstly, at the time of development of source to ascertain if the source would yield water within safe chemical-content limits.
- Secondly, after commissioning of the water supply schemes, to monitor any change in quality of the water supply source over the years.
- Water samples, apart from the source, are also taken from different points in the distribution system including the consumer end and tested in the laboratories.

Table A.5: Frequency of Testing of sources according to Uniform Drinking Water Quality Monitoring Protocol, February 2013

Testing Personnel	Responsibility
State Level	• Shall monitor all drinking water quality parameters once in a year. • Depending upon the occurrence of specific parameters in drinking water sources and their local relevance, number of the parameters or frequency of analysis for some of the parameters may be reduced as deemed appropriate. • Monitoring for heavy metals, pesticides and specific

Testing Personnel	Responsibility
	contaminants of local importance. • Analysis/Evaluation/Impact assessment of specific contaminants • Virological examination of drinking water sources of such areas where contamination is likely having surface water based drinking water sources.
District and Sub-district Laboratory	• Twice a year for water quality hot spot areas. Monitoring is to be intensified, if following criteria are met: – Waterborne diseases are reported by community using source water – Source is rejected by community due to taste, odour, colour etc. – Source water is reported to be contaminated in the last monitoring or exceeded 0.8 times the standard. – To verify efficacy of the water quality improvement interventions undertaken. ▪ Twice a year/source for bacteriological parameters and once a year for chemical parameters during pre-monsoon and post-monsoon season duly registering the GPS co-ordinates and depth of ground water. ▪ In-viltro UV laminar flow chamber shall be used for testing microbiological parameters and for preparation of organic media. ▪ Discrete monitoring during calamities, especially for residual chlorine.

Frequency and Responsibility of WQM&S through Laboratory Infrastructure for distribution network

Pump Operator of water distribution (Once in a day)	• Checking and ensuring the safety of water • Maintaining a record of residual chlorine
Junior Engineer (Once in a week)	• Checking turbidity of treated water from filters in case of surface water sources • Testing residual chlorine • Checking the water quality record maintained by operator • Maintaining the record of water quality
Sub Divisional Engineer / Executive Engineer (Once in a month)	• Testing residual chlorine in water samples • Checking the record of tests conducted by the pump operator and JE and will record his comments over the results
Sub Divisional Engineer / Executive Engineer (Once in Quarter)	• Collecting and sending samples for bacteriological analysis • Maintaining the records of bacteriological water quality
Sub Divisional Engineer / Executive Engineer (Twice in a year – Pre and Post monsoon)	• Collecting and sending samples to district laboratories for chemical analysis • Maintaining the records of chemical water quality

A.15 Water and Waste water Sampling Procedure

A.15.1 Drinking Water Sampling Procedure

Bureaus of Indian Standards have specified drinking water quality standards in India to provide safe drinking water to the people. It is necessary that drinking water sources should be tested regularly to know whether water is meeting the prescribed standard limits. Apart from BIS, there is one more guideline for water quality brought out by Ministry of Water Resources known as Uniform Drinking Water Quality Monitoring Protocol. The most effective means of ensuring safe drinking water is through the use of water safety plan which effectively utilizes water quality data in planning, preventive measures and corrective actions. General guidelines and precautions for drinking water sampling are as mentioned below:

- Collect a sample that conforms to the requirement of the sampling programme and handle it carefully so that it does not deteriorate or get contaminated during its transport to the laboratory. Representative samples of some sources can only be obtained by making composites of samples results collected over a period of time or at a number of different sampling points.
- While collecting a sample from the distribution system flush the lines adequately, taking into consideration the diameter and length of the pipe to be flushed and the velocity of flow.
- Collect samples from tube wells only after sufficient pumping to ensure that the sample represents the ground water source.
- When samples are to be collected from a river or stream, analytical results may vary with depth, flow, distance from the banks. In surface water bodies, water samples should preferably be collected at 0.2 times the depth of the water body from the top.
- Make detailed record of every sample collected (with unique code and GPS coordinates). Identify each container and record information like date, time and exact location (block, habitation, panchayat, village, etc.)
- While taking samples from drinking water sources or consumers, the samplers should take the signatures of the operator, GP member or household member in the register to verify genuineness of the sample.
- Sampling may be done by Sampling Assistant. If they are not available, staff working in district/sub-district laboratory should identify some local villagers/students and train them in sampling procedures for different type of parameters (chemical and bacteriological).

A.15.2 Wastewater Sampling Procedure

The following precautions should be taken when collecting wastewater samples:

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample.
- Collected samples are in custody of the sampler until the samples are relinquished to another party.
- A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled and the gloves should be donned immediately after the sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.

- Sample containers for samples suspected of containing high concentrations of contaminants should be stored separately.
- If possible, one member of the field sampling team should take all the notes and photographs, fill out log book etc. while the other members collect the samples.
- Influent wastewaters are preferably sampled at locations of highly turbulent flow in order to ensure good mixing; however in many cases, the most desirable location is not accessible. Preferable sampling locations are:
  - Grit Chamber
  - Aerated Grit Chamber
  - Wet Well when the pump is operating
  - Downstream of preliminary screening
- Effluent samples shall be collected at the most representative site prior to discharge into the receiving water.

A.16 Construction Site Management/ Labour Camps

- It should be located away from the residential areas/schools/hospitals/river banks/canals.
- Layout of construction camps if any should be approved from GPWSCs
- Construction camps, if any should have separate toilets for male and female workers, drinking water, cooking fuel and first aid facilities.
- Proper cooking fuel should be provided to the labour residing in the camps. In any case, woods should not be used for cooking.
- Proper sanitation facilities should be provided in the construction camps.
- Potable drinking water should be provided to the workers.
- Water logging conditions should not be allowed inside the camp.
- For establishing construction camps, contractor should obtain NOC from the State Pollution Control Board

A.17 Occupational Health & Safety

- Safe access to the job sites should be provided to all workers
- Passage ways, walkways, and stairways should be kept free of materials, scraps or obstructions
- First Aid box should be readily available at construction sites
- Contact with nearest nursing homes/clinics/primary health centre should be maintained by the Contractor to deal with any emergency at site
- A vehicle should be readily available at construction site to meet emergency situation
- The contractor should comply with all the precautions as required for the safety of the workmen as per the International Labour Organization as far as those applicable to this project
- The contractor should strictly follow the statutory child labour act
- Personal Protective Equipment such as helmets, hand gloves, safety shoes, nose masks, safety goggles should be provided to the workers.

Appendix B. Public Disclosure Workshop on Updated Environmental Management Framework

B.1 Background

As per the World Bank's safeguard policy - 'BP 17.5 – Disclosure of Information', the State Program Management Cell (SPMC) of the Govt. of Punjab organized the captioned workshop, which was chaired by Er R.L. Kauldhar, Chief Engineer (Central).

Mott MacDonald Pvt Ltd (MMPL), consulting firm appointed for Environment & Social Assessment Studies, prepared Draft Final Report of EMF & Social Assessment Study, and gave presentation on these two reports in the Workshop organized by SPMC to seek feedback from various stakeholders.

Departmental Engineers right from Chief Engineers to JE level, GPWSC members, personnel from PwC, Deloitte, Remote Sensing Center – Ludhiana and a representative from World Bank attended the Workshop. There were in total about 96 persons participated in this Workshop.

The workshop was conducted in two sessions – A. Environment Assessment; B. Social Assessment

In the morning session, MMPL gave presentation on EA & EMF study and the presentation mainly focused on the status of water supply and sanitation in the state, key environmental issues emerged during field visits to representative sample villages, mitigation measures, institutional strengthening required for environmental monitoring during implementation of the project and training and capacity building requirements to empower the departmental engineers and community on environmental aspects. On presentation, the workshop was opened for discussions and during discussions, the comments/ suggestions received from the participants in connection with EMF is summarized below for incorporation in the report.

B.2 Secondary Data

MMPL has done the analysis on water quality status based on the secondary data collected from SPMC, which is of 2013-14.

One of the key Stake Holder, Chief Engineer (Central), suggested that there is latest data on prevailing ground water quality, which could be checked and collected; subsequently, the report be updated, if necessary.

B.3 Cost of Land Acquisition

MMPL presented the environmental categorization for the sewerage schemes, wherein they touched on the land acquisition in case of non-availability of the land.

The World Bank clarified that land acquisition cost would not be financed through the World Bank, and land acquisition under this project should not be there. Also, the SPMC officials conveyed that the Gram Panchayat needs to have the land in their possession prior to conceiving a scheme.

B.4 Institutional Set-up

MMPL proposed the institutional arrangement to take care of environmental supervision, compliance, audit, etc.

Executive Engineer (Technical), SPMC enquired on the employment mode of the various proposed staff. Superintending Engineer cum Senior Programme Specialist, SPMC stated that the proposed Institutional Structure is only the suggestion of the Consultant at this stage, which will be further evaluated, discussed and finalized at State Govt., level with their mode of employment, in due course.

PWC advised to have a plan for providing training to the persons at field level. In fact, MMPL has already mentioned this aspect in their report.

B.5 Performance Indicator

MMPL proposed the performance indicator parameters for both the schemes – water supply and sewerage.

SPMC, PWC and World Bank suggested that frequency of sampling should be mentioned as well as responsibilities of the same should be well assigned.

The World Bank further suggested that inflow of sewage and outflow of treated effluent should be measured so that any leakages or additional flow coming in could be identified at the right time.

SPMC is contemplating to discuss with State Pollution Control Board regarding revised discharge standards for disposal of treated effluent into natural drains/ water bodies/ agricultural uses.

B.6 Environmental Data Sheet

The World Bank suggested capturing sanitation data (no. of toilets functioning, and being used, availability of water supply, etc.) in Environmental Data Sheet.

B.7 World Bank's Safeguard Policies

MMPL reported requirement of 'BP 7.50 – Projects on International Waterways' w.r.t. some of the rivers, as the rivers are flowing from Punjab (India) to Pakistan.

SPMC's Executive Engineer (Tech) conveyed that since in earlier EA&EMF this particular Safeguard Policy was not there, and they do not foresee applicability of this policy in PRWSSP-II also. Hence, it should be dropped from the report.

B.8 Provision for Environmental Management Cost (1%)

There has been provision of 1% of the estimated scheme cost against environmental management during implementation. In the previous EMF, it was suggested to provide rainwater harvesting structure under this

component. However, MMPL has made a provision of 2% to meet this requirement , since cost of rainwater harvesting structure could not be met from 1% provision in water supply scheme.

B.9 Other Suggestions

The Superintending Engineer (Ferozepur, Mr. Talwar) opined that the selection of scheme should be demand driven.

It was suggested by some officials that the status of toilets (number constructed, number in use, if in use whether all members of household are using the facility or not) should be recorded in Scheme Data Sheet.

There has been consensus among department officials that there is shortage of vehicles particularly for movement of Field Engineers, and this should be addressed at the earliest possible time.

Some of the Departmental Officers mentioned that instead of design service level @ 70 LPCD, the use of water is in the range of @ 150-200 LPCD.

Also, in view of over exploitation of Ground Water in 110 blocks of the state, Superintending Engineer cum Senior Programme Specialist suggested for suitable legislative measures at Govt. level so that conservation of water could be ensured for future.

B.10 Conclusion

The World Bank advised to provide accepted copy of the updated Environment & Social Assessment Management Framework to World Bank and host the same on Website for General Public.

Appendix C. Environment Data Sheet format at Preliminary Scheme Report (PSR)

Environmental Data Sheet for Preliminary Stage Report Preparation (Please √ in appropriate place)						
1.	**GENERAL PARAMETERS:**					
1.1	Name of village			1.2	Population	
1.3	Block/District			1.4	Total house holds	
				1.5	Average Cattle Population	
1.6	Topography	a) Plain	b) Rolling		c) Hilly	
1.7	Category of Village	a) Bet Area	b) Kandi Belt	c) Water Logged	d) Border Area	e) General (Not falling in specified category)
1.8	Type of Roads	Bituminous/Cemented/Brick paved/Kachcha/others				
1.1.1	Average width of Road in m					
2.	**WATER SUPPLY PARAMETERS**					
2.1.	Source of Water Supply	Canal/Groundwater/Other				
2.2.	Type of Water Supply	a) Individual Source (Submersible Pump)/Hand Pump/Dugwell				
		b) Departmental supply				
		c) Other				
2.3.	Service Level of Water Supply in lpcd,					
2.4.	Water Quality as per Test Report	(a) Potable	(b) Saline	(c) Fluoride	(d) Contaminated with Heavy Metals	
2.5.	Groundwater Level	a) Shallow	b) Deep			
2.6.	**In case of WTP, please furnish the following data**					
2.7.	Approximate Land Requirement in ha. (for new WTP)					
2.8.	Availability of land					
2.9.	Ownership of the land for proposed Intake/ WTP site	a) Private Land	b) Gram Panchayat Land	c) Others (Forest)		

Environmental Data Sheet for Preliminary Stage Report Preparation (Please √ in appropriate place)										
3.	**EXISTING SEWERAGE AND SANITATION PARAMETERS**									
3.1.	Approximate Quantity of Wastewater in mld									
3.2.	Current Sanitation Practices	a) Bore well latrine	b) Single Pit Toilet	c) Twin Pit Toilet	d) Toilet with Septic tanks	e) Others (Open Defecation)				
3.2.1	Specify the Numbers of above in respective columns									
3.2.2	Number of the above in use									
3.2.3	Availability of water supply in toilets									
3.3.	Whether Existing Ponds are being used for Sewage Discharge				a) Yes	b) No				
3.4.	If the existing pond to be used as STP, please specify the method of disposal of waste water during construction				a) Other pond	b) Nearby drain	c) Low lying area	d) Others		
3.5.	**In case of New STP, please furnish the following data**									
3.5.1	Approximate Land Requirement in ha. (for new STP or Additional)									
3.5.2	Availability of land									
3.5.3	Ownership of the land for proposed STP site	a) Private Land			b) Gram Panchayat Land			c) Others (Forest)		
3.5.4	Distance from the nearest settlements (meters)									
3.5.5	Type of nearest water body	a) Canal			b) River			c) Pond		
3.5.5.1.	Please specify the usage of the Water body	a) Drinking			b) Bathing			c) Cattle Washing		
3.5.5.2.	Distance from the nearest water body (meters)									
3.6.	Present Land use around STP site	a) Barren Land	b) Agriculture land	c) Pasture land	d) Forest land	e) Residential				
3.7.	If the existing pond to be used as STP (refer 3.3), Please specify the method of disposal/storage its wastewater during	a) Other Ponds	b) Nearby drain	c) River	d) Low lying areas					

Environmental Data Sheet for Preliminary Stage Report Preparation (Please √ in appropriate place)					
	construction				
3.8.	Location of any Sensitive Receptors and specify it approximate distance	a) Wildlife Sanctuary	b) Primary Health Center	c) Religious Structure	d) School
3.9.	In case existing STP of Municipal corporation to be used, then the distance from Sewer pipe line from the village				
4.	**ENVIRONMENTAL HEALTH**				
4.1.	Number of incidences of spread of any water born disease in the recent past (consult Primary Health center)				
4.2.	If Yes : Name of Disease				
5. PROVISION REQUIRED FROM GENERIC EMF IN THE SCHEME VILLAGE					
5.1.	Provision of Lawns and Tree Plantation at the WTP/ STP Site	Yes	No		
5.2.	Provision of Rainwater harvesting tanks	Yes	No		
5.3.	Repair and Cleaning of Drains (Once in Construction period)	Yes	No		
5.4.	Air, Noise and water quality testing	Yes	No		
5.5.	Need of Public Awareness on health and hygiene	Yes	No		
6.	**Whether cleaning of Pond is required**	**Yes**	**No**		

Appendix D. Environmental Data Sheet for Water Supply and Sewerage Schemes for DSR Stage

Format for Environmental Data Collection for Water Supply and Sewerage Schemes				
8. GENERAL				
8.1. Name of Village/Habitation: 8.2. Gram Panchayat 8.3. Block: 8.4. District:				
8.5. Zone (North/Central/South)				
9. BASELINE ENVIRONMENT				
9.1. Topography (Plain/Rolling/Hilly)				
9.2. Type of Soil:	☐ Alluvial	☐ Silt	☐ Silty Clay	
	☐ Sandy	☐ Sandy Clay	☐ other	
9.3. Intensity of Rainfall	☐ Low	☐ Moderate	☐ High	
9.4. Temperature:	Min: ^{0}C		Max:	
9.5. Natural Slope of the Land				
9.6. Predominant wind Direction				
9.7. Water Table (Depth Below Ground Level)	☐ Shallow (0-5m)	☐ Moderate (5-10m)		
	☐ Deep aquifer (10-20m)	☐ Very Deep (below 20m)		
9.8. Existing water body within village:	☐ River	☐ Canal	☐ Pond/Lake	
	☐ Other (Specify)			
9.8.1. If pond, current use of it. (Please give the numbers of ponds)	☐ Drinking	☐ Cattle washing	☐ Irrigation	
	☐ Sewage Disposal	☐ Others		
9.9. Water logging problem within village/villages: (Yes/No)	if yes, a. Name of area/areas: b. Area under water logging: c. Period of water logging (Annually): d. Population affected by water logging: e. Contamination of Drinking water sources from water logging:			
9.10. Minimum and Maximum width of village roads (meters)				
9.11. Existing Roads in the village are metallic/un-metallic/Brick Paved				
9.12. Current Solid Waste Disposal System	☐ Combined Dust bin	☐ Door to door collection	☐ Drains	☐ In Streets

Format for Environmental Data Collection for Water Supply and Sewerage Schemes			
9.13. Local Vegetation: (Mention Species)			
10. SOCIAL ENVIRONMENT			
10.1. opulation			
10.2. umber of households			
10.3. and use pattern of village	☐ Rural	☐ Urbanized Rural	
10.4. istorical/ Religious Importance	☐ Yes	☐ No	
10.5. ajor Source of Income	☐ Agriculture	☐ Business	☐ Service
	☐ Labor	☐ Others	
10.6. Is the proposed project likely to affect any natural habitats/cultural properties? 10.6.1. If yes, whether appropriate safeguards are proposed? (Write note)			Yes / No
10.7. Is the proposed project likely to infringe on the rights of the local people, including traditional land water rights? 10.7.1. If yes, whether appropriate mitigation measures have been proposed? (Write Note)			Yes / No
11. PUBLIC HEALTH ISSUES			
11.1. ny incident of Waterborne epidemic/ disease in the recent past	☐ Yes	☐ No	
11.1.1. f Yes: Name of diseases (Waterborne)	☐ Diarrhea	☐ Gastro entities	
	☐ Typhoid	☐ Others	
11.2. s there any vector borne disease	☐ Yes	☐ No	
11.2.1. ame of Vector borne disease	☐ Malaria	☐ Dengue	☐ Filaria
12. WATER SUPPLY SCHEME			
12.1. ype of Scheme	Existing/New Scheme		
12.1.1. hether the proposed water supply scheme is	☐ Single Village Scheme	☐ Multi Village Scheme	
12.1.2. f new water Supply scheme is proposed, briefly give data on the current drinking water situation			
12.1.3.	☐ River	☐ Lake	☐ Groundwater

Format for Environmental Data Collection for Water Supply and Sewerage Schemes			
ource of drinking water supply:	☐ Canal	☐ Pond	
12.1.4. ater availability in lpcd			
12.1.5. vailability of Land for Intake/WTP site	☐ Panchayati Land	☐ Private land	☐ Forest land
12.1.6. as the source of water quality been assessed, if yes attach a copy of the test report.	☐ Yes	☐ No	
12.1.7. ention the appropriate nature of the quality problem	☐ Fluoride	☐ Iron	☐ Heavy Metals
	☐ Bacteriological	☐ TDS	☐ Pesticide
	☐ Nitrate	☐ Others	☐ No Problem
12.1.8. Is there potential risk of contamination of source due to industrial contaminants, human waste discharge, solid waste dumping, use of agro chemicals (Fertilizers, pesticides etc?) 12.1.8.1. If yes, whether appropriate preventive/ corrective actions taken? (Write a note)			Yes / No
12.1.9. Does the proposed project involve provision of any bore well within 1 km of international border between India and Pakistan? 12.1.9.1. If yes, the project cannot be sanctioned.			Yes / No
12.1.10. canal source, indicate the Treatment Technology proposed.	❑ Slow Sand Filter (SSF) ❑ Package Treatment Plant	❑ Rapid Sand Filter (RSF) ❑ Any other method	
12.1.11. indicate the Treatment	❑ R O Plant ❑ Iron removal Plant	❑ De-fluoridation Plant (D F) ❑ Any other method.	
12.1.12. Has disinfection system been provided		□ Yes	□ No
12.1.12.1. If yes, type of disinfection method (Silver Ionization or Chlorinator)			
12.2. Provision Required from Generic EMF in the water supply scheme village			
12.2.1. Air, Noise and water quality testing& rain water harvesting		□ Yes	□ No
12.2.2. Lawns and Tree Plantation in Water Works		□ Yes	□ No
12.3. **Anticipated Environmental Issues and Mitigation Measures during implementation**			
12.4. Parameter	**Issue**	**Mitigation measure**	

Format for Environmental Data Collection for Water Supply and Sewerage Schemes		
12.4.1. availability		
12.4.2.		
12.4.3.		
12.4.4.		
12.4.5. construction wastes 12.4.6.		

13. SEWERAGE SCHEME			
13.1. hether Proposed Sewerage Scheme is	☐ Single Village Scheme	☐ Multi Village Scheme	
13.2. urrent Sanitation Practices *	☐ Septic Tank	☐ Septic Tank with Soak Pits	
	☐ Open Defecation	☐ Bore well/ soak pit type	
	☐ Others		
13.3. sage of toilets in terms of number and percentage			
13.4. ercentage of households having septic tanks*			
13.5. vailability of water supply in toilets			
13.6. urrent Drainage Pattern*	☐ Open Drains	☐ Partially covered with Open Drains	☐ No Drainage system
13.7. oes the wastewater from cattle sheds discharged into the open drains*	☐ Yes	☐ No	
13.8. oes the grey water and black water mix*	☐ Yes	☐ No	
13.9. illagers feedback about current sanitation practice*	☐ Satisfied	☐ Unsatisfied	
13.10. Approximate Wastewater Quantity in mld			
13.11. Method of treatment to be Provided			

Format for Environmental Data Collection for Water Supply and Sewerage Schemes						
13.11.1. Whether existing Ponds will be used as STP	☐ Yes	☐ No				
13.11.2. Pond's distance from the nearest settlement (m)						
13.11.3. Whether distance from the nearest schools/primary health center/religious structure is more than 200 m.	☐ Yes	☐ No				
13.11.4. Water Quality of Pond by visual inspection	☐ Good	☐ Very bad				
13.11.5. Current use of Pond proposed for STP	☐ Cattle Wash	☐ Irrigation	☐ Sewage Disposal	☐ Aquaculture	☐ Any other	
13.11.6. Is there any requirement of expansion of pond to use as a STP	☐ Yes	☐ No				
13.12. Is there sufficient land available for expansion of the pond or new STP	☐ Yes	☐ No				
13.12.1. If yes, current land use	☐ Agriculture	☐ Barren land	☐ Forest			
13.13. Is there plantation around pond site/STP	☐ Yes	☐ No				
13.14. Environmental Features around the new STP site, vii. Approximate area of land in ha. viii. Land use pattern ix. Distance from the nearest water body x. Distance from the nearest settlement xi. Accessibility of area xii. Is there stagnation of water takes place (Yes/No)		☐				
13.15. Contamination of Drinking Water Source from the Pond/STP	☐ Yes	☐ No				
13.16. Disposal of Treated Effluent	☐ Inland water body	☐ On to land for irrigation				
13.17. Is there potential risk of contamination of source of water? If yes, whatare the appropriate preventive/corrective actions taken? (write note)						
13.18. **Provision Required from Generic EMF in the Sewerage Scheme Village**						
13.18.1. Provision of Lawns and Tree Plantation at the STP Site water works premises and STP site	□ Yes	□ No				
13.18.2. Provision of Rainwater harvesting	□ Yes	□ No				

Format for Environmental Data Collection for Water Supply and Sewerage Schemes		
13.18.3. Repair and Cleaning of Drains	□ Yes	□ No
13.18.4. Air, noise and water quality testing	□ Yes	□ No
13.18.5. Need of Public Awareness on health and hygiene	□ Yes	□ No

13.19. Anticipated Environmental Issues and Mitigation Measures during implementation		
Parameter	Issues	Mitigation measure
13.19.1. Site selection of STP		
13.19.2. Sewage Treatment Technology		
13.19.3. Disposal of Treated effluent		
13.19.4. Disposal of Sludge		
13.19.5. Construction Phase impacts		
13.19.6. Disposal of Construction debris		
14. Whether Cleaning of Pond is required	**Yes**	**No**

Signature
JE/FE
EO/ EM/ Sr EM/ ES/ EMS
EE (Approval as per ES Recommendation)
SE

Note: * In case of multi-village scheme, please attach the data for each village separately.

Appendix E. Environmental Audit Format for Water Supply Schemes and Sewerage Schemes

Table E.1: Environmental Audit Format for Water Supply Scheme

Particulars	Description
•	**Date of Audit:**
• Name of Auditors:	
• Name of Zone:	
• Name of Circle:	
• Name of Division:	
General	
• Name of the Scheme	
• Name of Village covered	
• Block:	
• District:	
• Scheme based on tube-well/canal	
• Technical Sanction Cost (In Lacs), no. & date	
• Provision of Environment Cost (in Lacs)	
• Date of start of work on the scheme	
• Date of commissioning of scheme	
• Date of completion	
• Number of households in village	
Construction Stage	
Provision made under 2% Environment Cost	
• Lawn and Tree Plantation in water works site	
• Air, Noise and Water quality testing & rain water harvesting	
• Number of trees cut	
• Number of trees planted and surviving	
• Proper disposal of debris/construction waste of water works site done or not?	
• Location of disposal site (distance from village)?	
• Whether barbed wire fencing around water works site provided or not?	
• Whether safety measures i.e. safety banners, sign boards etc. provided by the contractor during execution of works or not?	
• Whether access provided to the residents during laying of pipe lines?	
Operation and Maintenance Stage	

Particulars	Description
• O&M by GPWSC through Agency / GPWSC?	
• Name of agency during O&M:	
• O&M contract period of Agency:	
• Whether village getting water supply on 24x7 or intermittent basis? • If on intermittent basis, mention no. of hours water is being pumped?	
• Number of water supply connections (%age of connections):	
• Whether water supply connections are metered?	
• Sufficiency of revenue collected towards O&M expenses	
• Inlet/raw water and treated water testing report (canal based) please attach it.	
• Status of sample testing report of tube well based water supply scheme. Whether any parameter is beyond rejection limit.	
• What is the frequency of testing water samples?	
• Is GPWSC using the Field Testing Kit (FTKs) for testing water samples?	
• Present Ground water table (to be measured yearly):	
• What is the present yield (in LPM) of the bore-well	
• Type of disinfection unit. Whether working or not/	
• Water works lawn maintained or not?	
• Whether the frequency of water testing is maintained or not?	
• Water sampling testing record maintained or not?	
• If bleaching powder is being used whether register maintained or not?	
Other Issues	
• Any leakage noticed?	
• What is the present quantity of water supply (in lpcd) & whether the pressure is adequate?	
• Number of awareness programs on water supply conducted:	
• Whether the local community (especially women folk) are aware of the precautions to	

Particulars	Description
be practiced to reduce wastage and keep water clean?	
• Any other Environment Issues (whether there is wastewater in valve chamber, wastewater pools around households or low lying areas etc.) find at the time of audit.	

Signature of Auditors

Signature	1.	2.
Name of Auditor (in capital letters)	1.	2.
Address	1.	2.

Table E.2: Environmental Audit Format for Sewerage Scheme

Sr. No.	Description
• Name of Auditors:	
• Name of Zone:	
• Name of Circle:	
• Name of Division:	
GENERAL	
• Name of the Scheme:	
• Name of the villages covered:	
• Name of the block:	
• Name of the District:	
• Technical Sanction Cost of the Scheme (Rs. In Lacs), No. & date:	
• Provision of 1% Environment Cost (Rs. In Lacs)	
• Date of start of work on the scheme:	
• Date of commissioning of scheme:	
• Date of completion:	
• Number of households in village:	
Construction Phase	
Provision made under 2% of Environment Cost	
• Lawn and Tree plantation in STP site	
• Air, noise & water quality testing and Rain water harvesting	
• Repair and cleaning of drain	
• Number of trees cut:	
• Number of trees planted and surviving	

Sr. No.	Description
• Proper disposal of debris/surplus soil of STP site done or not.	
• Location of disposal site (distance from village)?	
• What type of lining sheet used in Ponds?	
• Whether sludge drying beds are constructed or not?	
• Whether composting pits are constructed or not?	
• Whether proper lighting in STP site or not?	
• Proper plant layout on a STP site or not?	
• Whether rest room including toilet constructed or not? If not, give reasons	
• Whether barbed wire fencing around STP site provided or not?	
• Whether safety measures i.e. safety banners, sign boards etc. provided by the contractor during execution of works or not?	
• Whether access provided to the residents during laying of sewers?	
Operation and Maintenance Stage	
• O&M by GPWSC through Agency / GPWSC:	
• Name of Agency during O&M:	
• O&M contract period of Agency:	
• Number of sewerage connections:	
• Percentage of sewerage connections:	
• Number of households having latrines:	
• Sufficiency of revenue collected towards O&M expenses	
Status of Influent, Effluent, Sludge/Compost testing report etc.:	
• Influent (parameters more than permissible); (pH, BoD, CoD, TSS, Total Nitrogen, Total Phosphorous & Faecal Coliform etc.)	
• Effluent (parameters more than permissible); (pH, BoD, CoD, TSS, Total Nitrogen, Total Phosphorous & Faecal Coliform etc.)	
• Organic manure quality (parameters more than permissible):	
• Ground water quality of nearby tube-wells / hand pumps tested half yearly or not? If tested, parameters are within limit or not:	
• Whether influent characteristics are being tested quarterly or not?	
• Whether effluent characteristics are being tested quarterly or not?	

Sr. No.	Description
• Whether sludge quality and compost quality tested half yearly or not?	
• Are any solids or floating matter is present in the influent?	
• STP lawn maintained or not?	
• No. of plants/trees at STP site	
• Whether tree guards provided or not?	
• If STP site is within 200 meter from habitation, whether buffer zone of tree plantation exists or not? If exists, width of buffer zone.	
• What is disposal procedure of tree leaves at STP site?	
• Whether path at STP site are pucca or kaccha? If kaccha, paths are there then what action is being taken to prevent dust during movement of trolleys?	
• Any blockage of sewer noticed? If yes, action taken by local authorities to remove blockage.	
• Disposal of treated effluent.	
Status of Record maintained	
• Record of Sample Testing	
• Record of Compost sale	
• Record of Effluent sale	
Other Issues	
• Whether any kind of pesticide used to control the pest at site of STP? If yes, what kind of it is?	
• Contamination of Drinking Water Source from the STP?	
• If effluent is used by farmers then number of farmers using it.	
• Whether first aid facilities provided at STP site or not?	
• Status of cleaning of septic tanks since commissioning:	
Year	**No. of Septic Tanks from which sludge removed** / **Remarks**
• Discharge per day of treated waste water. Write in KL.	
• Whether odour exists at STP site	
• Number of awareness programs on solids free sewerage system conducted:	
• Whether the local community (especially women	

Sr. No.	Description
folk are aware of precautions to be practices such as not to throw solid waste in STs/ICs/drains, amount of tariff and schedule of paying of monthly tariff etc."	
• Any other Environment issues find at the time of Audit. Please Write it.	

Signature of Auditors

Signature	1.	2.
Name of Auditor (in capital letters)	1.	2.
Address	1.	2.

Appendix F. Environmental Monitoring Format for Water Supply and Sewerage Schemes

Table F.1: Environmental Monitoring Format for Water Supply Scheme

Particulars	Description
• Name of the District	
• Name of the Block	
• Name of the Constituency	
• Name of the Scheme	
• Estimated Cost of the Scheme (Rs. In Lacs)	
• Environmental Cost of the Scheme (Rs. In Lacs)	
Parameters to be checked to ensure proper implementation of EMP during Project activities for Water Supply Scheme	
Pre-Construction Phase	
• Environmental Category of the Scheme	
• Water Availability	
– Is there adequate water supply as per design available?	
– If not, what mitigation measures are to be adopted to get the targeted water supply level as per design	
• Water Quality	
– Issues	
– Mitigation Measures	
• Site Selection Issues	
– Is site is away from the sewerage line/disposal area	
– What is sanitation status at source	
– Mitigation measures	
• Environmental issues to be mitigated with 1% environmental management cost	
– List of activities taken under EMP	
– Cost Taken	
Construction Phase	
• Site for identification of disposal of debris (Yes/No)	
• Safety measures to be taken by contractor on construction site (PPE, Safety manual, Safety banners, fencing etc.)	
• Site clearance	
– Issues	
– Mitigation measures	

Particulars	Description
• Status of removal of debris from water works site (yet to be removed/removed)	
• Access provided to the residents during construction/laying of pipes	
• Whether environmental issues identified under environmental management (Covered/Not covered)	
– If covered, list of activities taken up in the scheme	
– Cost incurred (Rs. In Lacs)	
Operation and Maintenance Phase	
• Safe drinking water availability of 70 lpcd to the targeted households	
– Total Households	
– Covered up-to previous quarter	
– During the quarter	
– Total	
• Water Quality Testing	
– Previous quarter test results	
– Date of testing of source	
– During the quarter test results	
– Date of testing of source	
• Level of ground water table of source in meter	
– At the beginning of scheme	
– After the completion of scheme	
– Yearly	
• Status of lawn/plantation of water works site (Maintained/Not maintained)	
• No. of trees removed during construction of scheme	
• No. of trees planted in the scheme and water works area	
• Disinfection unit (whether in working order or not). If not mention alternative arrangement or any mitigation measures proposed	

Table F.2: Environmental Monitoring Format for Sewerage Scheme

Sr. No.	Description
• Name of the District	
• Name of the Block	
• Name of the Constituency	
• Name of the Scheme	
• Estimated Cost of the Scheme (Rs. In Lacs)	
• Environmental Cost of the Scheme (Rs. In Lacs)	
Parameters to be checked to ensure proper implementation of EMP during Project activities for Sewerage Scheme	
Pre-Construction Phase	
• Environmental Category of the Scheme	
• Site selection for treatment unit	
– Issues	
– Mitigation measures	
• Environmental issues to be mitigated with 1% environmental management cost	
– List of activities taken under EMP	
– Cost Taken	
Construction Phase	
• Site clearance	
– Issues	
– Mitigation measures	
• Safety measures to be taken by contractor on construction site (PPE, Safety manual, Safety banners, fencing etc.)	
• Status of removal of debris from sewerage works site (yet to be removed/removed)	
• Access provided to the residents during construction/laying of sewerage pipes	
• Whether high noise creating machinery are enclosed with aquostic chamber or not	
• Whether environmental issues identified under environmental management (Covered/Not covered)	
– If covered, list of activities taken up in the scheme	
– Cost incurred (Rs. In Lacs)	

Sr. No.	Description
• Corrective measures taken to prevent seepage of waste water at STP site	
Operation and Maintenance Phase	
• Increased access of households to common sewerage/sanitation system	
– Total Households	
– Covered up-to previous quarter	
– During the quarter	
– Total	
• Effluent Quality testing (pH, CoD, BoD, TSS)	
– Previous quarter Test Results	
– During the quarter Test Results	
• Corrective measures taken to prevent the leakage/blockage and repair of interception chamber/manholes/sewer lines/open street drains	
• In case, any industrial effluent stream in getting mixed with sewerage stream, check whether it is pre-treated or not (if yes mention effluent quality)	
• Observation of weeds/algal blooms or any water plant species growth in ponds	
• Status of buffer zone around Treatment unit (Maintained/Not maintained)	
• Compost quality inspection	
– Previous testing	
– During the quarter	
– Parameters noticed above the permissible limits	
• Whether compost produced is being used by villagers. If yes then mention	
– No. of residents using compost	
– Quantity of compost used.	

Appendix G. Terms of Reference for Environmental Staff

G.1 Terms of Reference for Environmental Management Specialist

G.1.1 Position

Environmental Management Specialist (EMS)

G.1.2 Qualification and Experience of EMS

The EMS must have qualification of Post Graduate in Environment Engineering / Science with 7 to 10 years of experience in Infrastructure and at least 3 years in water supply and sanitation sector.

G.1.3 Functions and Responsibilities of EMS

- Assist DWSS in Environmental assessment and appraisal of RWSS schemes
- Assist DWSS in obtaining approvals from other departments
- Assist DWSS in monitoring activities of Environmental staff of the department
- Assists DWSS in Environmental monitoring of the completed RWSS schemes / auditing of 100% water supply and sewerage schemes. Further, monitoring of audit conducted by third party for 15% water supply schemes, 100% sewerage schemes and 100% surface water based schemes.
- Compile EMP implementation progress and compliances for DWSS.
- Ensuring the implementation of the recommendations of the EMF during the entire project period up-to finalization of the Project Completion Report.
- Assist DWSS in water quality monitoring of the completed RWSS schemes
- Organize state/ circle level training programs
- Guide other environmental staff deployed by DWSS.

G.2 Terms of Reference for Senior Environmental Managers

G.2.1 Position

Senior Environmental Manager

G.2.2 Qualifications and Experience

Senior Environmental Manager must be a Graduate in Civil Engineering or Environment Science with experience of 7 to 10 years in Infrastructure Sector.

G.2.3 Functions and Responsibilities of Senior Environmental Manager

- Assist DWSS in Environmental assessment and appraisal of RWSS schemes
- Assist DWSS in monitoring activities of circle level Environmental Managers
- Assists DWSS in Environmental monitoring of the completed RWSS schemes / auditing of 100% water supply and sewerage schemes. Further, monitoring of audit conducted by third party for 15% water supply schemes, 100% sewerage schemes and 100% surface water based schemes.

- Train Circle / Division level Environmental staffs and operational staff of DWSS in implementing/supervising environmental mitigation measures and water quality monitoring for completed RWSS schemes.

G.3 Terms of Reference for Environmental Manager

G.3.1 Position

Environmental Manager

G.3.2 Qualifications and Experience

Environment Manager must be a Graduate in Civil Engineering or Environment Science with 5 to 7 years of experience in Infrastructure sector.

G.3.3 Functions and Responsibilities of Environmental Manager

- Assist DWSS in Environmental assessment and appraisal of RWSS schemes
- Assist DWSS in monitoring activities of division level Environmental Officers
- Assists DWSS in Environmental monitoring of the completed RWSS schemes
- Train Division level Environmental officers and operational staff of DWSS and GPWSCs in implementing/supervising environmental mitigation measures and water quality monitoring for completed RWSS schemes.

G.4 Terms of Reference for Environmental Officers

G.4.1 Position

Environmental Officer

G.4.2 Qualifications and Experience

Environmental Officer must be a Diploma in Civil Engineering or Graduate in Science with experience of 3 to 5 years in Infrastructure Sector.

G.4.3 Functions and Responsibilities of Environmental Officer

- Assist DWSS in monitoring and implementation of mitigation measures at village levelfor RWSS schemes.
- Assist DWSS in preparation of environmental appraisalsfor clearances.
- Train GPWSCs, community members and other stakeholders at village level in implementing activities under EMF.
- Propose/Report mitigation measures in case of any environmental issues encountered during execution.

Appendix H. Scope of Work for Environmental Audit

Objectives:

Objectives of external audit are to verify/check the following:

- To check the adequacy/correctness of EDS, screening and environmental evaluation of the 15% of Category I RWSS schemes and all Category II & III RWSS schemes;
- To check in the field the quality of implementation and effectiveness of the environmental mitigation measures with reference to the performance indicators.
- To assess the effectiveness of supervision and capacity building initiatives undertaken as part of the EMF

Scope:

External audit will be carried once in a year. The audit will also conduct a desk review to verify whether the environmental assessments procedures are followed correctly. The external audit will be done by an external agency appointed by the SPMC.

Sampling of Schemes for External Audit:

Purposive sampling of schemes for External Audit will be done considering the significance of the scheme-type to the environment. The following table indicates the number of samples of each type of scheme that will be included in the supervision:

Sampling of schemes for external audit

Components	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	Total	Remarks
SVS					-		
Audit Sample – SVS							
MVS							
Audit Sample – MVS							
Rain water harvesting							
Audit Sample – RWH							
Improvements							
Augmentation of SVS (distribution system)							
Audit Sample – Augmentation of SVS (distribution system)							
Augmentation of MVS (distribution system)							
Audit Sample – Augmentation of MVS (distribution system)							
Improving ground water sources							
Audit Sample - Improving ground water sources							
Catchment area protection for surface sources							
Audit Sample - Catchment area protection for surface sources							

Components	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	Total	Remarks
Sanitation and Sewerage Schemes							
IHHLs							
Audit Sample – IHHLs							
Pavements, drains and SLWM in major GPs							
Audit Sample - Pavements, drains and SLWM in major GPs							
Soak pits in GPs							
Audit Sample – Soak pits in GPs							
UGD							
Audit Sample – UGD							
Total Projects each year							
Total Sample each year							
Percentage of sample							

50% of the schemes taken up for external audit will be selected on the above basis from the schemes already supervised internally to assess the effectiveness of internal supervision.

A) Documents to be referred to prior to and during the External Audit:

- EA/EMF of the PRWSS
- Reports of all supervision reports
- List of performance indicators
- Reports of previous External Audits (if applicable)
- Reports of all capacity building programs related to the EMF
- Latest MIS of the PRWSS showing district-wise, scheme-type wise list of schemes
- For the specific schemes selected for field visits:
  - Filled in EDS of the scheme-type
  - Filled in Checklist for Environmental Assessment of the Category II Schemes (if applicable)
  - Report of any previous internal supervision visit undertaken to the scheme (if applicable)
  - Scheme-specific audit checklist given in Annexure.
  - Format of report of field visits undertaken during audit

B) Process of External Audit:

The audit includes the following methodology:

- Interaction with the SWSM and at least 30% of the DWSCs
- Desk review of all relevant EMF documents (mentioned in A)
- For the specific schemes selected for field visits:
  - Interaction with JE/AE
  - Interaction with EE & SE
  - Interaction with GPWSC
  - Field inspection of all components of the scheme under supervision
  - Interaction with beneficiaries

  - Photo documentation (highlighting any significant issues)
- Report of Audit: A detailed report of the external audit as per the format given in Annexure must be submitted to the SPMC for action. The report must include the following:
- Description of methodology including details of sampling
- Review of the following (implementation and issues):
- Effectiveness of the environmental assessment system in identifying issues and implementing appropriate mitigation measures
- Institutional arrangements for implementation of the EMF
- Capacity building on the EMF
- Responsiveness of EMF to emerging environmental concerns
- Overall environmental performance of the PRWSS with respect to the performance indicators
- Recommendations for strengthening the EMF
- Individual reports of the field visits undertaken (Sample Report of Field Visits Undertaken during Internal Supervision / External Audit).

A copy of the report of the Audit must be sent to DWSS for reference.

Appendix I. Guidelines on Sanitary Survey for Water Supply Schemes

Guidelines for Sanitary Survey

The guidelines for Sanitary Surveydocumented are as per the Implementation Manual on National Rural Water Quality Monitoring and Surveillance Programme published in 2004 by the Rajiv Gandhi National Drinking Water Mission.The Sanitary Inspection Forms given in this are in line with the Protocoldocumented in the Uniform Drinking Water Quality Monitoring Protocol published in 2013 by the Ministry of Drinking Water and Sanitation, Government of India.

Sampling Frequency

SOURCE AND MODE OF WATER SUPPLY	**Minimum number of sanitary inspections per year**		
	By GPWSC	**By JE/SDE of DWSS**	**By EE /**
Ground Water			
Shallow tube-wells with hand pumps	4 (including once initially while filling the EDS of the scheme)	Once initially (while filling the EDS) and thereafter as situation demands	
Deep tube-wells with hand pumps	4 (including once initially while filling the EDS of the scheme)	Once initially (while filling the EDS) and thereafter as situation demands	
Wells and piped supplies	1 (including once initially while filling the EDS of the scheme)	1 (including once initially while filling the EDS of the scheme)	Once initially thereafter once every 5 years or as situation demands
Surface Water and/or chlorinated and piped supplies			
Population up to 5000	12 (including once initially while filling the EDS of the scheme)	2 (including once initially while filling the EDS of the scheme)	Once initially thereafter once every 5 years or as situation demands
Population 5000-20000		24-48 (including once initially while filling the EDS of the scheme)	Once a year

Community rainwater collection systems	1 (including once initially while filling the EDS of the scheme)	1 (including once initially while filling the EDS of the scheme)	

Sanitary Survey Procedure and Recording Forms

Sanitary inspection requires detailed examination of the water-supply system, especially at its key points in order to check whether the installations are satisfactory and whether the various operations are being carried out properly. The recommended method of undertaking an inspection is to follow the natural sequence: starting with the source water and its intake, and going on to treatment, disinfection, storage, distribution, etc. Observations are recorded on pre-set forms.

Formats for various sources are given below:

Sanitary survey for the assessment of risks of contamination of drinking water sources

1. Sanitary Inspection Form for Piped Water

I. Type of Facility: Piped Water

1. General Information: Zone: Area:

2. Code Number

3. Date of Visit

4. Water samples taken? …….. Sample Nos. ……

II. Specific Diagnostic Information for Assessment of Risk

(Please indicate at which sample sites the risk was identified) Sample No

1. Do any tap stands leak? Y/N ……

2. Does surface water collect around any tap-stand? Y/N …….

3. Is the area uphill of any tap-stand eroded? Y/N …….

4. Are pipes exposed close to any tap-stand? Y/N …….

5. Is human excreta on the ground within 10m of any tap-stand? Y/N …….

6. Is there a sewer within 30m of any tap-stand? Y/N…….

7. Has there been discontinuity in the last 10 days at any tap-stand?Y/N …….

8. Are there signs of leaks in the mains pipes in the Parish? Y/N…….

9. Do the community report any pipe breaks in the last week?Y/N …….

10. Is the main pipe exposed anywhere in the Locality? Y/N …….

Total Score of Risks ..../10

Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

III. Results and Recommendations:

The following important points of risk were noted :(list nos. 1-10)

Signature of surveyor:

Comments: .....

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2. Sanitary Inspection Form for Piped Water with Service Reservoir

I. Type of Facility: Piped Water with Service Reservoir

1. General Information: Zone: Area:

2. Code Number:

3. Date of Visit:

4. Water samples taken? …….. Sample Nos. ……

II. Specific Diagnostic Information for Assessment of Risk

(Please indicate at which sample sites the risk was identified) Sample No.

1. Do any standpipes leak at sample sites? Y/N …….

2. Does water collect around any sample site? Y/N …….

3. Is area uphill eroded at any sample site? Y/N ……..

4. Are pipes exposed close to any sample site? Y/N …….

5. Is human excreta on ground within 10m of standpipe? Y/N …….

6. Sewer or latrine within 30m of sample site? Y/N …….

7. Has there been discontinuity within last 10 days at sample site? Y/N …….

8. Are there signs of leaks in sampling area? Y/N …….

9. Do users report pipe breaks in last week? Y/N …….

10. Is the supply main exposed in sampling area? Y/N…….

11. Is the service reservoir cracked or leaking? Y/N …….

12. Are the air vents or inspection cover insanitary? Y/N …….

Total Score of Risks ..../12

Risk score: 10-12 = Very high; 8-10 = High; 5-7 = Medium; 2-4 = Low; 0-1 =Very Low

III. Results and Recommendations:

The following important points of risk were noted:

(list nos. 1-12)

Signature of surveyor:

Comments: .....

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3. Sanitary Inspection Form for Deep borehole with Mechanized Pumping

I. Type of Facility DEEP BOREHOLE WITH MECHANISEDPUMPING

1. General Information: Supply zone: Location:

2. Code Number:

3. Date of Visit:

4. Water sample taken? …….. Sample No. …… FC/100ml ……..

II. Specific Diagnostic Information for Assessment of Risk

1. Is there a latrine or sewer within 100m of pump-house? Y/N……..

2. Is the nearest latrine un-sewered? Y/N…….

3. Is there any source of other pollution within 50m? Y/N……

4. Is there an uncapped well within 100m? Y/N……

5. Is the drainage around pump-house faulty? Y/N……..

6. Is the fencing damaged allowing animal entry? Y/N…….

7. Is the floor of the pump-house permeable to water? Y/N……..

8. Does water forms pools in the pump-house? Y/N……

9. Is the well seal insanitary? Y/N……..

Total Score of Risks …./9

Risk score: 7-9 = High; 3-6 = Medium; 0-2 = Low

III. Results and Recommendations:

The following important points of risk were noted:

(list nos. 1-9)

Signature of surveyor:

Comments: .....

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4. Sanitary Inspection Form for Piped Water Supply with service reservoir and mechanized pumping

I. Type of Facility Piped Water Supply with service reservoir and mechanizedpumping

1. General Information: Zone: Location:

2. Code Number:

3. Date of Visit:

4. Water sample taken? …….. Sample No. ……. FC/100ml ……..

II. 1. Does the pipe leak between the source and storage tank? Y/N……

2. Does surface water collect around any tap-stand? Y/N …….

3. Can animals have access within 10m of the reservoir? Y/N------

4. Does open defecation is prevalent or cattle-dung is observed within 50 m of thereservoir? Y/N……..

5. Is there a sewer within 30m of any tap-stand or reservoir? Y/N--------

6. Are the pipes corroded? Y/N--------

7. Are there signs of leaks in the mains pipes in the Parish? Y/N…

8. Are the reservoirs used for human and cattle bathing? Y/N--------

9. Are the buried pipes ever checked for leakage? Y/N--------

10. Are storage tanks are cleaned at specified intervals? Y/N--------

Total Score of Risks …./10

Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

5. Sanitary Inspection Form for Rainwater collection and Storage

I. Type of Facility RAINWATER COLLECTION AND STORAGE

1. General Information: Zone: Location:

2. Code Number:

3. Date of Visit:

4. Water sample taken? …….. Sample No. …… FC/100ml ……..

II. Specific Diagnostic Information for Assessment Risk

1. Is rainwater collected in an open container? Y/N……

2. Are there visible signs of contamination on the roof catchment? Y/N……..

(e.g. plants, excreta, dust)

3. Is guttering that collects water dirty or blocked? Y/N…….

4. Are the top or walls of the tank cracked or damaged? Y/N……

5. Is water collected directly from the tank (no tap on the tank)? Y/N……

6. Is there a bucket in use and is this left where it can become contaminated?Y/N……

7. Is the tap leaking or damaged? Y/N……..

8. Is the concrete floor under the tap defective or dirty? Y/N……

9. Is there any source of pollution around the tank or water collection?

area?Y/N……

10. Is the tank cleans inside? Y/N……..

Total Score of Risks …./10

Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

III. Results and Recommendations:

The following important points of risk were noted:

(list nos. 1-10)

Signature of surveyor:

Comments: .....

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Appendix J. Format for Declaration by Contractor / Consultant

Contract Package:

Contract No.:

I/We hereby declare that we have read and understood the Updated Environmental Management Framework for the Punjab Rural Water Supply and Sanitation Project. We will implement all the necessary mitigation measures, procure required goods and equipment, provide the required services, build/ construct necessary works, etc. in order to comply with the EMF. The following clauses of the EMF as well as relevant ECOPs stated within the EA & EMF report are applicable for our package.

Clauses:

Table 7.16: EMP for Construction stage impacts for Water Supply Scheme

Table 7.17: EMP for Operation & Maintenance Stage Impacts for Water Supply Scheme

Table 7.19: EMP for Construction Stage Impacts for Sewerage Scheme

Table 7.20: EMP for Operation & Maintenance Stage Impacts for Sewerage Schemes

Signature of Authorized Representative of Contractor/ Consultant

Name in Full:

Designation:

Company Seal

Place:

Date:

Appendix K. International Labour Organization Policy

C167 - Safety and Health in Construction Convention, 1988 (No. 167)

Convention concerning Safety and Health in Construction (Entry into force: 11 Jan 1991)*Adoption: Geneva, 75th ILC session (20 Jun 1988) - Status: Up-to-date instrument (Technical Convention).*

Preamble

The General Conference of the International Labour Organisation,

Having been convened at Geneva by the Governing Body of the International Labour Office, and having met in its Seventy-fifth Session on 1 June 1988, and

Noting the relevant international labour Conventions and Recommendations and, in particular, the Safety Provisions (Building) Convention and Recommendation, 1937, the Co-operation in Accident Prevention (Building) Recommendation, 1937, the Radiation Protection Convention and Recommendation, 1960, the Guarding of Machinery Convention and Recommendation, 1963, the Maximum Weight Convention and Recommendation, 1967, the Occupational Cancer Convention and Recommendation, 1974, the Working Environment (Air Pollution, Noise and Vibration) Convention and Recommendation, 1977, the Occupational Safety and Health Convention and Recommendation, 1981, the Occupational Health Services Convention and Recommendation, 1985, the Asbestos Convention and Recommendation, 1986, and the list of occupational diseases as revised in 1980 appended to the Employment Injury Benefits Convention, 1964, and

Having decided upon the adoption of certain proposals with regard to safety and health in construction, which is the fourth item on the agenda of the session, and

Having determined that these proposals shall take the form of an international Convention revising the Safety Provisions (Building) Convention, 1937,

adopts this twentieth day of June of the year one thousand nine hundred and eighty-eight the following Convention, which may be cited as the Safety and Health in Construction Convention, 1988:

I. SCOPE AND DEFINITIONS

Article 1

- 1. This Convention applies to all construction activities, namely building, civil engineering, and erection and dismantling work, including any process, operation or transport on a construction site, from the preparation of the site to the completion of the project.
- 2. A Member ratifying this Convention may, after consultation with the most representative organisations of employers and workers concerned, where they exist, exclude from the application of the Convention, or certain provisions thereof, particular branches of economic activity or particular undertakings in respect of which special problems of a substantial nature arise, on condition that a safe and healthy working environment is maintained.
- 3. This Convention also applies to such self-employed persons as may be specified by national laws or regulations.

Article 2

For the purpose of this Convention:

- (a) The term ***construction*** covers:
  - (i) building, including excavation and the construction, structural alteration, renovation, repair, maintenance (including cleaning and painting) and demolition of all types of buildings or structures;
  - (ii) civil engineering, including excavation and the construction, structural alteration, repair, maintenance and demolition of, for example, airports, docks, harbours, inland waterways, dams, river and avalanche and sea defence works, roads and highways, railways, bridges, tunnels, viaducts and works related to the provision of services such as communications, drainage, sewerage, water and energy supplies;
  - (iii) the erection and dismantling of prefabricated buildings and structures, as well as the manufacturing of prefabricated elements on the construction site;
- (b) the term ***construction site*** means any site at which any of the processes or operations described in subparagraph (a) above are carried on;

- (c) the term ***workplace*** means all places where workers need to be or to go by reason of their work and which are under the control of an employer as defined in subparagraph (e) below;
- (d) the term ***worker*** means any person engaged in construction;
- (e) the term ***employer*** means:
  - (i) any physical or legal person who employs one or more workers on a construction site; and
  - (ii) as the context requires, the principal contractor, the contractor or the subcontractor;
- (f) the term ***competent person*** means a person possessing adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work. The competent authorities may define appropriate criteria for the designation of such persons and may determine the duties to be assigned to them;
- (g) the term ***scaffold*** means any temporary structure, fixed, suspended or mobile, and its supporting components which is used for supporting workers and materials or to gain access to any such structure, and which is not a "lifting appliance" as defined in subparagraph (h) below;
- (h) the term ***lifting appliance*** means any stationary or mobile appliance used for raising or lowering persons or loads;
- (i) the term ***lifting gear*** means any gear or tackle by means of which a load can be attached to a lifting appliance but which does not form an integral part of the appliance or load.

II. GENERAL PROVISIONS

Article 3

The most representative organisations of employers and workers concerned shall be consulted on the measures to be taken to give effect to the provisions of this Convention.

Article 4

Each Member which ratifies this Convention undertakes that it will, on the basis of an assessment of the safety and health hazards involved, adopt and maintain in force laws or regulations which ensure the application of the provisions of the Convention.

Article 5

- 1. The laws and regulations adopted in pursuance of Article 4 above may provide for their practical application through technical standards or codes of practice, or by other appropriate methods consistent with national conditions and practice.
- 2. In giving effect to Article 4 above and to paragraph 1 of this Article, each Member shall have due regard to the relevant standards adopted by recognised international organisations in the field of standardisation.

Article 6

Measures shall be taken to ensure that there is co-operation between employers and workers, in accordance with arrangements to be defined by national laws or regulations, in order to promote safety and health at construction sites.

Article 7

National laws or regulations shall require that employers and self-employed persons have a duty to comply with the prescribed safety and health measures at the workplace.

Article 8

- 1. Whenever two or more employers undertake activities simultaneously at one construction site-
  - (a) the principal contractor, or other person or body with actual control over or primary responsibility for overall construction site activities, shall be responsible for co-ordinating the prescribed safety and health measures and, in so far as is compatible with national laws and regulations, for ensuring compliance with such measures;
  - (b) in so far as is compatible with national laws and regulations, where the principal contractor, or other person or body with actual control over or primary responsibility for overall construction site activities, is not present at the site, he shall nominate a competent person or body at the site with the authority and means necessary to ensure on his behalf co-ordination and compliance with the measures, as foreseen in subparagraph (a) above;
  - (c) each employer shall remain responsible for the application of the prescribed measures in respect of the workers placed under his authority.

- 2. Whenever employers or self-employed persons undertake activities simultaneously at one construction site they shall have the duty to co-operate in the application of the prescribed safety and health measures, as may be specified by national laws or regulations.

Article 9

Those concerned with the design and planning of a construction project shall take into account the safety and health of the construction workers in accordance with national laws, regulations and practice.

Article 10

National laws or regulations shall provide that workers shall have the right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on the working procedures adopted as they may affect safety and health.

Article 11

National laws or regulations shall provide that workers shall have the duty to-

- (a) co-operate as closely as possible with their employer in the application of the prescribed safety and health measures;
- (b) take reasonable care for their own safety and health and that of other persons who may be affected by their acts or omissions at work;
- (c) use facilities placed at their disposal and not misuse anything provided for their own protection or the protection of others;
- (d) report forthwith to their immediate supervisor, and to the workers' safety representative where one exists, any situation which they believe could present a risk, and which they cannot properly deal with themselves;
- (e) comply with the prescribed safety and health measures.

Article 12

- 1. National laws or regulations shall provide that a worker shall have the right to remove himself from danger when he has good reason to believe that there is an imminent and serious danger to his safety or health, and the duty so to inform his supervisor immediately.

- 2. Where there is an imminent danger to the safety of workers the employer shall take immediate steps to stop the operation and evacuate workers as appropriate.

III. PREVENTIVE AND PROTECTIVE MEASURES

Article 13

SAFETY OF WORKPLACES

- 1. All appropriate precautions shall be taken to ensure that all workplaces are safe and without risk of injury to the safety and health of workers.
- 2. Safe means of access to and egress from all workplaces shall be provided and maintained, and indicated where appropriate.
- 3. All appropriate precautions shall be taken to protect persons present at or in the vicinity of a construction site from all risks which may arise from such site.

Article 14

SCAFFOLDS AND LADDERS

- 1. Where work cannot safely be done on or from the ground or from part of a building or other permanent structure, a safe and suitable scaffold shall be provided and maintained, or other equally safe and suitable provision shall be made.
- 2. In the absence of alternative safe means of access to elevated working places, suitable and sound ladders shall be provided. They shall be property secured against inadvertent movement.
- 3. All scaffolds and ladders shall be constructed and used in accordance with national laws and regulations.
- 4. Scaffolds shall be inspected by a competent person in such cases and at such times as shall be prescribed by national laws or regulations.

Article 15

LIFTING APPLIANCES AND GEAR

- 1. Every lifting appliance and item of lifting gear, including their constituent elements, attachments, anchorages and supports, shall-

- (a) be of good design and construction, sound material and adequate strength for the purpose for which they are used;
- (b) be properly installed and used;
- (c) be maintained in good working order;
- (d) be examined and tested by a competent person at such times and in such cases as shall be prescribed by national laws or regulations; the results of these examinations and tests shall be recorded;
- (e) be operated by workers who have received appropriate training in accordance with national laws and regulations.

- 2. No person shall be raised, lowered or carried by a lifting appliance unless it is constructed, installed and used for that purpose in accordance with national laws and regulations, except in an emergency situation in which serious personal injury or fatality may occur, and for which the lifting appliance can be safely used.

Article 16

TRANSPORT, EARTH-MOVING AND MATERIALS-HANDLING EQUIPMENT

- 1. All vehicles and earth-moving or materials-handling equipment shall-
  - (a) be of good design and construction taking into account as far as possible ergonomic principles;
  - (b) be maintained in good working order;
  - (c) be properly used;
  - (d) be operated by workers who have received appropriate training in accordance with national laws and regulations.
- 2. On all construction sites on which vehicles, earth-moving or materials-handling equipment are used-
  - (a) safe and suitable access ways shall be provided for them; and
  - (b) traffic shall be so organised and controlled as to secure their safe operation.

Article 17

PLANT, MACHINERY, EQUIPMENT AND HAND TOOLS

- 1. Plant, machinery and equipment, including hand tools, both manual and power driven, shall-

- (a) be of good design and construction, taking into account as far as possible ergonomic principles;
- (b) be maintained in good working order;
- (c) be used only for work for which they have been designed unless a use outside the initial design purposes has been assessed by a competent person who has concluded that such use is safe;
- (d) be operated by workers who have received appropriate training.

- 2. Adequate instructions for safe use shall be provided where appropriate by the manufacturer or the employer, in a form understood by the users.
- 3. Pressure plant and equipment shall be examined and tested by a competent person in cases and at times prescribed by national laws or regulations.

Article 18

WORK AT HEIGHTS INCLUDING ROOFWORK

- 1. Where necessary to guard against danger, or where the height of a structure or its slope exceeds that prescribed by national laws or regulations, preventive measures shall be taken against the fall of workers and tools or other objects or materials.
- 2. Where workers are required to work on or near roofs or other places covered with fragile material, through which they are liable to fall, preventive measures shall be taken against their inadvertently stepping on or falling through the fragile material.

Article 19

EXCAVATIONS, SHAFTS, EARTHWORKS, UNDERGROUND WORKS AND TUNNELS

Adequate precautions shall be taken in any excavation, shaft, earthworks, underground works or tunnel-

- (a) by suitable shoring or otherwise to guard against danger to workers from a fall or dislodgement of earth, rock or other material;

- (b) to guard against dangers arising from the fall of persons, materials or objects or the inrush of water into the excavation, shaft, earthworks, underground works or tunnel;
- (c) to secure adequate ventilation at every workplace so as to maintain an atmosphere fit for respiration and to limit any fumes, gases, vapours, dust or other impurities to levels which are not dangerous or injurious to health and are within limits laid down by national laws or regulations;
- (d) to enable the workers to reach safety in the event of fire, or an inrush of water or material;
- (e) to avoid risk to workers arising from possible underground dangers such as the circulation of fluids or the presence of pockets of gas, by undertaking appropriate investigations to locate them.

Article 20

COFFERDAMS AND CAISSONS

- 1. Every cofferdam and caisson shall be-
  - (a) of good construction and suitable and sound material and of adequate strength;
  - (b) provided with adequate means for workers to reach safety in the event of an inrush of water or material.
- 2. The construction, positioning, modification or dismantling of a cofferdam or caisson shall take place only under the immediate supervision of a competent person.
- 3. Every cofferdam and caisson shall be inspected by a competent person at prescribed intervals.

Article 21

WORK IN COMPRESSED AIR

- 1. Work in compressed air shall be carried out only in accordance with measures prescribed by national laws or regulations.
- 2. Work in compressed air shall be carried out only by workers whose physical aptitude for such work has been established by a medical examination and when a competent person is present to supervise the conduct of the operations.

Article 22

STRUCTURAL FRAMES AND FORMWORK

- 1. The erection of structural frames and components, formwork, falsework and shoring shall be carried out only under the supervision of a competent person.
- 2. Adequate precautions shall be taken to guard against danger to workers arising from any temporary state of weakness or instability of a structure.

- 3. Formwork, falsework and shoring shall be so designed, constructed and maintained that it will safely support all loads that may be imposed on it.

Article 23

WORK OVER WATER

Where work is done over or in close proximity to water there shall be adequate provision for-

- (a) preventing workers from falling into water;
- (b) the rescue of workers in danger of drowning;
- (c) safe and sufficient transport.

Article 24

DEMOLITION

When the demolition of any building or structure might present danger to workers or to the public-

- (a) appropriate precautions, methods and procedures shall be adopted, including those for the disposal of waste or residues, in accordance with national laws or regulations;
- (b) the work shall be planned and undertaken only under the supervision of a competent person.

Article 25

LIGHTING

Adequate and suitable lighting, including portable lighting where appropriate, shall be provided at every workplace and any other place on the construction site where a worker may have to pass.

Article 26

ELECTRICITY

- 1. All electrical equipment and installations shall be constructed, installed and maintained by a competent person, and so used as to guard against danger.

- 2. Before construction is commenced and during the progress thereof adequate steps shall be taken to ascertain the presence of and to guard against danger to workers from any live electrical cable or apparatus which is under, over or on the site.
- 3. The laying and maintenance of electrical cables and apparatus on construction sites shall be governed by the technical rules and standards applied at the national level.

Article 27

EXPLOSIVES

Explosives shall not be stored, transported, handled or used except-

- (a) under conditions prescribed by national laws or regulations; and
- (b) by a competent person, who shall take such steps as are necessary to ensure that workers and other persons are not exposed to risk of injury.

Article 28

HEALTH HAZARDS

- 1. Where a worker is liable to be exposed to any chemical, physical or biological hazard to such an extent as is liable to be dangerous to health, appropriate preventive measures shall be taken against such exposure.
- 2. The preventive measures referred to in paragraph 1 above shall comprise-
  - (a) the replacement of hazardous substances by harmless or less hazardous substances wherever possible; or
  - (b) technical measures applied to the plant, machinery, equipment or process; or
  - (c) where it is not possible to comply with subparagraphs (a) or (b) above, other effective measures, including the use of personal protective equipment and protective clothing.
- 3. Where workers are required to enter any area in which a toxic or harmful substance may be present, or in which there may be an oxygen deficiency, or a flammable atmosphere, adequate measures shall be taken to guard against danger.

- 4. Waste shall not be destroyed or otherwise disposed of on a construction site in a manner which is liable to be injurious to health.

Article 29

FIRE PRECAUTIONS

- 1. The employer shall take all appropriate measures to-
  - (a) avoid the risk of fire;
  - (b) combat quickly and efficiently any outbreak of fire;
  - (c) bring about a quick and safe evacuation of persons.
- 2. Sufficient and suitable storage shall be provided for flammable liquids, solids and gases.

Article 30

PERSONAL PROTECTIVE EQUIPMENT AND PROTECTIVE CLOTHING

- 1. Where adequate protection against risk of accident or injury to health, including exposure to adverse conditions, cannot be ensured by other means, suitable personal protective equipment and protective clothing, having regard to the type of work and risks, shall be provided and maintained by the employer, without cost to the workers, as may be prescribed by national laws or regulations.
- 2. The employer shall provide the workers with the appropriate means to enable them to use the individual protective equipment, and shall ensure its proper use.
- 3. Protective equipment and protective clothing shall comply with standards set by the competent authority taking into account as far as possible ergonomic principles.
- 4. Workers shall be required to make proper use of and to take good care of the personal protective equipment and protective clothing provided for their use.

Article 31

FIRST AID

The employer shall be responsible for ensuring that first aid, including trained personnel, is available at all times. Arrangements shall be made for ensuring the removal for medical attention of workers who have suffered an accident or sudden illness.

Article 32

WELFARE

- 1. At or within reasonable access of every construction site an adequate supply of wholesome drinking water shall be provided.
- 2. At or within reasonable access of every construction site, the following facilities shall, depending on the number of workers and the duration of the work, be provided and maintained-
  - (a) sanitary and washing facilities;
  - (b) facilities for changing and for the storage and drying of clothing;
  - (c) accommodation for taking meals and for taking shelter during interruption of work due to adverse weather conditions.
- 3. Men and women workers should be provided with separate sanitary and washing facilities.

Article 33

INFORMATION AND TRAINING

Workers shall be adequately and suitably-

- (a) informed of potential safety and health hazards to which they may be exposed at their workplace;
- (b) instructed and trained in the measures available for the prevention and control of, and protection against, those hazards.

Article 34

REPORTING OF ACCIDENTS AND DISEASES

National laws or regulations shall provide for the reporting to the competent authority within a prescribed time of occupational accidents and diseases.

IV. IMPLEMENTATION

Article 35

Each Member shall-

- (a) take all necessary measures, including the provision of appropriate penalties and corrective measures, to ensure the effective enforcement of the provisions of the Convention;
- (b) provide appropriate inspection services to supervise the application of the measures to be taken in pursuance of the Convention and provide these services with the resources necessary for the accomplishment of their task, or satisfy itself that appropriate inspection is carried out.

V. FINAL PROVISIONS

Article 36

This Convention revises the Safety Provisions (Building) Convention, 1937.

Article 37

The formal ratifications of this Convention shall be communicated to the Director-General of the International Labour Office for registration.

Article 38

- 1. This Convention shall be binding only upon those Members of the International Labour Organisation whose ratifications have been registered with the Director-General.
- 2. It shall come into force twelve months after the date on which the ratifications of two Members have been registered with the Director-General.
- 3. Thereafter, this Convention shall come into force for any Member twelve months after the date on which its ratification has been registered.

Article 39

- 1. A Member which has ratified this Convention may denounce it after the expiration of ten years from the date on which the Convention first comes into force, by an act communicated to the Director-General of the International Labour Office for registration. Such denunciation shall not take effect until one year after the date on which it is registered.
- 2. Each Member which has ratified this Convention and which does not, within the year following the expiration of the period of ten years mentioned in the preceding paragraph, exercise the right of denunciation provided for in this Article, will be bound for another period of ten years and, thereafter, may denounce this Convention at the expiration of each period of ten years under the terms provided for in this Article.

Article 40

- 1. The Director-General of the International Labour Office shall notify all Members of the International Labour Organisation of the registration of all ratifications and denunciations communicated to him by the Members of the Organisation.
- 2. When notifying the members of the Organisation of the registration of the second ratification communicated to him, the Director-General shall draw the attention of the Members of the Organisation to the date upon which the Convention will come into force.

Article 41

The Director-General of the International Labour Office shall communicate to the Secretary-General of the United Nations for registration in accordance with Article 102 of the Charter of the United Nations full particulars of all ratifications and acts of denunciation registered by him in accordance with the provisions of the preceding Articles.

Article 42

At such times as it may consider necessary the Governing Body of the International Labour Office shall present to the General Conference a report on the working of this Convention and shall examine the desirability of placing on the agenda of the Conference the question of its revision in whole or in part.

Article 43

- 1. Should the Conference adopt a new Convention revising this Convention in whole or in part, then, unless the new Convention otherwise provides-
  - (a) the ratification by a Member of the new revising Convention shall ipso jure involve the immediate denunciation of this Convention, notwithstanding the provisions of Article 39 above, if and when the new revising Convention shall have come into force;
  - (b) as from the date when the new revising Convention comes into force this Convention shall cease to be open to ratification by the Members.
- 2. This Convention shall in any case remain in force in its actual form and content for those Members which have ratified it but have not ratified the revising Convention

Appendix L. Punjab Pollution Control Board Notification

GPC notification

PUNJAB POLLUTION CONTROL BOARD

Vatavaran Bhawan, Nahba Road, Patiala

Notification 155

.....Date 2/5/12

No. ..... In exercise of powers conferred under clause (m) of sub-section (1) of section 17 of the Water (Prevention & Control of Pollution) Act, 1974, Punjab Pollution Control Board in its 153rd meeting held on 07.09.2011 has laid down the following standards for the discharge of treated domestic effluents at the out let of sewage treatment plants (STPs) for the various towns in the State of Punjab and are applicable with immediate effect :

Sr. No.	Parameter	Effluent characteristics at the final out let of sewage treatment plants (STPs)
1	2	3
1	*Temperature*	Shall not exceed 5° C above the receiving water temperature
2	*pH*	5.5-9.0
3	*BOD*	≤10 mg/l ← 30 mg/l BOD for irrigation is acceptable to PPCB
4	*COD*	≤ 50 mg/l
5	*TSS*	≤ 20 mg/l
6	*Sulphates*	≤ 200 mg/l
7	*TKN*	≤ 50 mg/l 3 day BOD
8	*T-Coliform*	--
9	*Faecal Coliform*	≤ 1000 MPN/100 ml
10	*Total Phosphorous*	≤ 2 mg/l
11	*Ammonical Nitrogen as N*	≤ 20 mg/l
12	*Nitrate Nitrogen*	Not required as standard for TKN has already been proposed
13*	*SAR*	≤ 3.5 mg/l
14*	EC	≤ 2000 us/cm
15*	*RSC*	≤ 2.5 ~~mg/l~~ meq./l.

quality of work maintained on these

* *The standard should be made applicable, in as, treated effluent is used for irrigation purposes depending upon the soil quality.*

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RAVINDER SINGH
CHAIRMAN

Endst. SEE (HQ-1)/2012/19421-58 Dated 2/5/12

Glossary

AE	:	Assistant Engineer
APL		Above Poverty Line
AR	:	Artificial Recharge
ARWSP	:	Accelerated Rural Water Supply Programme
ASP	:	Activated Sludge Process
BCM		Billion Cubic Meter
BML	:	Bhakhra Main Line
BoD	:	Biochemical Oxygen Demand
BP	:	Bank Procedure
BPL		Below Poverty Line
BRC	:	Block Resource Centre
CE	:	Chief Engineer
CES	:	Consulting Engineers Services
CGWB	:	Central Ground Water Board
CPCB	:	Central Pollution Control Board
CRSP		Central Rural Sanitation Programme
DO	:	Dissolved Oxygen
DPMC		District Programme Management Cell
DPS	:	Duckweed Pond System
DSR		Detail Scheme Report
DWSC		District Water Sanitation Committee
DWSM	:	District Water and Sanitation Mission

DWSS		Department of Water Supply & Sanitation
EA	:	Environment Assessment
EC	:	Electrical Conductivity
ECoPs		Environment Codes of Practices
EDS	:	Environment Data Sheet
EE	:	Executive Engineer
EIA	:	Environment Impact Assessment
EMF	:	Environment Management Framework
EMP	:	Environment Management Plan
EMS	:	Environmental Management Specialist
ENVIS	:	Environmental Information System
FAL	:	Facultative Aerated Lagoons
FTK	:	Field Testing Kits
GoI		Government of India
GoP	:	Government of Punjab
GP	:	Gram Panchayat
GPS	:	Global Positioning System
GPWSC		Gram Panchayat Water Sanitation Committee
HAM (ham)		Hectare meter
HRD	:	Human Resource Development
IBRD	:	International Bank for Reconstruction and Development
ICR		Implementation Completion Report

ICMR	:	Indian Council of Medical Research
IDA		International Development Association
IDSP		Integrated Disease Surveillance Programme
IEC		Information, Education and Communication
IHHL		Individual Household Latrines
IMD	:	Indian Meteorological Department
IS	:	Indian Standard
ISL		Individual Sanitary Latrine
JE	:	Junior Engineer
Lpcd		Liter per Capita per Day
MDWS	:	Ministry of Drinking Water & Sanitation
M&E		Monitoring & Evaluation
MLD	:	Million Liters per Day
MoEF		Ministry of Environment & Forest
MPN	:	Most Probable Number
MVS		Multi Village Scheme
NABARD		National Bank for Agriculture and Rural Development
NBA	:	Nirmal Bharat Abhiyan
NC	:	Not Covered
NGO	:	Non-Government Organization
NOC	:	Non Objection Certificate
NRDWP	:	National Rural Drinking Water Programme

NTU	:	Nephelometric Turbidity Units
O&M	:	Operation & Management
OP	:	Operational Policy
PC	:	Partially Covered
PPCB	:	Punjab Pollution Control Board
PRIs	:	Panchayati Raj Institutions
PSR		Preliminary Stage Report
PRWSS	:	Punjab Rural Water Supply & Sanitation
RO	:	Reverse Osmosis
RPM	:	Respirable Particulate Matter
RWH	:	Rain Water Harvesting
RWSS	:	Rural Water Supply & Sanitation
SBM		Swachh Bharat Mission
SC		Scheduled Casts
SE	:	Superintending Engineer
SEA		Sector Environment Assessment
SLC		Scheme Level Committee
SLWM		Solid & Liquid Waste Management
SO		Support Organization
SPM		Suspended Particulate Matter
SPMC	:	State Programme Management Cell
SRP		Sector Reform Project

ST	:	Schedules Tribes
STP	:	Sewage Treatment Plant
SVS	:	Single Village Scheme
SWAp	:	Sector Wide Approach
SWSM	:	State Water & Sanitation Mission
TSC		Total Sanitation Campaign
TSS	:	Total Suspended Solids
VWSC	:	Village Water & Sanitation Committee
WHO	:	World Health Organization
WSP	:	Waste Stabilization Pond
WQM&S	:	Water Quality Monitoring and Surveillance
WSSO	:	Water and Sanitation Support Organization