CHAPTER 16 ACTION PLAN

<Objective of the Study>

Action plan was formulated in terms of institutional improvement

<Result of the Study>

Following nine subjects are required to be discussed as Action Plans:

1) *Self-reliant Management of Sewerage Works*
2) *Preparation of Annual Business Plan up to Project Completion*
3) *Development of Asset Ledger*
4) *Improvement of Information Management System*
5) *Streamlining of Sewage Tariff and Improvement of a Collection System*
6) *Mandatory House Connection to a Sewerage Network*
7) *Preparation of Financial Statements*
8) *Improvement of Customer Service*
9) *Improvement of Human Resource Development and Management*

In the sewage works, a sewerage system consisting of sewage collection, treatment and disposal is managed by one utility including billing and collection and its operation and maintenance cost will be covered by tariff revenue at least will be the basis of self-reliant management. However, in both cases of EPC and HAM-PPP in UP, the present sewerage management system by two organizations will be maintained in the future. Following issues supposing the management by single organization will be excluded from Action Plans.

1) *Self-reliant Management of Sewerage Works*
2) *Preparation of Annual Business Plan up to Project Completion*
3) *Streamlining of Sewage Tariff and Improvement of Collection System*
4) *Preparation of Financial Statements*

*Refer to the discussions in **Chapter 12** to cover abovementioned issues as required.*

In the State of Uttar Pradesh, the UPJN is responsible for planning and construction of sewerage facilities, but for their operation and maintenance, the UPJN is responsible for sewage pumping stations and sewage treatment plants, while the Jal Kal Varanasi (JVK) is responsible for sewer networks in addition to the billing and collection of sewage tariff.

The O&M cost of UPJN is covered by centage charges from the state government but not the sewage tariff, while the JVK is responsible for billing and collection of the sewage tariff which is spent for personnel and other O&M expenses for JVK itself and not allocated to the UPJN. Like this, in the

situation that a sewerage system composed of sewage collection, treatment and disposal is not managed by one utility but separately managed by two organizations and the sewage tariff collected by the JVK has not been allocated to the UPJN, there is no concept for a self-accounting system as the whole of a sewerage system.

The Central Government of India has decided to apply the Hybrid Annuity Model under PPP (HAM-PPP) to the construction, operation and maintenance of sewage pumping stations and sewage treatment plants through the establishment of the Special Purpose Vehicle (SPV) to be invested by the central, state, local governments and concessionaire under the Ganga Action Plan Phase-II. Under the HAM-PPP, the Central Government will pay the annuity regardless the sewage tariff collection to a concessionaire based on the bidding amount. Therefore, under the HAM-PPP, the SPV will be only substituted for UPIN and there will be no change in the formation that a sewerage system will be separately maintained by two organizations in the future.

Accordingly, the following issues supposed to be managed by single organization are not suitable to the situation that a sewerage system will be managed separately by two organizations. Hence, they are excluded from further discussions

5) Self-reliant Management of Sewerage Works
6) Preparation of Annual Business Plan up to Project Completion
7) Streamlining of Sewage Tariff and Improvement of Collection System
8) Preparation of Financial Statements

16.1 Development of Sewerage Asset Ledger

The mapping system for sewerage is basically composed of (i) automated mapping (AM) system, (ii) geographical information system (GIS), and (iii) facility management system (FM), out of which a geographical information system (GIS) is to process and analyse the information on the geographical information, while a facility management system is to construct the database integrating the geographical location and its relevant information and to search and process the geographical information and attribute information.

Figure 16.1.1 shows the conceptual image of a mapping system for sewerage.

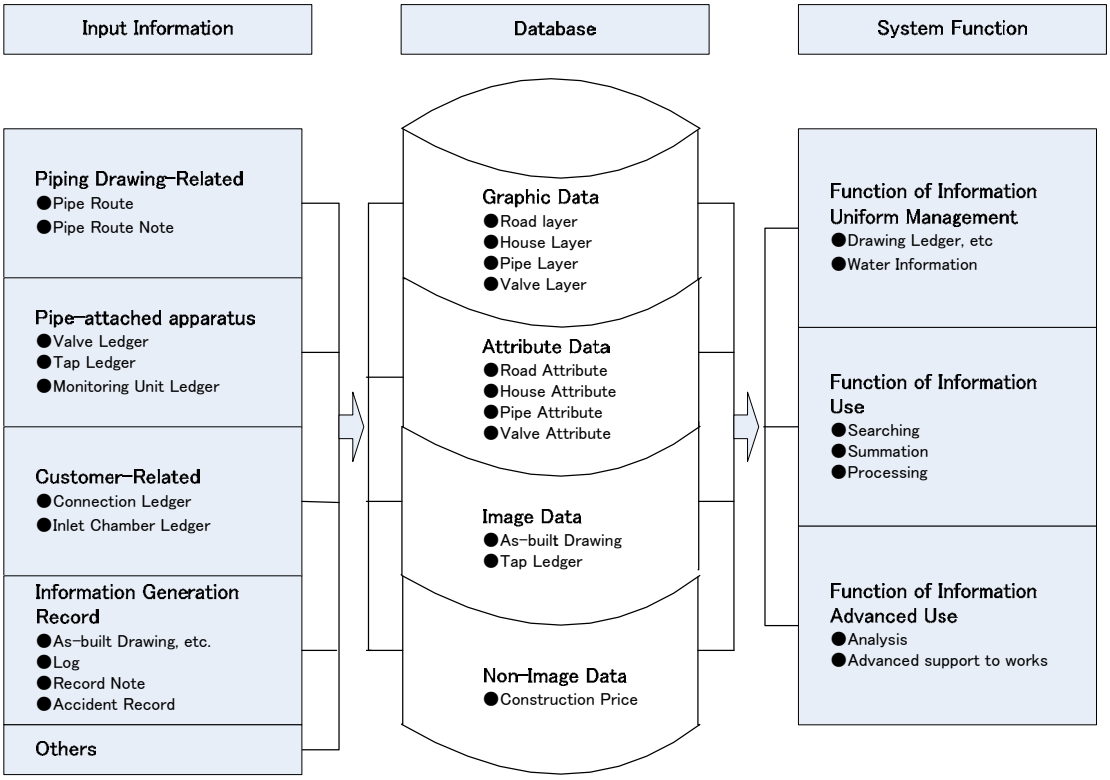


Figure 16.1.1 Conceptual Image of a Mapping System for Sewerage

The construction of a mapping system for sewerage makes the following possible:

1. Uniform management of the information

The uniform management of information means that information sources on the particular pipe will be concentrated in only one location. Therefore, when the particular information is inputted, the relevant drawing ledger, etc. will be simultaneously corrected or added and there will be no risk that another section / unit will get the different information.

2. Rapid information use through searching, etc.

Up to now, it takes a lot of manpower to search, retrieve, summarize and process information.

However, with the use of computer-based programs, these activities can be done more accurately and with more speed.

3. A variety of analysis linked to supporting the work

Through the development of database contents and the application of a variety of analytical methodologies, such as a hydraulic analysis, earthquake damage projection and so on, the linkage and integration between routine works and planning works can be easily achieved.

4. Linkage with other systems

The database of a mapping system for sewerage can be linked with another system enabling the exchange of the data between different mapping systems.

A mapping system requires a database (data arrangement and inputting) which is composed of the graphic information such as pipes, roads, houses, letters, etc. and attribute information such as piping material, diameter, etc.

Table 16.1.1 Action Plan and Monitoring Sheet for Provision of Sewerage Asset Ledgers

Sr. No.	Action	Contents/Outputs Expected Hints to Be Included	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official	Monitoring		
						Date (DD/MM/YY)	Status	Remarks
1	Conceptual design of asset ledgers for water supply facilities using GIS	**Subjects:** •Scope of system •Graphic data •Attribute data •Image data •etc.	31/09/2018	—	Zone I: E.E.		•Not started •On-going •Completed (DD/MM/YY)	
2	Selection of basic map & software for preparation of asset ledgers	**Subjects:** •How to use the information •Type of analysis •Type of output	30/11/2018	—				
3	Review of input data for GIS database		31/01/2019	—				
4	Data collection of existing water supply facilities		31/03/2019	—				
5	Provision of IT devices for GIS database preparation		31/03/2019	—				
6	Training of GIS database operators		30/06/2019	—				
7	Construction of GIS database		31/12/2025	—				
8	Operation of asset ledgers for water supply facilities		01/01/2026	—				

16.2 Improvement of Information Management System

16.2.1 Project Rationale under the JICA-assisted Preparatory Survey on Ganga Rejuvenation

India and Japan has come together to enhance the living environment in Varanasi city and other neighbouring four cities along Ganga river through improved sanitation system under the Ganga rejuvenation project.

Looking at the challenges faced due to rapid growth of the all these five municipal departments along the Ganga River, there is urgent need to have a comprehensive, integrated, "**GIS database**" and "**GIS based MIS System**" at each municipal premises. Such a system will help administration to adhere to the reforms agenda set under the preparatory survey on Ganga rejuvenation project. This reform agenda is given below:-

- ***Promote people centric administration:*** *Common citizens should get the benefits of the system of accurate billing.*
- ***Move from process accountability to productivity accountability and from transactional to transformative governance****:*
- ***Reduce delays and ensure promptness in delivery of services:*** *Computerization integrated with "GIS model" would ensure timely delivery of accurate service.*
- ***e-Administration:*** *Improve administrative processes by cutting cost, managing performance, making strategic connections within the local bodies and creating empowerment*
- ***Citizen Centric Organization****: JICA will be interested to augment the citizen centricity by integrating the GIS technology & new IT initiative at different service delivery channels.*

We proposed to leverage strength of information technology for creation of authentic baseline data and support utilities in IT enablement of their business processes at each municipal office. The creation of IT infrastructure will enable utilities to integrate other business processes such as GIS, MIS, Sewerage/Water Simulations, and SCADA Systems together.

16.2.2 Project Approach

Although the Varanasi urban area "GIS Master database" & "GIS enabled MIS system" has been conceptualized under the Institutional Development plan (IDP) of the JICA assisted Ganga Action Plan, and the same has been approved by the JICA, UP-Jal Nigam, VMC, UP-UDD-Lucknow, and other stake holders of the project. So there won't be any other requirement for further investment on IT & ITES side for the Varanasi Municipal Corporation. Notice inviting tender for the provision of consulting services under the Institutional Development plan (IDP), Varanasi has been floated on 5th May 2015. The method of selection was single stage, three envelopes, quality based system tender against the loan agreement number:-ID-P164. The process for the selection of the consultant through

the tender document has been completed.

16.2.3 Proposed system architecture for Varanasi Urban Area & its integration with E-Nagar Sewa portal at SDC, Lucknow under IDP Program:-

The "GIS database" and "GIS enabled Decision Support System" of Varanasi Urban area developed under IDP-GAP-II project will be integrated with the **E-Nagar Sewa portal** on the pilot basis.

Overall system architecture has been designed in close discussion with Director UP-UDD, Lucknow Government of Uttar Pradesh, and other stakeholders of the project. The proposed system of Varanasi Urban Area has been approved by JICA & other stake holders for further processing.

The State Data Centre, (SDC), Lucknow will host & manage the GIS database, and GIS enabled MIS for Varanasi urban area. The replica of the same will be implemented by UP-UDD, Lucknow in another 634 urban bodies around the state of Uttar Pradesh, on the basis of priority and the availability of funds.

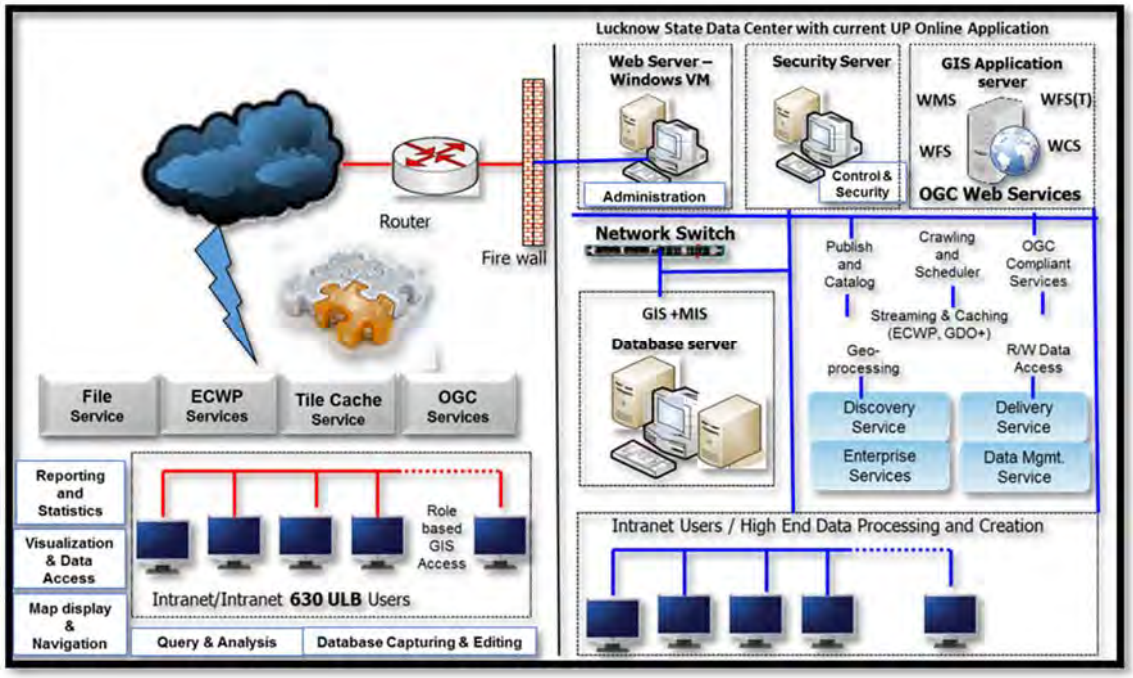


Figure 16.2.1 System Architecture for the Integration of Varanasi Urban Area "GIS Database" and "GIS based MIS" with the E-Nagar Sewa Portal under the "National Mission Mode Project on Municipalities"

16.2.4 Proposal from the Survey Team

We propose the scope of work to be implemented under the new Project Management Consultancy (PMC) schedule. Since the development of detailed GIS/MIS of VMC has been conceptualized under the IDP-GAP-II, we propose to implement comprehensive "GIS database" & "GIS based MIS system" at other four municipal departments in replica with Varanasi Urban area under IDP program.

Tasks to be undertaken by PMC during the implementation stage for four municipal departments are:-

- *Detail study of the four Municipal departments and preparation of AS-IS document.*
- *Preparation of Functionality Scope for the "**To-Be processes"** in consultation with the department of each municipal department.*
- *Objective analysis of the existing Information Technology solution at these municipal departments.*
- *Development of **"GIS based household database"** for the four municipal departments.*
- *Development of **"GIS based Water/Sewerage Asset Database"** that includes the existing and the future network for all municipal departments.*
- *Design, development & implementation of GIS based "Decision Support System" with Asset data, Consumer Database & Call Centre Management Module (Server/Desktop/Mobile Application).*
- *Design and develop the Integration plan of **"GIS based MIS Model"** with existing application of each Municipal department.*
- *Develop & implement the Capacity Building program for managing & updating the GIS Database &"GIS based Decision Support System" to selected officers from these municipal departments.*
- *Procurement of associated software, database, hardware equipment's that includes the Servers, Storages, firewall etc. for hosting, maintaining, developing & updating with GIS database & Web-GIS based MIS application*
- *Development of **"E-Knowledge Centre"** at each municipal departments*
- *Integration of each municipal department with the E-Nagar Sewa portal at State data center, Lucknow.*
- *Support to maintain the **"E-Knowledge Centre"** at each municipal department for minimum three years after the complete "Go Live "process.*

16.2.5 Proposed Project Components at Four Municipal Departments

E-Knowledge Data Centre will be responsible for providing all the technical and managerial information needed for strategic planning as well as daily operation decision making. The department will be comprised of four main sections.

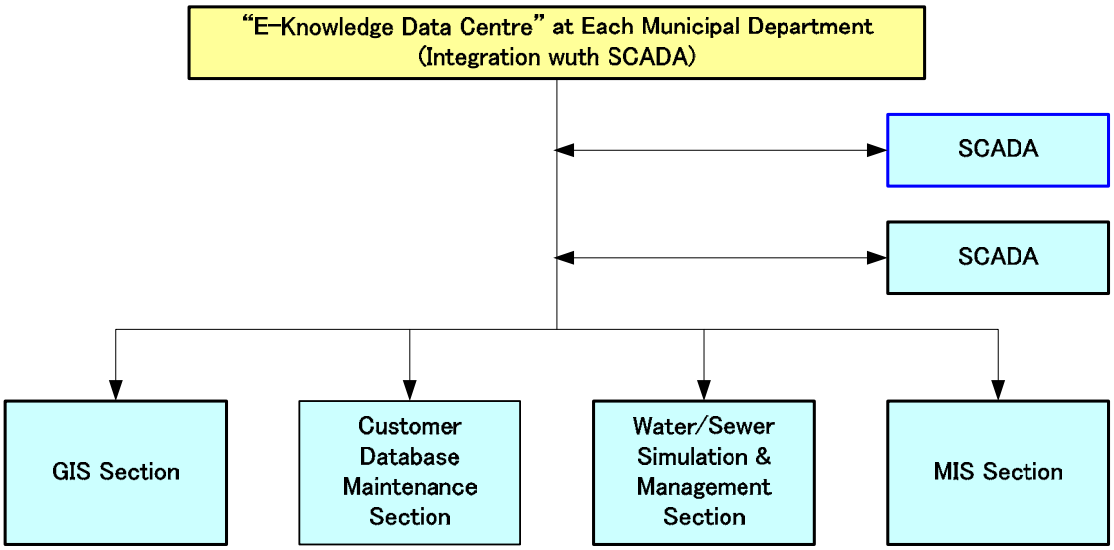


Figure 16.2.2 E-Knowledge Data Centre

(1) GIS Section

GIS Section will be responsible for keeping the most updated base map of the entire municipal area with various layers. It will also include the information of all utilities that includes the sewerage/water network facilities as well as household connections for entire municipal area limits. Comprehensive marketing cum service connection survey under the project management consultancy should be undertaken during the project implementation stage to register all the possible water/sewerage connections on the GIS platform. The GIS database should be made available for all the staff through internet/intranet within the organization for strategic needs such as marketing, maintenance and investment planning.

(2) Customer Database Maintenance Section

Customer Database Maintenance Section will be responsible for the development and maintenance of customer database including metering and billing information. During the design and implementation period, the division needs to start and, build an accurate database of all customers with in the each municipal department. It is estimated that the four municipal departments will generate approximately **1,00,000 customers**. New service connections to the household connection work should follow a sequence of marketing – connection application – actual service connection – metering and billing.

(3) Sewer/Water Model Building & Management Section

GIS and hydraulic modelling are complementary technologies. By integrating them with each other, each municipal department can reap substantial time and cost savings. A well-designed integration of

the two systems provides ready access to mission-critical data. As a result, risk-of-failure analysis, repair and replacement, capacity assessment, capital improvement planning, and numerous other utility applications run more efficiently and more effectively. *GIS and Hydraulic Modelling* identifies the challenges that must be navigated and offers best practices for achieving an integration that will be sustainable over the long term. We propose a platform that provides hydraulic modellers at each municipal department, the necessary tools to efficiently perform all aspects of system assessment. These include some of the following features:

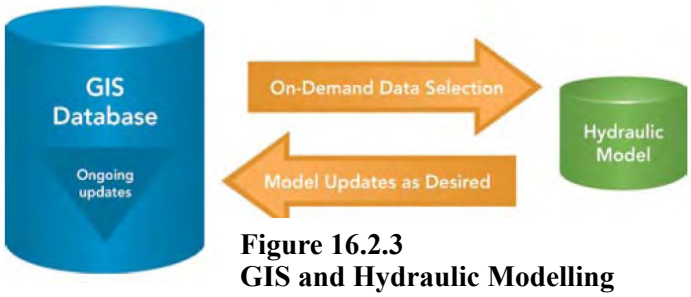


Figure 16.2.3
GIS and Hydraulic Modelling

1. *Model real-life and theoretical simulations to predict the impacts of rainfall on existing sanitary sewer systems*
2. *Offer variables for nearly any possible element in a sanitary collection system*
3. *Identify risk and magnitude of dry and wet weather sewer overflows*
4. *Optimize capital spending to eliminate combined and sanitary sewer overflows*
5. *Analyse performance and benefits of system controls*

We also propose to integrate all the four municipal departments "SCADA Division" with E-Knowledge Centre on real time basis. At least it should able to monitor the

1. *On-off status of pumps and valves of main facilities.*
2. *Flow volumes at major nodes including the WTP, STP, major gate valve nodes within the distribution networks, and*
3. *Sewer/Water quality at the STP/WTP outflows on real-time basis. The information should be made available not only for the Operation and Control Division but also for Regulatory Authority on a real-time basis as well to ensure the governance of the operation at all times.*

1. Management Information System Section

MIS Section will be responsible for preparing and analysing daily operation status, water consumption, billing records, work progress, etc. One of the main tasks for MIS Division would be productivity enhancement to compute the attainment of performance targets for each department, division and individuals to be linked with performance incentives.

2. Training & Capacity Building Section

Training is crucial in order to maintain the skill levels of the staff. Continuous training and capacity-building exercises will ensure that new staffs within all municipal departments are equipped with the

skills and knowledge required for managing operations, and which will, in turn, ensures long-lasting success of the program. With the incorporation of GIS Model & GIS based MIS systems at each municipal department, it will be imperative for the majority of the staff to acquire GIS/MIS skills. The program can be set up to teach the basics of computer programming operation as well as to teach specific operations of the deployed MIS/GIS System. A certification program may be designed to incorporate incentives for learning. Professional and technicians can be trained on how to properly plan, monitor, and manage the work at hand.

16.2.6 Proposed Scope of Services

The proposed scopes of services are:

1) Develop the "GIS Database" for four municipal department areas, i.e.,
   - *Mirzapur municipal council*
   - *Ramnagar municipal council*
   - *Chunar municipal council*
   - *Ghazipur municipal council*
2) Development of enterprise GIS based MIS systems and setup of "E-Knowledge Centre" at all four municipal departments.
3) Integration of "GIS Master database" and "GIS enabled MIS" at all four municipal departments through the State data centre, Lucknow, same in replica with Varanasi urban area designed under IDP-GAP-II Project.
4) Support for next three years in terms of supplying man power and required infrastructure at four municipal departments.

(1) Develop the "GIS-based Database" for Four Municipal Departments:-

For the development of "GIS Master Database" for each municipal area, it is proposed to establish the project office for twelve months at each town, near to the municipal department. This process will result in the development of accurate "GIS database" of each municipal area at the higher scale.

Stage I: Procurement of Latest High Resolution Satellite Imagery from NRSA, Hyderabad

In this project, the role of **"Fresh High Resolution Satellite Imagery"** is to provide feature in a very short amount of time, covering a vast area. The high resolution imagery, geo-positioned with DGPS equipment, provides an excellent source of base information upon which to develop an accurate Map. Latest 30 CM resolution; 4 bands natural Color composite Imagery is available for each

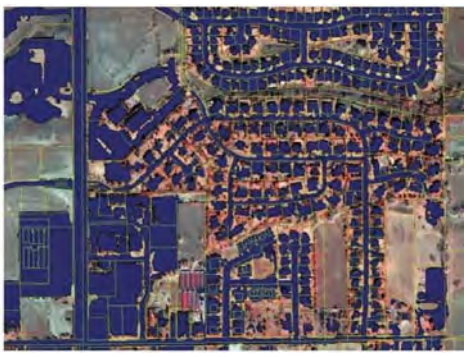


Figure 16.2.4 High Resolution Satellite Image

municipal department's area.

1) **Stage II: Geo Positioning, Edge Matching, Tiling, & Image Drape from High Resolution Satellite Imagery**

Geo-referencing of the High Resolution satellite imagery is necessary to ensure the positioning, scaling and orientation. After the pre-processing the satellite imagery needs to be geo-referenced using ground control points (GCP's) acquired from the Dual frequency DGPS survey for accurate referencing and ortho-rectification process.

Figure 16.2.5 Geo-referencing of High Resolution Satellite Image.

2) **Stage III: Update/ develop the detailed Base Map of each Municipal departments:**

The existing database collected from the various stake holders will be updated during this stage, these includes: - administrative boundaries, Base layers & land base data. The vector database developed will undergo a strict quality check under the supervision of expert before acceptance.

3) Stage IV-A: Development of Municipal Corporation Water/Sewerage Asset Register:-

The Project Management Consultants will assist each municipal department in carrying out GIS based survey of Water/sewerage facilities including, rising mains, transmission mains, raw mains, trunk sewers, main sewers, distribution networks, pumps stations, and sewage treatment plant, water treatment plants of the whole city to prepare a comprehensive GIS based asset data. The objective will be to locate & collect the maximum information related to asset on-site. Validation at certain places will be required to develop the accurate asset data. The attributes collected during the surveys will include but are not limited to the following:-

- *Location of asset (x,y)/Design Information like size, capacity, diameter, material etc.*
- *Operational details like sewage quantity, influent, effluent, chemical use, power consumption etc.*
- *assets, which are under control;*
- *the condition and existing performance of these assets*
- *the approximate residual life of these assets/the approximate value of these assets*

- *the asset repair, rehabilitation or replacement costs*
- *the date on which the asset was acquired or brought into use*
- *the original cost, or the re-valued amount determined in compliance*
- *the re-valued value of such fixed assets*
- *the accumulated depreciation to date/the carrying value of the asset*
- *the current insurance arrangements*

Stage IV-B: Development of Consumer database level information from High resolution Satellite Imagery & extensive field surveys.

Demarcation of individual plot level information using the High resolution Satellite Imagery& field surveys will be developed on High resolution Satellite Imagery. Validation of digitized plots will take place on-site. Here comes into play the idea of introducing a latest handheld GPS with android/windows/ios platform. The positional accuracy of these GPS will be very high. The application within the GPS will be pre-loaded with **consumer database form**. Each household demarcated on GIS platform will be interviewed onsite. The consumer database at each house will be filled online & the data once saved will be automatically updated at Web-GIS Server. This will be the **"new & unique thing"** adopted for the development of consumer database.

(2) Development of Enterprise GIS/MIS Systems for All Four Municipal Departments

The functionality of proposed MIS has to involve users with different roles and different access levels. We propose to apply model-based approach for designing & development of MIS. It provides many benefits to the various operation and maintenance activities. The benefits of using an integrated data model will be further leveraged by accessing the integrated data model through a **GIS interface**. It will enhance the ability to explore, navigate, access, and query asset data. Assisted by the GIS functionality, this integration can potentially improve the efficiencies, cost effectiveness, and coordination of maintenance plans and work processes. Suggestive functional modules under GIS based MIS for each municipal department are given below.

- *Multi-level security and user access control framework Module*
- *Property Database Management System*
- *Water/Sewerage based asset register Module*
- *Customer service and complaints Module*
- *Inventory Management System*
- *On line data updating Module*
- *Reporting and Analysis Module*
- *Documentation and Manuals Module*

(3) Integration of Four Municipal Departments "GIS Data" and "GIS Enabled MIS System" with the SDC, Lucknow, in Replica with Varanasi Urban Area Designed under IDP-GAP-II.

The selected PMC need to explore all the possible options to link each municipal department - GIS Model and application with E-Nagar Sewa portal for ULB websites in best possible & efficient manner & it should be ensure that the Web-GIS Decision Support System would route through E-Nagar Sewa portal in the efficient manner. As the major procurements and investment at SDC, Lucknow will be completed through the Infrastructure Enhancement component program under the GAP-II.

We suggest for other four municipal departments integration with SDC, Lucknow, the PMC should use the same integration process in replica with Varanasi urban area. Also the existing IT infrastructure, man-power resources, Web/Mobile-GIS Model, software's, and hardware's etc., at SDC, Lucknow funded and provided through the IDP (GAP-II) should be used for the integration purposes between four municipal departments with SDC, Lucknow. Some of the major advantages of integration between the GIS database & GIS enabled application of each municipal with E-Nagar Sewa Portal are:-

- *A customized Web-GIS-based decision support system with each municipal department spatial database will incorporate selected business requirements of existing E-NAGAR SEWA PORTAL Solution based MIS that including property Tax, Asset Management, PWD, water supply, Drainage, slums, Encroachment, etc.*
- *The customized application will be integrated with the authenticated server for MIS at SDC, Lucknow. Through this authentication server, only registered users could able to access & update the GIS Master database & GIS based decision support application at S-GIS Level.*
- *With this SDC, Lucknow will be able to manage, monitor & control the overall GIS database flow for entire UP State through customized application.*
- *The GIS users at each municipal department will be using standard desktop, web & mobile user applications to perform their routine work to develop the required analysis & update the spatial database of each municipal department at regular intervals.*
- *There will be certain cross check for updating the spatial database at each municipal corporations/councils/towns department & only then final updating will take place at SDC, Lucknow (S-GIS level).*

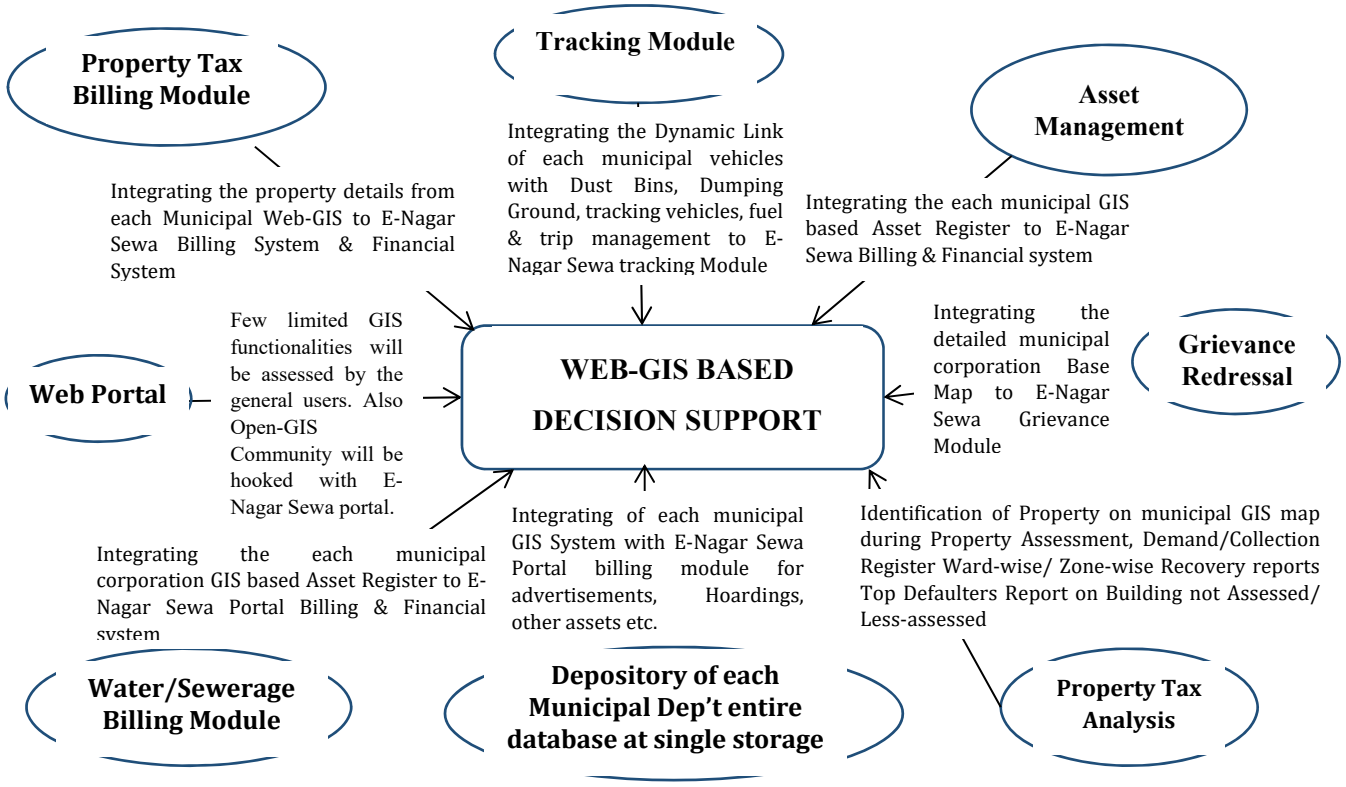


Figure 16.2.6 Suggested Integration Architecture for the Deployment of "GIS Model at State Level" for Four Municipal Departments

(4) Support for Next Three Years in Terms of Resources and IT-Infrastructure at Each "E-knowledge Centre" for Four Municipal Departments:-

The support in terms of resources and IT infrastructure will suffice by the project budget, so that the **"E-Knowledge Centre"** in all the four municipal councils/town Department areas could sustain for the longer duration. Also minimum three year resource based support program after the completion of the work is suggested to provide through the JICA funding. Detailing of each resource required is provided in the below mentioned table.

Table 16.2.1 IT-Infrastructure required at Each "E-Knowledge Centre"

Urban Local Bodies	Resources Required at Each Municipal Department	IT-Infrastructure required at Each "E-Knowledge Centre"
Mirzapur Municipal Council (Nagar Palika Parishad)	1-GIS/MIS Executive 1-Network Modeler (Water/Sewerage) 1-Hardware & Networking 1-GIS Surveyor 1-Helper	5 Hi configuration desktop system 1 Basic & Advance GIS Software license 2 Network Modelling Software 1 CAD Software, Laptop, Server A3/A4 Laser Printer, A0 Plotter/ Scanner Network enabled Centre with Hi end Internet facility, Generator/UPS etc.,

16.2.8 Implementation Approach

Since GIS & MIS require different kind of expertise, we propose domestic positions and support staff for the implementation of GIS & MIS systems at four different municipal departments.

(1) For GIS

To keep the data uniform, safe, accurate & useful, GIS database need to be fully developed under the Project Management Consultancy umbrella. Project Management Consultancy needs to develop the "GIS Master database" of 4 municipal departments during the design phase and need validate the same during the implementation stage. In this way the accuracy of the data will be double checked before delivered to the each municipal department.

(2) For MIS

Focus should be given on the use of **"COTS Modules"** to deliver functionality. Bespoke development for certain modules shall be allowed. Project Management Consultancy will be responsible for the final delivery of the entire GIS based MIS System with specific modules. We propose to publish open tenders by Project Management Consultancy for

- *Procurement of COTS Modules.*
- *Development of **"E-Knowledge Data Centre"** at each municipal department's premises. The tender will include the supply, installation, testing & support of servers, hardware & other equipment's to be set-up at **"E-Knowledge Data Centre"***

COTS Modules for the MIS development provide some of the following strengths:

- *Applications are provided at a reduced cost.*
- *The application is more reliable when compared to custom built software because its reliability is proven through the use by other organizations.*
- *"COTS" is more maintainable because the systems documentation is provided with the application.*
- *The application is higher quality because competition improves the product quality.*
- *COTS are of higher complexity because specialists within the industry have developed the software.*

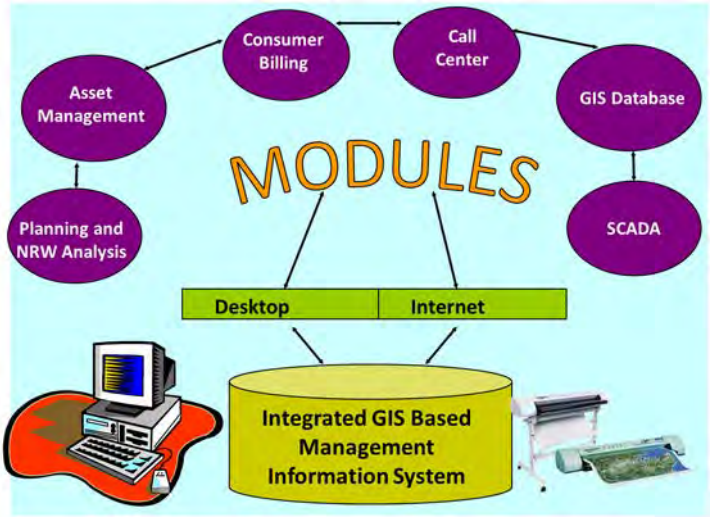
Specific Functionalities of GIS & MIS System Implementation are:-

- ***Geographical Information System** will be one of the core requirements of the system and will form the back bone of the decision making and planning process.*

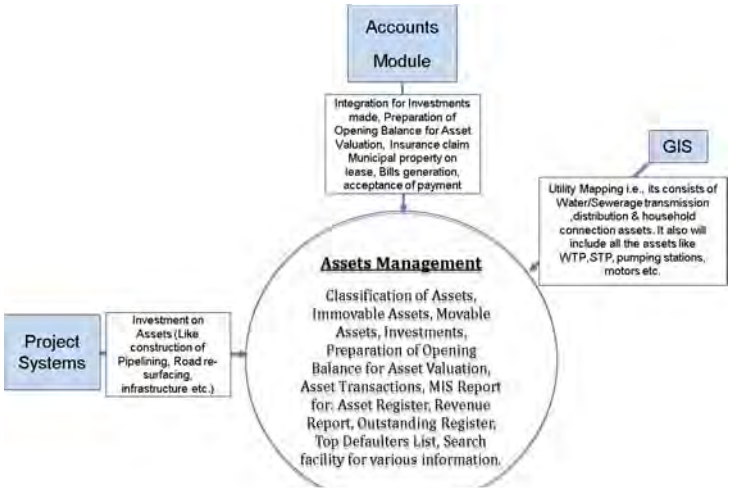
- ***Asset Management System****:-The spatial view of an asset will add new dimensions to supervisors' abilities, maintenance and work crews' efficiency, management curiosity, and a host of other intangible benefits. To wit, the ability to visually display the asset data that affects an individual employee's planned or completed work activities, along with reference features such as roads, buildings, sidewalks, and so on, can make all the difference between an efficient organization and a misdirected one.*
- ***Sewer/Water Model Building & Management Section*** *would base on integrated IT solution by use of GIS indexing, asset mapping &along with SCADA Application.*
- ***Call Centre****: - Single window customer care centres would be available at front end to interact with consumers, which will run through linking of back end business processes. The GIS system will be real time integrated with the Call Centre Application. All the data available in the call centre could be viewed through the GIS application. All incoming calls made through landlines have to be tracked to area it is coming from and displayed on the map. The calls as they are made should blink on the location in real time.*
- ***Billing &Metering****: - The system will provide realistic information on the billing and metering, based on GIS database and automates the revenue mobilization processes.*

On utilization of the services, all the "four municipal departments may benefit under following parameters:

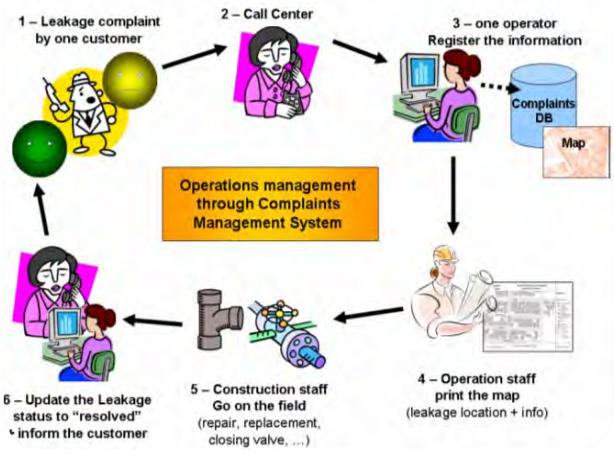
- ***Fool proof security****– locked server cabinets, with IP-based CCTV surveillance and hand key biometric access to all areas.*
- *24x7 monitoring of the IT infrastructure.*
  Fully Integration with SDC, Lucknow



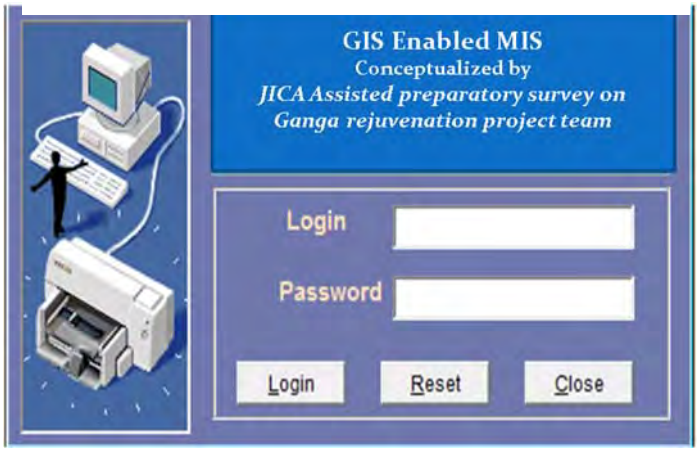
"Suggested Structure of GIS Model at each municipal department" with various modules



Suggested Structure for Asset Management module



Suggested Structure for Grievance Redressal Management



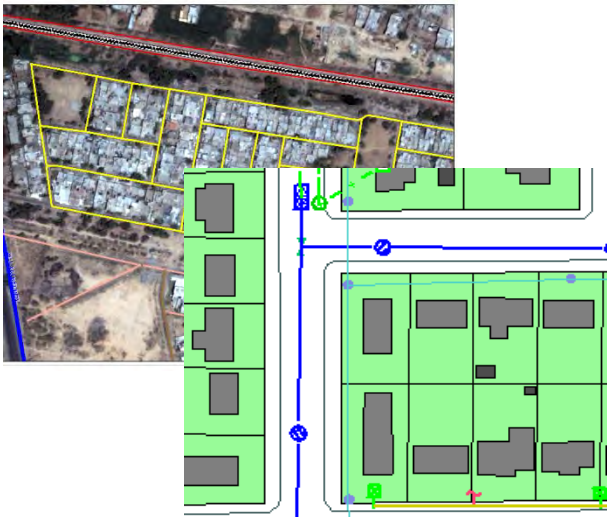


Figure 16.2.7 Utilization of "E-Knowledge Data Centre" at Each Municipal Department

16.3 Mandatory House Connection to a Sewerage Network

The Uttar Pradesh Water Supply and Sewerage Act, 1975 defines the house connection or sewer connection as follows:

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"**74. Right of owner or occupier to obtain sewer connection.** – The owner or occupier of any premises shall be entitled to empty sewage of the premises into a sewer of a Jal Sanstan provided that, before doing so, he, -

(a) Obtains written permission of the Jal Sanstan and pays connection fee in accordance with the bye-laws: and
(b) Compiles with such other conditions as may be provided by bye-laws."

"**75. Power to require owner to have sewer connection.** – Where any premises are, in the opinion of a Jal Sanstan, without sufficient means of effectual disposal of sewage and the sewer of the Jal Sanstan is situated at a distance of fifty metres from any part of the premises, the Jal Sanstan may, by written notice, require the owner of the said premises to have sewer connection as provided by bye-laws."

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Therefore, the house connection with a public sewerage system has been already mandatory for the people when the sewer of the Jal Sanstan is situated at a distance of fifty metres from any part of the premises.

According to the Service Lebel Benchmark (SLB) of the MoUD defines the coverage by sewage network services as follows:

The coverage by sewage network services

$$= \frac{\text{(Total number of properties with direct connection to the sewage network)}}{\text{(Total number of properties in the service area)}} \times 100$$

Table 16.3.1 No. of House Connections Proposed in the DPR

	Service Level Benchmark*1		DPR	
	Status (%)	Target (%)	Transfer of Exist.	New Pipe
	2010-11	2011-12		
Varanasi	67.3	72.3		
District I			38,288	9,804
District II			79,836	34,216
District III			100	5,987
Ramnagar	75.0	79.0	-	-
Mirzapur	53.0	56.0		5,726
Chunar	85.0	89.0		-
Ghazipur	98.0	100.0		3,900

The sewer connections from an inspection chamber to a manhole are proposed. These inspection chamber will be constructed along the roadside, as close to the house property lines as possible. The diameter of a pipe from an inspection chamber shall be the minimum of 150 mm. The part of the sewer connection inside the property and the sewer connection to the roadside inspection chamber will have to be constructed by the property owner. Even though the inspection chamber is installed along the roadside, it will be worthless if there is no connection from an inspection chamber to a house. Therefore, the house connection work to collect the domestic wastewater from respective houses is essential in the sewerage development project

Some DPRs for Varanasi, Ramnagar, and Ghazipur describe “Public Participation and Awareness: Communication and Public Outreach” in their projects

In the public participation and awareness, the focus will be to create awareness about ensuring the sewer connection to the households for cooperating in laying the sewer lines at household levels as well as improved solid waste, reduced open defecation, reduced introduction of pollutants into the River Ganga, sanitation management and environmental aspects of the River Ganga, including specific watch dog activities.

The actual implementation of the awareness & publicity campaign and conducting motivational training should be entrusted to a suitably chosen agency(s) and/or NGO(s). For this purpose the Corporation may invite agencies/NGOs by publishing “Expression of Interest (EOI)” advertisement clearly defining the scope of work. The agencies/NGOs who respond to the EOI may be requested to make presentations before a committee to prove their competence for carrying out the work. Only shortlisted parties may be invited to bid for the tender. The tender bids may be in two parts the “Technical Bid” and the “Financial Bid”. The technical bids (which also give the proposed

methodology and detailed scheme and work plan with time targets) may again be evaluated by a suitable committee and the financial bid of only those parties may be opened whose technical bids have been found to be satisfactory. The budgetary estimates given can act as a guideline for the implementing agency while choosing the agency which will execute the work.

16.4 Improvement of Customer Service: A Commitment to Level of Service

16.4.1 Introduction

Promoting customer service standards in the provision of water supply and sewerage services is a responsibility of the urban local bodies through their respective Jal Kals. Such customer service standards should not only be consistent with government and industry levels, but should also focus on customer expectations. Thus, performance targets and indicators provide a means to measure service, as well as to encourage continuous improvement. The key responsibility is being committed to provide continuous and reliable water supply and sewerage service to the Jal Kal customers who also happen to be residents of the Nagar Nigam / Nagar Palika Parishad.

The achievement of a specified level of performance for water supply and sewerage can be broadly categorized into the: (i) Day-to-day or 24/7 water supply; (ii) Adequate and reliable water supply system; (iii) Safe and high-quality water supply; (iv) Effective transportation and treatment of sewage; and (v) Sustainable and continuous water supply and sewerage services in the long-term.

1) Service Level Benchmarks of the Ministry of Urban Development

The quality of service provided by the water supply and sewerage utilities to its customers can be best assessed when compared to the performance indicators embodied in the Service Level Benchmarks (SLB) issued by the Ministry of Urban Development (MoUD) in 2008. The SLB identified basic minimum service level performance parameters for four basic urban services, including water supply and sewerage. The national government, through the Ministry, operationalized said framework by disseminating the service level performance parameters, defining a common minimum framework for monitoring and reporting on these indicator; and setting out guidelines in a phased manner while encouraging urban local bodies / utilities to integrate the benchmarking process and its outputs into their decision processes.

After a pilot initiative in the 2009 involving 28 pilot cities across 14 states, the SLB has moved Indian water utilities away from just being “production and supply” organisations to one that provides an essential and critical social and civic service to its various types of customers. As such, water utilities are now expected to perform their mandates based on a specified level of performance with respect to providing their constituents or customers, with safe, adequate, continuous and reliable of water supply and sewerage services. The benchmarks for water supply and sewerage are shown in **Table 16.4.1**[1]

[1] http://moud.gov.in/sites/upload_files/moud/files/pdf/Indicators&Benchmarks.pdf

Table 16.4.1 Service Level Benchmarks for Water Supply and Sewerage

No.	Indicator for Water Supply Service	Bench mark	No.	Indicators for Sewage Management	Bench mark
1	Coverage of water supply connections	100%	1	Coverage of toilets	100%
2	Per capita availability of supply of water at consumer end	135 lpcd	2	Coverage of sewage network services	100%
3	Extent of metering of water connections	100%	3	Collection efficiency of the sewage network	100%
4	Extent of non-revenue water (NRW)	15%	4	Adequacy of sewage treatment capacity	100%
5	Continuity of water supply	24 hrs	5	Quality of sewage treatment	100%
6	Quality of water supplied and adequacy of treatment/ disinfection	100%	6	Extent of reuse and recycling of sewage	20%
7	Efficiency in redressal of customer complaints	80%	7	Efficiency in redressal of customer complaints	80%
8	Cost recovery in water supply services	100%	8	Extent of cost recovery in sewage management	100%
9	Efficiency in collection of water supply-related charges	90%	9	Efficiency in collection of sewage charges	90%

Sourced from: http://moud.gov.in/sites/upload_files/moud/files/pdf/Handbook.pdf

2) Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

In addition to the SLBs, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) was launched in June 2015 with the focus of the urban renewal projects is to establish infrastructure that could ensure adequate robust sewerage networks and water supply for urban transformation. The state of Uttar Pradesh has prepared the State Annual Action Plan (SAAP) (2015-16) that seeks to invest Rs3,287 Cr for improving water supply in 60 mission cities and sewerage project in 24 cities under AMRUT Action Plan. Out of the 60 mission cities are Varanasi, Mirzapur and Ghazipur, which are included in this Project. The SLB issued by the MoUD have been adopted by both Uttar Pradesh in its SAAP as basis for its water supply and sewerage improvement targets for funding under AMRUT.

To be taken up under AMRUT's water supply improvement projects are: (i) Water supply systems including augmentation of existing water supply, water treatment plants and universal metering; (ii) Rehabilitation of old water supply systems, including treatment plants; (iii) Rejuvenation of water bodies specifically for drinking water supply and recharging of ground water, and (iv) Special water supply arrangement for difficult areas, hill and coastal cities, including those having water quality problems (e.g. arsenic, fluoride).

Likewise, sewerage improvements under AMRUT are: (i) Decentralised, networked underground sewerage systems, including the augmentation of existing sewerage systems and sewage treatment

plants; (ii) Rehabilitation of old sewerage system and treatment plants; and (iii) Recycling of water for beneficial purposes and reuse of wastewater.[2] It should be noted that while there other cities under this project not included under AMRUT, they are still guided by the SLB for water supply and sewerage.

Table 16.4.2 shows the existing levels of service of the three cities based on selected water supply and sewerage indicators included in the SAAP/ AMRUT.

Table 16.4.2 Indicators of Service in Water Supply and Sewerage in UP State Annual Action Plan, 2015

	Water Supply Indicator	Bench mark	Varanasi	Mirzapur	Ghazipur	Sewerage Indicator	Bench mark	Varanasi	Mirzapur	Ghazipur
			Existing	Existing	Existing			Existing	Existing	Existing
2	Coverage (%)	100	59.85	59	55	Sewerage network coverage (%)	100	68	39.46	0
3	Liters per capita per day (LPCD)	135	206	105	300	Efficiency in collection (%)	100	40	No data	Not applicable
4	Non-revenue water (NRW) (%)	20	59	45	49	Efficiency in treatment (%)	100	38	No data	Not applicable

Source: Compiled from various tables, State Annual Action Plan (Uttar Pradesh), 2015, pp 17-32.

16.4.2 Institutional Development Programme (IDP) under JICA-assisted GAP II

The commitment of the Jal Kal (Nagar Nigam/ Nagar Palika Parishad) to the water supply and sewerage service levels is institutionalized in their respective annual plans and targets. These plans also become a basis for additional funding either from current State and/or the Central Government programs, or even from loans from development partners. One such project is the JICA-assisted Ganga Action Plan Project (Varanasi) under NGRB, with a component called the Institutional Development Programme (IDP), now ready to take off in June 2016.[3]

The Institutional Development Programme (IDP) was envisioned to support and strengthen JKV to operate and maintain water supply and sewerage infrastructure projects turned over to it, as in the case of the sewerage facilities being implemented under the JICA-assisted GAP II project, among others. The IDP is comprised of nine action plan clusters, and will take approximately two years, or from 2016-2018, to implement / complete. Obviously, the IDP will also will greatly benefit/ support the

[2] State Annual Action Plan (SAAP) submitted in 2015 by the Department of Urban Development, Government of Uttar Pradesh, Directorate of Urban Local Bodies, Government of Uttar Pradesh, and the Regional Centre For Urban and Environmental Studies, Lucknow to the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Ministry of Urban Development.

[3] According to Mr. Gupta, Deputy Project Manager for Sewerage, Project Management Office for JICA-assisted GAP II, the IDP Consultant has already been procured/ chosen and that signing of the contract between the parties will be in the next three months, depending on negotiations.

projects to be undertaken under the Ganga Rejuvenation Project for Varanasi, and to a lesser extent for UPJN-GPPU.[4] Its successful implementation will have a positive impact on improving the over-all performance levels of JKV in providing water supply and sewerage services to its constituents.

1) IDP Components

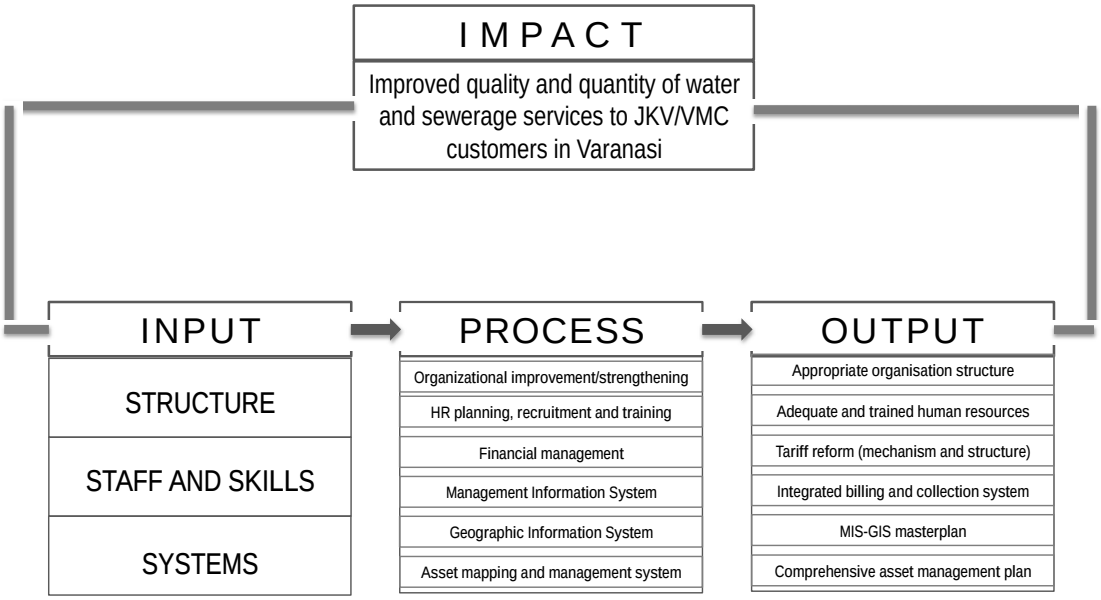
The IDP consists of the two components – consulting services and the provision of soft and hard infrastructure enhancement and equipment.

Under consulting services are the following areas or clusters: (i) Organization structure improvement and strengthening; (ii) Training /capacity development through conduct of training needs assessment, the development of a training plan, and implementation of overseas training and regular organization-wide; (iii) Tariff structure development through formulation of tariff mechanism and development of rationalized tariff structure; (iv) Asset Management Planning through GIS-enabled asset management planning and user connection mapping, the development of operation and maintenance manuals for key water supply and sewerage assets of JKV, and STPs and related assets operated by UPJN-GPPU; (v) Design and development of State level GIS-based Management Information System and the required architecture to support the consumer and utility database of all the Urban Local Bodies of Uttar Pradesh, including the VMC/ JKV; and (vi) Technology transfer and guidance to the Institutional Development Cell (IDC) under UPUDD and co-located in both UPUDD and JKV/VMC.

Under the provision infrastructure enhancement and equipment are the following: (i) Procurement of services for MIS and State Level GIS development, procurement of commercially available software, and procurement of hardware; (ii) Procurement of basic sewerage equipment; (iii) Upgrading of laboratory equipment; (iv) Provision of enhanced training infrastructure, upgrading of training facilities and equipment; and (v) Development of infrastructure at main burning ghats for 24/7 online birth and death registration facility.

The IDP framework (**Figure 17.4.1)** provides the interventions (the inputs) broadly categorized under structure, staff and skills, and systems; what is to be performed by the IDP consultants (the processes), and what are to be achieved (the outputs) and the expected results of the IDP (the impact) not only to JKV/ VMC but also to residents of Varanasi.

[4] Institutional Development Programme (IDP) Action Plan. JICA-assisted Ganga Action Plan Project (Varanasi) under NGRBA, by the Project Management Consultants, December 2013.



Source: Institutional Development Programme (IDP) Action Plan. JICA-assisted Ganga Action Plan Project, December 2013.

Figure 16.4.1 Framework for Institutional Development Program (IDP)

2) IDP Impact on Customer Service in JKV

The implementation of the IDP will have a big impact on customer (commercial) services and practices by improving the management of a wide range of customer service-related issues – on the organization development side, on capacity development and training, billing and collection efficiency with use of GIS-based MIS modules, redressal efficiency with the integration of the present grievance redressal management system to the GIS map, tariff development and structure, and others, as shown below:

- Under *organisational structure improvement*, establishing important units in JKV, such as:
  - Commercial / customer services unit that will manage customer requests for connecting, reconnecting to, and disconnecting from water supply and sewerage services; billing and collection, metering and payment of services; complaints handling and redressal;
  - Public information, education and communication (IEC) unit to tackle public health and sanitation aspects, water conservation and education, and the like;
  - Human resources management unit to address training and development and performance management; and
  - Further strengthening of the operation and maintenance unit(s).
- Under *GIS based on-line MIS System*, development of billing, asset management, call

redressal and water quality modules for VMC and JKV with the integration of the present grievance redressal management system to the GIS map to better monitor the location (spatial) of the grievance-prone areas thereby increasing redressal efficiency;

- In *management information system (MIS) modules for billing and collection*, working on the:
    - Implementation of mobile device-based MIS/ GIS billing and collection apps and its integration with the VMC/ JKV website, including the facility for online billing and payment management system, citizen service centre, payment at bank counter or other public/private agencies;
    - Development of integrated consumer database plan using door-to-door household's survey on GIS platform for VMC and JKV; and
    - Integration of VMC and JKV data with the State level billing and collection modules for property tax.
- In *tariff mechanism and tariff structure*, establishing and developing:
    - The actual and required expenditure requirements to fully cover for O&M of the water supply and sewerage systems in order to achieve the service level benchmarks set at 100% of water supply and sewerage costs; and
    - The appropriate tariff structure for implementation in a phased manner taking into consideration 100% metering plan of water service connections, using consultative processes, ensuring tariffs are affordable, while balancing long-term economic efficiently and financial sustainability.

3) IDP Impact on Customer Service in the Other Cities in this Project

While the IDP will primarily benefit JKV's ability and capacity to deliver better water supply and sewerage services, all other urban local bodies of the state of Uttar Pradesh will also benefit from it because one of the IDP's tasks is the development of the "State level GIS-based Management Information System", which also includes the required architecture. This will complement and support the consumer and utility database of all the ULBs in the State of U.P. In addition, the other customer service initiatives to be taken up in the IDP can also serve as a model for the other project ULBs to emulate and replicate.

16.4.3 Customer Services in Jal Kal of Project Cities

1) Jal Kal Varanasi

Comparing with the SLB of 100 percent for "service coverage", JKV presently covers only 67 percent

of its service area, as on December 2015. But in "sewerage network service coverage", JKV has a lot of catching up to do, having a mark of only 30 percent out of the SLB of 100 percent. This situation leaves the residents to cope with their own devices – like having household sewage flow into open drains, or constructing their own septic tanks, among others. Add to this the rotating water service of 10 hours per day, which is way below the 24/7 SLB on "continuity of service".

The billing and collection system is computerized, and payment of water supply tax and sewerage tax is accepted via bank, or at JKV offices. Collection of water and sewerage tariff or fees outside of the annual rental value (property tax) is also done through the accredited banks. SLB for "collection efficiency" is pegged at 90 percent, with JKV only able to muster collection efficiency of 72 percent for water supply and 76 percent for sewerage, as on 2014-15.

An average of 290-300 complaints per month are lodged with JKV through the following methods – web-based (online), by phone or through personal visit to the office. Only four percent of the complaints are not redressed within 24 hours, giving a redressal efficiency score of 96 percent, higher than the SLB on "complaint redressal" which is at 80 percent.

There is a redressal management system in place in JKV. A 24-hour control room receives all types of complaints from the public, and these are registered or entered into the system. These are fielded to the proper units for proper action, and the offices with access to the system can view the complaints by zone. The actions taken on the complaints are then logged into the system to confirm its redressal, which in turn will provide the redressal statistics at the end of the day, which is compiled on a monthly basis. Most of the complaints centre on water service – the supply hours, disruptions, leakage and water quality. The few complaints on the sewerage system were on damaged lines due to the on-going construction of new trunk lines and chocking from household sewage due to inclusion of solid waste.

The implementation of the IDP is very crucial for improving customer services, as it will complement management of the infrastructure being constructed, and those soon to be constructed. The IDP will ensure that JKV's billing and collection modules are integrated into the soon-to-be developed GIS map, thus making it easier for JKV to pinpoint and take appropriate action on the households not connected to the system, or those illegally connected, or households connected but not paying their water or sewerage bills on time. The GIS map will also help in ascertaining the actual number of water and sewerage connections, thus increasing service income for the Jal Kal. In addition, the GIS map's integration with the current grievance redressal management system will enable on-the-spot location of grievance-prone areas for even better redressal time and proper action improving on this particular indicator of good customer service – that is the efficiency in the redressal of customer complaints.

The revised JKV structure will include the organization of a dedicated customer service/ public information unit in each zonal office. The unit shall have a major role as JKV moves towards metering all service connections, as well as in getting more households to be connected with the sewerage system. It will have marketing and customer relations functions, and will process requests for new connections, disconnection, reconnections. Equally important is accepting/ processing customer complaints for redressal. This unit will also be in charge of public information, education and communication campaigns and bring important messages of JKV across to its customers. The number of personnel required for this commercial / customer service unit (and for the entire JKV, for that matter) will also be reviewed, analysed and recommended by the IDP consultants to ensure efficiency and effectiveness in the performance of the functions of the unit.

See **Annex 16.4.1** for the survey form on the commercial (customer service) practices of Varanasi.

2) Jal Kal Mirzapur

Mirzapur has a water supply service coverage of 51 percent and a sewerage network coverage of 57 percent. Water supply is available only for 6.5 hours per day. These numbers are way below the service level benchmarks of 100 percent for water supply and sewerage network coverage, and 24 hours per day for continuity of water supply service. There are 8,375 service connections and collection efficiency for water supply is 75 percent, 15 percent below the benchmark of 90 percent. There are 1,889 households with sewerage connections, but sewer fees are not charged/ collected as of the present time.

Mirzapur Jal Kal has an average redressal efficiency rate of 98 percent, besting the benchmark of 80 percent. There is an average of 250 complaints per month, received by telephone/ mobile, in writing, or by personal visit to the office. The complaints are official recorded in a logbook, including the action taken and the date and time it was taken. The most common complaints are about turbid or "dirty" water, leakages, and mini or motorized tube well breakdowns.

See **Annex 16.4.2** for the survey form on the commercial (customer service) practices of Mirzapur.

3) Jal Kal Ramnagar

There is no sewerage system in Ramnagar. However, the water supply system coverage is 92 percent, and water supply availability is at 12 hours per day. Billing is computerized for the almost 7,000 customers who pay through the banks, visits at the office, and through bill collectors. The water supply collection efficiency is at 131 percent (SLB is 90 percent).

In terms of complaint redressal, records are kept which also includes action taken on complaints. Complaints increase from 3-5 a month during the dry season, to 15-20 complaints a month during the

monsoon season. These are received by phone, or from the personal visits at the office. Complaints are usually on "dirty" water supplied and on pipe leaks. Redressal efficiency stands at an average of 93 percent per month.

See **Annex 16.4.3** for the survey form on the commercial (customer service) practices of Ramnagar.

4) Chunar

Chunar does not have a sewerage system. The water supply system coverage is at 95.4 percent, but water supply availability is only 11 hours per day. There are 8,375 water service connections and collection efficiency for water supply averages 92 percent.

Complaints are recorded, and around 50 reach the Jal Kal by telephone, and either verbally of in writing when customers visit the office. The main complaints are turbidity in supply, or dirty water during the monsoon season, leakage and contamination and stand post breakdown. Average redressal efficiency is at 100 percent.

See **Annex 16.4.4** for the survey form on the commercial (customer service) practices of Chunar.

5) Ghazipur

Ghazipur is without a sewerage system. Water supply coverage is quite low at 55.53 percent. On the redressal of complaints, there is an official record of complaints, which also includes the action taken on the complaints. There is an average of 60 complaints per month, reported through telephone/ mobile, relayed via personal visit to the office, or hand-written and also dropped at the Jal Kal office. Common complaints are hand pump / stand post breakdown and leakages.

See **Annex 16.4.5** for the survey form on the commercial (customer service) practices of Ghazipur.

16.4.4 PROPOSED ACTION PLAN FOR CUSTOMER SERVICE

As explained in the previous section, each of the ULBs in this Project has its own customer service practices, with the service level benchmarks guiding their performance in providing both water supply and sewerage. However, there is a need to strengthen customer service practices – on procedures for recording both customers' complaints and the responses of the service provider; analyzing cases and finding resolutions; and the monitoring of implementation of or disposal of the complaints.

There is much that can be done on the matter of commercial practices improvement; however, the *Action Plan for Customer Service* will focus on achieving customer service objectives by: (i) Putting in place a "Customer Service System" with the formulation of a citizen's charter; and (ii) Developing a more thorough "Complaint Redressal System".

1) The Formulation of Citizen's Charter

The first among the major activities in the action plan is the formulation of the "Jal Kal Citizen's Charter", defined as "the expression of an understanding between citizens and the provider of a public service with respect to the quantity and quality of services the former receive in exchange for their taxes."[1] It is essentially about the rights of the public, in this case, the water supply service and the sewerage service consumers; and the obligations of the public servants, in this case the Jal Kals of Varanasi, Ramnagar, Mirzapur, Chunar and Ghazipur.

The Citizen's Charter will define the service standards of the water supply and sewerage service provider, or the Jal Kal. As a written voluntary declaration by the service provider, it will discuss choice, accessibility, and non-discrimination. It will ensure transparency and accountability standards in accordance with the expectations of its citizens. Obviously, it is a useful way of defining for the customers the nature of service provision and explicit standards of service delivery, which is actually the duty of each public official in spending the public money that are collected through taxes, rent or water and sewerage tariff / fees. It is also an effective tool to help deliver good governance. Other water supply and sewerage service providers in India, as well as in Uttar Pradesh, have utilized the Citizen's Charter. It contributes tremendously in the improvement of service delivery, provides the public with greater responsiveness from the public officials, and results in greater public satisfaction with services.

a) Components of Citizen Charter for Jal Kal

The Citizen's Charter should be able to provide benefits to all Jal Kal stakeholders/ parties. To do so, the following components are suggested for inclusion: (i) Vision and mission statements; (ii) Details of business transacted by the Jal Kal, in general; (iii) Related legislation; (iv) Information about the Jal Kal; (v) List of services provided to each client / consumer group; (vi) Quality standards; (vii) Citizens' duties; (vii) Rights and compensation of the citizens; (viii) Details of grievance redressal mechanisms and how to access it; (ix) Citizen friendly measures; and (x) Expectations from the clients.

The central focus of a good citizen's charter is the requirements of the customer. It is imperative that the citizen charter be written in a language, and expressed in a manner, that can be easily understood by the customers, with the assurance that effective remedies to problems can be easily accessed. This process entails providing a feedback mechanism that includes close monitoring of the actions taken. Citizens expect service providers to provide reliable, responsive and consistent service performance and should attend to customer needs with empathy, courtesy and care.[2] Therefore, the citizen's charter shall see to it that the standards of service are published as a show of openness and transparency. It should be participative in the sense that the customers be given opportunities to openly consult on choices they have to make. It should also provide redress to the customers when

things go wrong.

b) Steps in Formulating a Citizen's Charter

Each Jal Kal is encouraged to start formulating its own Jal Kal Citizen's Charter. The proposed steps, which come with a timetable for completing the process, are detailed in **Table 16.4.3.**

Table 16.4.3 Steps in the Formulation of the Jal Kal Citizen's Charter

SL	Actions	Timetable / Remarks
1	Organize the "Citizen's Charter Task Force" within the Nagar Nigam/ Nagar Palika Parishad of about seven persons Objective: To draw up/ formulate the "Jal Kal Citizen Charter" in consultation with identified stakeholders within six months	One week with formal Notification on task force membership
2	Conduct stakeholder consultations with major customer groups, cross section of the community: • Domestic, business, institutional consumers • Government stakeholders with Jal Kal staff • Cross sectional representation from small and medium sized business, civic/ religious, educational/ professional groups	• Three consultations (to be completed in two months) • Each consultation meeting should be documented • Secretariat will come from the Task Force.
3	Prepare the draft of the "Jal Kal Citizen's Charter" • Circulate for comments/ suggestions • Modify to include suggestions	Not more than two months
4	Jal Kal Citizen's Charter to be reviewed/ modified by Task Force	One to two weeks
5	Seek approval from ULB Head	One week to get formal approval
6	Submit a copy of the approved Jal Kal Citizen's Charter to the Department of Administrative Reforms and Public Grievances	One week
7	Formally issue and release the Jal Kal Citizen's Charter and put it up on Jal Kal Website and disseminate widely	One week
8	Send copies to people's representatives and all stakeholders who were consulted	One week to circulate the copies
9	Appoint a Nodal Officer within Jal Kal to ensure effective implementation and monitoring of the Jal Kal Citizen's Charter	One week to make the appointment

JICA Survey Team, 2017.

2) Development of Complaint Redressal System

The development of a complaint redressal system is the second major activity in the action plan. Redressal is really an inherent part of the Citizen's Charter, and is considered one of the yardsticks of providing good customer service. However, in a bid to upgrade the present manner by which complaints are handled, it is necessary for the Jal Kals to establish both a complaint procedure and the performance standards for the system.

Traditionally grievance redressal procedures involve the procedure of the complainant giving details of the location of the problem, such as the address, or name of the road, block or area, which, more

often than not, led to delays from the Jal Kal to figure out the exact location of problem and then act on the complaint. Also, the complaints could not be properly recorded and tracked in real time. For the Jal Kals, complaint communication methods can be further improved. This can be done by coming up with either an emergency number, or a three-digit toll free number, which can be assigned for lodging urgent complaints either through telephone of mobile phone. Or, an SMS number can also be provided, which can be utilized for complaint purposes. In the event the customer base of the Jal Kal reaches 10,000 for both water supply and sewerage connections, a call centre can be put up to receive calls and provide action taken, or progress of action taken on the complaints.

To be able to provide timely redressal, the complaint shall be officially registered and a "complaint number" assigned. The complainant will be informed of the number, either by telephone or email, depending on the manner by which the complaint was received. The complaint will be immediately referred to the proper unit for action; and the action taken to address the complaint shall be relayed back to the complainant and be noted in the complaint register. If the complaint is received through post, or in writing, the above system may also be adopted.

The customer care office / staff may inform the facts such as who is attending the complaints, their contact number and stage of action taken to the complainant, a day after receipt of complaint. The unit-in-charge of acting on the issue should report final stage of action taken within two days to the customer care office / staff. The customer care office / staff may inform the final action taken to the complainant immediately after receipt of details received from the concerned unit-in-charge. The head of the Jal Kal (executive or junior engineer as the case may be) may review the status of complaints received every week.

However, redressal systems can adopt computerized systems to handle the regular operations and even customer grievance redressal systems. While this system requires investments in using information technology, such as Web-based GIS-based Water / Sewerage Complaint Redressal System concepts, adapting to such available technology can vastly improve redressal time with the people being able to communicate faster, reduce the distance and time barrier between the customer and the Jal Kal, and transact in a more transparent, user-friendly and flexible manner. This would also improve redressal efficiency rates.

Having a GIS-based redressal system pre-supposes that the Jal Kal has the layouts/ maps, etc of its water supply and sewerage assets and facilities, particularly the networks which are below ground. In addition, it also requires a GIS-based customer database to be able to trace the complaint using network diagram. In the event that the Jal Kal cannot invest in such as system as of this time, then the traditional method can be enhanced with better and more responsive complaint handling and redressal procedures. It should be noted that customer complaints are a source of information reflecting the

customer's perspective and a primary measure of dissatisfaction or satisfaction with Jal Kal's services. An effective and efficient response is a demonstration of the organization's performance.

In enhancing the system for complaint redressal sans the GIS-based Water supply and Sewerage Redressal System, the Jal Kals needs to review the present way of complaint redressal by asking themselves questions regarding the procedure to be incorporated in the Citizen Charter (adapted from *Citizen's Charters: A Handbook*. DARPG, Government of India), which are detailed below:

- Is there an established procedure for dealing with complaints? If so, does the complaints procedure contain the following features?
- That consumers can complain informally to any member of staff with whom they have contact, who then tries to resolve the problem on the spot?
- That consumers can make a formal complaint?
- That there is a complaints officer identified (name and contact details) and how to make contact is explained?
- Does it guarantee that a full investigation of a complaint will be carried out and a full reply provided?
- Does it guarantee that a full investigation of a complaint will be carried out and a full reply provided?
- Does it specify target times within which they will acknowledge the complaint, provide a full response, or give an interim reply, explaining by when a full response will be provided?
- Does it set out a procedure by which, if consumers are dissatisfied with the initial response, they can take the matter further?
- To what extent is the complaints procedure, or any stage in that procedure, 'independent'?
- If there are separate procedures for dealing with different types of complaints?
- Does it insist or imply that all formal complaints must be in writing? Or does it allow complaints to be made in person or over the telephone?
- Does it invite consumers to make constructive comments and suggestions in addition to complaints and does it suggest how to do so?
- Does it say that if consumers are dissatisfied with the organization's complaints procedure, there are external and fully independent avenues for taking the complaint further (Lok Adalat, Ombudsman, and Regulatory Commission)?

- Does it tell consumers how to get independent advice on, or assistance with their complaint?

According to the Department of Administrative Reforms and Public Grievances (DARPG), grievance redress mechanisms are part and parcel of the machinery of any administration. "No administration can claim to be accountable, responsive and user-friendly unless it has established an efficient and effective grievance redress mechanism. In fact, the grievance redress mechanism of an organization is the gauge to measure its efficiency and effectiveness as it provides important feedback on the working of the administration."[3] It identifies DARPG as the nodal agency central with respect to policy initiatives on public grievances redress mechanism and citizen centric initiatives, but calls for central, state and local governments and government organisations to set up their grievance redress mechanisms for the public, based on guidelines that have been issued.

Currently at Jal Kal, complaints are received (logged) and are attended to, however, the present approach can be vastly improved and brought to the level required by DARPG. Grievance redressal must, therefore, be systematized within all the Jal Kals under this Project.

a) Areas to Be Addressed for Grievance Redressal System

- *Developing norms and standard operating procedures* in accepting, acknowledging, processing and investigating complaints.
- *Designating a location and staff* to receive complaints, including the identity (names and designations) of the assigned staff, their office locations and contact numbers/ details.
- *Developing a system for record-keeping*, using information technology to create a database that not only contains vital customer information, but also provides easy access to historical data to track similar complaints. Information required are:
- Name of customer and details of customer account
- Exact nature of complaint
- Manner complaint was filed, date and time, name of staff who received the complaint
- Analysis of complaint
- Name of unit and staff to whom complaint was forwarded for resolution,
- Action taken and timelines, including regular feedback to customer
- Disposal of grievance
- *Developing target time for feedback response*, including monitoring of complaint solution.
- *Making periodic analysis of complaints*, how these were solved or not solved, with the aim at

improving services and/or streamlining grievance mechanism / processes further.

- *Achieving measure of efficiency* in redressal of customer complaints of not lower than the service level benchmark of 80%.

b) Characteristics of Proposed Grievance Redressal System

The characteristics that the proposed complaint redressal mechanism should possess and address are the following: (i) Ease of accessibility; (ii) Speed in response time; (iii) Exhaustive investigative methods; (iv) Safeguarding confidentiality; (v) Upward and downward communication; (vi) Meticulous complaint recording and analysis; and (vii) Timely disposition and disposal of complaints / cases. See **Table 16.4.4.**

Table 16.4.4 Important Characteristics for the Proposed Grievance Redressal System for Jal Kal

SL	Characteristics	Description
1	Accessibility	• Make it easy for customers to access ways to lodge a complaint • Accessibility modes should be well disseminated • Access modes should be simple, easy to understand and use by customers • Use "customer care" or "customer service" desks / officers instead of "complaint" desk / officer
	Face-to-Face • Customer Service Desk • Customer Service Officer	
	Remote • Telephone / Call Centre • Online	
	Mail • Regular Mail • Email	
2	Response Time	• The speed in acknowledging complaint
		• Time limits established for acting on a complaint
		• Informing the complainant of the proposed action
		• Feedback time at keeping people informed of progress of action
3	Investigative Methods	• Fairness • Comprehensiveness • Impartiality • Time bound
4	Confidentiality	Complaint protocol must ensure the confidentiality of both the staff investigating and the complainant
5	Communication (Upward and Downward)	Provide information to top management regarding major grievances so that services can be improved
		Issue booklets/ pamphlets about the schemes/services available to the public indicating the procedure and manner in which these can be availed and the right authority to be contacted for service as well as for grievance redress
		Publish yearly the numbers and types/categories of complaints, the speed of response to the complaints received, and the action taken as a result of complaints to improve services.

6	Complaint Recording and Analysis	• Record the number of complaints and the type / categories of complaints • Analysis of the frequency of the occurrence of each type of complaint / area to identify grievance prone areas where modification of policies and procedures may be undertaken to make delivery of services more expeditious • Analysis of the response time and the reasons behind the problems encountered
7	Disposition and Disposal of Complaints / Cases	• Aim not only for quantity, but also for quality • Satisfaction of complainant should be achieved • Complainant should feel that grievance was addressed • Redressal options could be in the form of an apology, explanation, assurance that the same thing will not happen again, backed up by action to correct the wrong, monitoring the action and/or providing financial compensation.

JICA Survey Team, Ganga Rejuvenation Project, June 2016.

3. Review and Reformulation of Customer Service Policies in Billing and Collection

The action plan for billing and collection policies is directed more to the Jal Kals of Ramnagar, Mirazpur, Chunar, Ghazipur and Saidpur. Efficient and effective billing and collection directly contributes to the financial health of each Jal Kal. This is the function of its "Commercial Services" unit, and how well it is performed is measured by its collection efficiency ratio.

While billing and collection will be improved through the implementation of the IDP for Jal Kal Varanasi, the other Jal Kals under this project should improve its billing and collection systems to ensure the its own organisational viability and sustainability, as this has an immediate impact on enhancing the revenue streams / revenue base. The reverse is also true – that poor billing and collection practices prevent the Jal Kals from recovering sufficient costs to properly operate and maintain facilities and, therefore, provide adequate service to the customer.

According to a study by the World Bank, successful billing and collection practices "depend on many internal factors and this is where proper institutional arrangements have to be established"[4] and suitable policies framed in areas as the extent of metered service provision, water tariff structures including service to the poor, billing cycles, delivery of bills, facilities for customer payments, use of technology, and customer databases. Needless to say, efficient billing and collection practices become the incentives for the Jal Kal to charge and collect water and sewerage bills while also fulfilling a commercial / customer service orientation to its clients.

Measures for improving billing and collection are in: (i) Accurate, complete listing / recordkeeping of customers served, (ii) Clear billing procedures, (iii) Regularly updated customer databases, (iv) Using improved technology in billing activities; and (v) Encouraging and incentivizing staff to undertake billing and collection functions more diligently. The latter is related to Jal Kal having an institutional

arrangements' approach to water supply and sewerage service delivery as a commercial endeavor, aiming for independent financial management that includes setting its own revenue targets.

Improvements in billing and collection practices result in lower costs per unit of billing and collection and make such practices worth the resources that are allocated and spent. Ineffective and poorly managed billing and collection practices impact on staffing costs and staff efficiency levels. **Table 16.4.5** proposes action steps to review and reformulate billing and collection policies as the basis for the billing and collection system.

Table 16.4.5 Monitoring Sheet of Action Plan for Implementation for Customer Service for Jal Kal Varanasi

SL Nr	Action	Content / Outputs Expected	Target Date (DD/MM/YY)	Budget	Responsible Official	Monitoring Date (DD/MM/YY)	Status	Remarks
6.	Formulate *Jal Kal Varansi Citizen's Charter*	• Published *JKV Citizen's Charter* • Improved customer service delivery	01/12/2017	• 5 consultations @ 10,000 per consultation for total of INR 50,000.00 • Publication cost @ lump-sum 50,000	General Manager	Monthly after start date	Not started	-
7.	Establish enhanced *Complaint Redressal System*	• *JKV Complaint Redressal System* in place and functioning • Achieve service level benchmark for complaint redressal	To be determined by IDP schedule in terms of GIS-based database	Included/ sanctioned in IDP project	Executive Engineer	Monthly after start date	Current system in place; IDP for enhanced system	-
8.	Institutionalize customer service functions in JKV through the on-going Institutional Development Programme (IDP)	Structure: Commercial Service Section officially established and organized as per IDP	To be determined by IDP schedule	Included/ sanctioned in IDP project	General Manager	Monthly after start date	Existing organ-ization in place; Enhanced / new structure still to be implemented	-
	Review staffing plan for	Staff: Human resources for Commercial	To be determined by IDP	Included/ sanctioned in IDP project		Monthly after start date	Existing staffing in place;	-

	proposed "Commercial Service Unit" in each zone	Service Section recruited and in place as per IDP plan	schedule				Improved staffing to be implemented	
	Review training plan for customer service staff	Skills: Reformulated training plan for customer service staff as per IDP	To be determined by IDP schedule	Included/ sanctioned in IDP project		Monthly before and after training	Still to start	-
	Review and (re)formulate customer service policies, especially for sewerage services	• Jal Kal *Billing and Collection Policy* • Service Connection Rules and Regulations (including metering) for water supply • Service Connection Rules and Regulations for sewerage	• One year before metering program to market for new water supply connections • One year before completion and operation of sewerage system/ facilities	Included/ sanctioned in IDP project		Six months before review and monthly after implementation	Still to start	-

Table 16.4.6 Monitoring Sheet of Action Plan for Implementation for Customer Service for Ramnagar, Mirzapur, Chunar and Ghazipur

SL Nr	Action	Content / Outputs Expected	Target Date (DD/MM/YY)	Budget	Responsible Official	Monitoring Date (DD/MM/YY)	Status	Remarks
9.	Formulate *Jal Kal Citizen's Charter* For Ramnagar, Mirzapur, Chunar, Ghazipur and Saidpur	• Published *Jal Kal Citizen's Charter* • Better customer service delivery	01/12/2017	• 5 consultations @ 10,000 per consultation for total of INR 50,000.00 • Publication cost @ lump-sum 50,000	Executive Engineer or Junior Engineer in charge of Jal Kal	Monthly after start date	Not started	-
10.	Establish comprehensive *Complaint Redressal System*	• *Jal Kal Complaint Redressal System* in place and functioning • Achiev	01/08/2019	• For enhancement: • Cost of main-taining emer-gency number or SMS mobile		Monthly after start date	Not started	-

		e service level benchmark for complaint redressal		number • Cost of addi-tional customer service staff				
11.	Review and (re)formulate customer service policies, especially for sewerage services	• Written Jal Kal *Billing and Collection Policy* • Service Connection Rules and Regulations for sewerage • Service Connection Rules and Regulations for water supply	Mid-2019 or one year to market for new sewerage service connections	• Nil	Executive Engineer / Junior Engineer / Head of Jal Kal	Six months before review and monthly after implementation	Not started	

[1] India's Citizen's Charters: A Decade of Experience, Public Affairs Center, Bangalore, 2007, p. 16.
[2] *Citizen's Charters: A Handbook*. Ministry of Personnel, Public Grievances and Pensions, Department of Administrative Reforms and Public Grievances, Government of India.
[3] http://darpg.nic.in/darpgwebsite_cms/Document/file/PGR_Guideline.pdf
[4] Water and Sanitation Program (South Asia), Field Note on "Performance Improvement Planning: Developing Effective Billing and Collection Practices", April 2008.

16.5 Improvement of Human Resources Development (HRD) and Management (HRM)

16.5.1 Current Status of HRD and HRM of UP State, Varanasi City and UPJN

(1) Survey Results

Summarized survey results of HR development and HR management status in Urban Development Department (UDD) and State Ganga River Conservation Authority (SGRCA) in Uttar Pradesh State Government Lucknow, Uttar Pradesh Jal Nigam (UPJN) HQ in Lucknow, Varanasi Nagar Nigam (VNN) and Varanasi Jal Kal (VJK), and UPJN Varanasi are listed in **Table 16.5.1**.

Table 16.5.1 Survey Results for HR Management and Development of Involved Organizations

Categories	Q #	Description	Name of the related organizations			
			State Level		Urban Level	
			1)	2)	3)	4)
		For Q1~Q5, Q7~Q9, and Q11~Q13: (Yes, No, NA=Not Available, DN=Did not asked)	UDD, UPSGRCA	UPJN HQ Lucknow	VNN, VJK	UPJN Varanasi
		For Q6: (Annual, Bi-annual, Quarterly Q, NA=Not Available at the site, DN=Did not asked)				
		For Q10: Yes or No in following choice (L=Labour, W=Worker, O=Operator, S=Supervisor, and M=Manager position)				
		For Q10a: 1. OJT (On the job training) 2. In house skill/technical training 3. In house classroom lecture/seminar 4. Outside skill/technical training 5. Outside classroom lecture/seminar				
Office function	1	Do you have well defined function of the office?	Yes	Yes	Yes	Yes
Job description	2	Do you have well defined job description for each post?	Yes	Yes	No (Simple one Yes)	Yes
Performance Management of Personnel	3	Do you have an annual performance appraisal system for employees?	Yes	Yes	No (not for all level)	Yes
	4	Do you have a set format for performance	Yes	Yes	Yes	Yes

		evaluation?				
	5	Is the same format used for all groups of employees?	No	No	No	No
	6	Frequency of performance evaluation	Annual	Annual	Annual	Annual
Training and Development	7	Does training and development programs take inputs form performance evaluation reports?	No	No	Yes	No
	8	Are training and development programs based on Training Need Assessment?	No	No	No	No
	9	Is there a mechanism to measure the effectiveness of the training received by employees?	No	No	No	No
	10	Is there a training program for labour, worker, operator, and manager? (L=Labour, W=Worker, O=Operator, S=Supervisor, and M=Manager position)	No: L, W, & O Yes:M	No: L, W, &O Yes:M	No: L, W, &O Yes:M	No: L, W, &O Yes:M
	10 a	If so, what kind of training do they receive? 1. OJT (On the job training) 2. In house skill/technical training 3. In house classroom lecture/seminar 4. Outside skill/technical training 5. Outside classroom lecture/seminar (L=Labour, W=Worker, O=Operator, S=Supervisor, and M=Manager position)	DN	M:3, 5	S:2, 3 M:3, 5	L:1 W:1 O:No S:3 M:5
	11	Do you have “On the Job Training (OJT)”?	Yes	Yes	No	Yes
	12	Do you have “Training of Trainers (TOT)”?	DN	No	No	No
	13	Do you utilize “Internal Trainers”?	DN	Yes	No	Yes
	14	Do you utilize “Outsourced Trainers”?	Yes	Yes	Yes	Yes
Training Facilities	15	Is there a training facility exist in your organization?	DN	Yes (classroom)	No	No (in STP)
	16	Do you use outside training Facility?	DN	Yes	No	Yes

From contents of **Table 16.5.1,** following information can be identified.

1) Office Function and Job Description (Question 1 and 2)

There are written defined function of offices for state level, city and UPJK, and UPJN HQ and district office (STP) existing. Also there are written well defined job description in state level, and UPJN HQ and district office (STP) existing. For Varanasi city and UPJK, there are simple written defined job description existing. Since both office function and job description existing, and the organizational management system established, one assume that the operation of those organization can be conducted without any hindrance or difficulties.

2) HR Management (Question 3 ~ 6)

In terms of HR management, basic management tools such as organizational chart with management structure, office functions description, and job descriptions already exists at state level, city, UPJK, and UPJN. The details of those institutional set up are explained in Chapter 13 Institutional Set-up for Project Implementation. In order to motivate officers and workers, annual performance appraisal system may be an effective tool to use. This system is already applied at state level, at city and UPJK, and at UPJN and there are written performance evaluation format existing. In the case of UPJK, the evaluation format exists for managers only, and for workers evaluation, ordinary A4 size papers are utilized in the case of performing well or not well, etc. For UPJN, both for managers and workers the formats are prepared. The samples of those formats for UPJK and UPJN are listed below.

3) HR Development and Training Facilities (Question 7 ~ 16)

From question 7 to question 14, HR training and HR development activities were questioned. From the hearing activities conducted, there are training programs available to most of officers and managers at state level, city and UPJK, and UPJN. However, there are no training opportunities existed for site officers and supervisors where the actual O&M activities are implemented. Thus there are some HR training demands exist for those site officers and supervisors.

16.5.2 Required Capability Standards for Efficient Sewerage System Management

For the effective sewerage operation, it is essential to monitor individual indicators and requires continuous improvement activities utilizing the PDCA cycle. Performance indicators (PIs) can be considered as a management tool to evaluate the degree of the undertaking's efficiency and effectiveness. Efficiency is the extent to which the resources of an undertaking are utilized to provide services, e.g., maximizing services delivery with the minimum use of available resources. Effectiveness is the extent to which declared or imposed objectives, such as levels of services, are achieved. Performance Indicators (Pls) can also be used for quantitative comparative assessment of performance. This quantitative comparison can be conducted comparing the actual performance which the past undertaking records and

the project targets by an entity concerned and other similar entities.

The International Water Association (IWA) developed PIs for water supply services and wastewater services and published "Performance Indicator for Water Supply Services" in 2000 and "Performance Indicator for Wastewater Services" in 2003. The International Organization for Standardization (ISO) developed international standards regarding activities related to drinking water and wastewater services and published "Guidelines for the Assessment and for the Improvement of the Service to Users: ISO 24510", "Guidelines for Management of Wastewater Utilities and for the Assessment of Wastewater Services: ISO 24511", and "Guidelines for the Management of Drinking Water Utilities and for the Assessment of Drinking Water Services: ISO 24512" in 2007. ISO 24500s are guidelines for evaluation of entire wastewater services, and their aim is to enhance the efficiency of undertakings and services. PIs used for evaluation are key factors.

Performance of an undertaking can be evaluated from various aspects and wastewater services are composed of numerous complicated activities. Therefore, a number of PIs have been developed and make available. Wastewater services in different countries have different histories, and they have different roles. Therefore, selection of proper PIs for each undertaking is the most desirable.

In Japanese national guidelines namely, "Guideline for Improving O&M for Wastewater Systems", published in 2007 from Japan Sewage Works Association, Performance Indicators (PIs) are composed of Context Information (CI) for business entities, systems and districts, PIs for operation, users, services, management and environment and with References. **Tables 16.5.2** and **16.5.3** shown below is definition of PIs and CI in the Japanese national guidelines.

Table 16.5.2 Context Information (CI) and Performance Indicators (PIs) from Japanese National Guidelines "Guideline for Improving O&M for Wastewater Systems" (2007)

Context Information (CI)	
Content information means background information of a district about legal framework, geological conditions, population, and capacity of facilities, conditions for operation and maintenance, and environment. CI is composed of 25 items and categorized as follow.	
1)	Characteristics of an undertaking: 9 items (example of items: name of undertaking, application of local public entity law, name of project, scale of project, and number of employees, etc)
2)	Characteristics of a project: 12 items (example of items: population in administrative district, served population, population density, and service ratio, etc)
3)	Characteristics of a district: 4 items (example of items: annual rainfall, average temperature, future population (base year 2000 as 100%), and classification of receiving water body, etc)

Performance Indicators (PIs)
Performance indicator means indicator to evaluate quantitative results and levels of operation and maintenance service. PIs are composed of total 56 items. The breakdown of 56 items is 1) Operation (Sewers): 7 items, 2) Operation (Wastewater Treatment): 12 items, 3) User Services: 17 items, 4) Management: 13 items, and 5) Environment: 7 items. The contents are listed in Table X.9.3

Source: Guideline for improving O&M of wastewater system, 2007, Japan Sewage Works Association

Table 16.5.3 Details of Performance Indicators (PIs) (56 Performance Indicators (PIs))

No	Category	Performance Indicator (PI)	Calculation Formula	Improvement
(1) Operation (Sewers) (7 Items)				
1	Op10	Ratio of age of facility (sewer)	= Total length of sewers exceeding life time / Total length of sewers maintained x 100	↓ (lower the better)
2	Op20	Ratio of inspected sewers	= Total length of inspected sewers / Total length of sewers maintained x 100	↑ (higher the better)
3	Op30	Ratio of repaired sewers	= Total length of repaired sewers / Total length of sewers maintained x 100	↑ (higher the better)
4	Op40	Ratio of inspected house connections	= Number of inspected house connection / Total number of house connection x 100	↑ (higher the better)
5	Op50	Number of repaired house connections (per 100,000)	= Number of repaired house connection / Total number of house connection x 100,000	↑ (higher the better)
6	Op60	Number of collapse per 1 km of sewer	= Number of collapse / Total length of sewers maintained	↓ (lower the better)
7	Op70	Maintenance cost per 1 m of sewer	= Maintenance cost for sewers / Total length of sewers	↓ (lower the better)
(2) Operation (Wastewater Treatment) (12 Items)				
8	Ot10	Ratio of age of main equipment	= Total age of main equipment / Total average life time of main equipment x 100	↓ (lower the better)
9	Ot20	Ratio of marginal wastewater treatment capacity	= (1 – Daily maximum DWF / Design capacity for DWF) x 100	↑ (higher the better)
10	Ot30	Ratio of emergency power source security	= Number of STPs with emergency power source / Total number of STPs x 100	↑ (higher the better)
11	Ot40	Ratio of earthquake resistant facilities	= Number of earthquake – resistant buildings / Number of buildings to be earthquake – resistant x 100	↑ (higher the better)
12	Ot50	Compliance with discharge	= Number of tests compiled with standard	↑ (higher the

		standard (BOD)	(BOD) / Total number of tests (BOD) x 100	better)
13	Ot60	Compliance with standard (COD)	= Number of tests complied with standard (COD) / Total number of tests (COD) x 100	↑ (higher the better)
14	Ot70	Compliance with standard (SS)	= Number of tests complied with standard (SS) / Total number of tests (SS) x 100	↑ (higher the better)
15	Ot80	Compliance with standard (T-N)	= Number of test complied with standard (T-N) / Total number of tests (T-N) x 100	↑ (higher the better)
16	Ot90	Compliance with standard (T-P)	= Number of test complied with standard (T-P) / Total number of tests (T-P) x 100	↑ (higher the better)
17	Ot100	Compliance with standard of odor	= Number of test complied with standard odor / Total number of tests of odor x 100	↑ (higher the better)
18	Ot110	Unit power consumption (wastewater treatment)	= Power consumed (wastewater treatment) / Total wastewater treated	↓ (lower the better)
19	Ot120	Unit disinfection chemical usage	= Annual consumption of chemical / Total wastewater treated	↓ (lower the better)
(3) User Service (17 Items)				
20	U10	Provision of storm water drainage	= Area with storm water drainage / Total planning area x 100	↑ (higher the better)
21	U20	Compliance with legal water quality standard for water body (BOD)	= Number of samples complied with legal standard (BOD) / Total number of legal tests (BOD) x 100	↑ (higher the better)
22	U30	Compliance with legal water quality standard for water body (COD)	= Number of samples complied with legal standard (COD) / Total number of legal tests (COD) x 100	↑ (higher the better)
23	U40	Compliance with legal water quality standard for water body (SS)	= Number of samples complied with legal standard (SS) / Total number of legal tests (SS) x 100	↑ (higher the better)
24	U50	Compliance with legal water quality standard for water body (T-N)	= Number of samples complied with legal standard (T-N) / Total number of legal tests (T-N) x 100	↑ (higher the better)
25	U60	Compliance with legal water quality standard for water body (T-P)	= Number of samples complied with legal standard (T-P) / Total number of legal tests (T-P) x 100	↑ (higher the better)
26	U70	Compliance with legal water quality standard for water body (E-coli)	= Number of samples complied with legal standard (E-coli) / Total number of legal tests (E-coli) x 100	↑ (higher the better)
27	U80	Sewer Blockages (per	= Number of sewer blockages / Served	↓ (lower the better)

		100,000 persons)	population x 100,000	
28	U90	Third party accidents (per 100,000 persons)	= Number of third parties accidents / Served population x 100,000	↓ (lower the better)
29	U100	Complaints (per 100,000 persons)	= Number of complaints / Served population x 100,000	↓ (lower the better)
30	U110	Response to complaints	= Number of complaints responded within one week / Total number of complaints x 100	↑ (higher the better)
31	U120	Service charge (residential)	= According to local government	-
32	U130	Unit operating cost per person (O & M)	= Operating cost (O & M) / Served population	↓ (lower the better)
33	U140	Unit capital cost (capital)	= Capital cost (wastewater) / Served population	↓ (lower the better)
34	U150	Unit cost (O & M + capital)	= Cost (wastewater) / Served population	↓ (lower the better)
35	U160	Unit revenue per staff	= Revenue / Number of staff	↑ (higher the better)
36	U170	Unit revenue water per staff	= Annual volume of revenue water / Number of staff	↑ (higher the better)
(4) Management (13 Items)				
37	M10	Unit revenue water per person per day	= (Annual revenue water / number of days) / Served population	↑ (higher the better)
38	M20	Accounted –for water	= Annual accounted-for water / Total treated wastewater x 100	↑ (higher the better)
39	M30	Current balance	= Gross earning / Total cost x 100	↑ (higher the better)
40	M40	Transfer ratio (profitable earning)	= Transfer / Profitable earning x 100	↓ (lower the better)
41	M50	Transfer ratio (capital earning)	= Transfer / Capital earning x 100	↓ (lower the better)
42	M60	Unit revenue	= Total revenue / Total accounted-for water	↑ (higher the better)
43	M70	Unit wastewater treatment cost	= Wastewater treatment cost / Total accounted-for water	↓ (lower the better)
44	M80	Unit wastewater treatment cost (O&M)	= Wastewater treatment cost (O&M) / Total accounted-for water	↓ (lower the better)
45	M90	Unit wastewater treatment cost (capital)	= Wastewater treatment cost (capital) / Total accounted-for water	↓ (lower the better)

46	M100	Cost covering ratio	= Service charge revenue / Wastewater treatment cost x 100	↑ (higher the better)
47	M110	Cost covering ratio (O&M)	= Service charge revenue / Wastewater treatment cost (O&M) x 100	↑ (higher the better)
48	M120	Cost covering ratio (capital cost)	= Service charge revenue / Wastewater treatment cost (capital cost) x 100	↑ (higher the better)
49	M130	Working accident (per 1 million m^3 treated wastewater)	= Number of accidents which caused 4 days of absence or more / Total wastewater treated x 1,000,000	↓ (lower the better)
(5) Environment (7 Items)				
50	E10	Pollutant reduction ratio in dry weather (BOD)	= (1 – Effluent BOD / Inflow BOD) x 100	↑ (higher the better)
51	E20	Wastewater reuse	= Wastewater reused / Total wastewater treated by advanced treatment x 100	↑ (higher the better)
52	E30	Sludge recycle ratio	= Sludge recycled / Total sludge generated x 100	↑ (higher the better)
53	E40	GHG emission per person	= GHG emission by sewerage service in terms of CO2 / Served population	↓ (lower the better)
54	E50	Compliance with standard for discharge to sewerage	= Number of compliance with standard / Total number of samples x 100	↑ (higher the better)
55	E60	Service ratio of advanced treatment for environmental standard	= Population served by advanced treatment / Served population x 100	↑ (higher the better)
56	E70	Improvement of combined system	= Area for which combined system was improved (ha) / Total area of combined system (ha) x 100	↑ (higher the better)

Source: Guideline for improving O&M of wastewater system, 2007, Japan Sewage Works Association

Table 16.5.4 Indicators from India's Service Level Benchmarking

2.2 Sewage Management (Sewerage and Sanitation				
No	Proposed Indicator	Calculation Formula	Benchmark	Improvement
2.2.1	Coverage of Toilets	= 1/(1+Total number of properties without individual or community toilets within walking distance / Total number of properties with access to individual or community toilets)*100	100%	↑ (higher the better)
2.2.2	Coverage of Sewage Network Services	= (Total number of properties with direct connection to the sewage network / Total number of properties in the service area)*100	100%	↑ (higher the better)
2.2.3	Collection Efficiency of the Sewage Network	= [Wastewater collected / ((Total water supplied + Estimated water use from other sources)*0.8)]*100	100%	↑ (higher the better)
2.2.4	Adequacy of Sewage Treatment Capacity	= [Treatment plant capacity / ((Total water consumed + Total number of properties with direct connection to the sewage network) * 0.8)] *100	100%	↑ (higher the better)
2.2.5	Quality of Sewage Treatment Capacity	= (Number of samples that pass the specified secondary treatment standards / Total number of wastewater samples tested in a month) * 100	100%	↑ (higher the better)
2.2.6	Extent of reuse and recycling of sewage (wastewater)	= (Wastewater recycled or reused after appropriate treatment / Wastewater received at STPs) * 100	20%	↑ (higher the better)
2.2.7	Efficiency in redressal of customer complaints	= (Total number of complaints redressed within the month / Total number of sewage – related complaints received per month)*100	80%	↑ (higher the better)
2.2.8	Extent of cost recovery in sewage management	= (Total annual operating revenues / total annual operating expenses) *100	100%	↑ (higher the better)
2.2.9	Efficiency in collection of sewage charge	= (Current revenues collected in the given year / Total operating revenues billed during the given year) * 100	90%	↑ (higher the better)

Source: JICA team summarized data from table of "Benchmarks at a Glance" in P. 8 and formulas from P. 40 ~ P.57, from Handbook of Service Level Benchmarking, 2008, Ministry of Urban Development, Government of India

16.5.3 Current Technical Skills and Abilities of Staffs in Supervising Agency (VNN), and implementing agency VJK and UPJN)

1) VNN and VJK O&M Staff Technical Level and Training

Sewer system supervising organization the Nagar Nigam and lower branch O&M implementing body the UPJK are conducting day to day O&M activities without any difficulty. The typical JKV organogram including the site O&M team is listed in **Figure 165.1**.

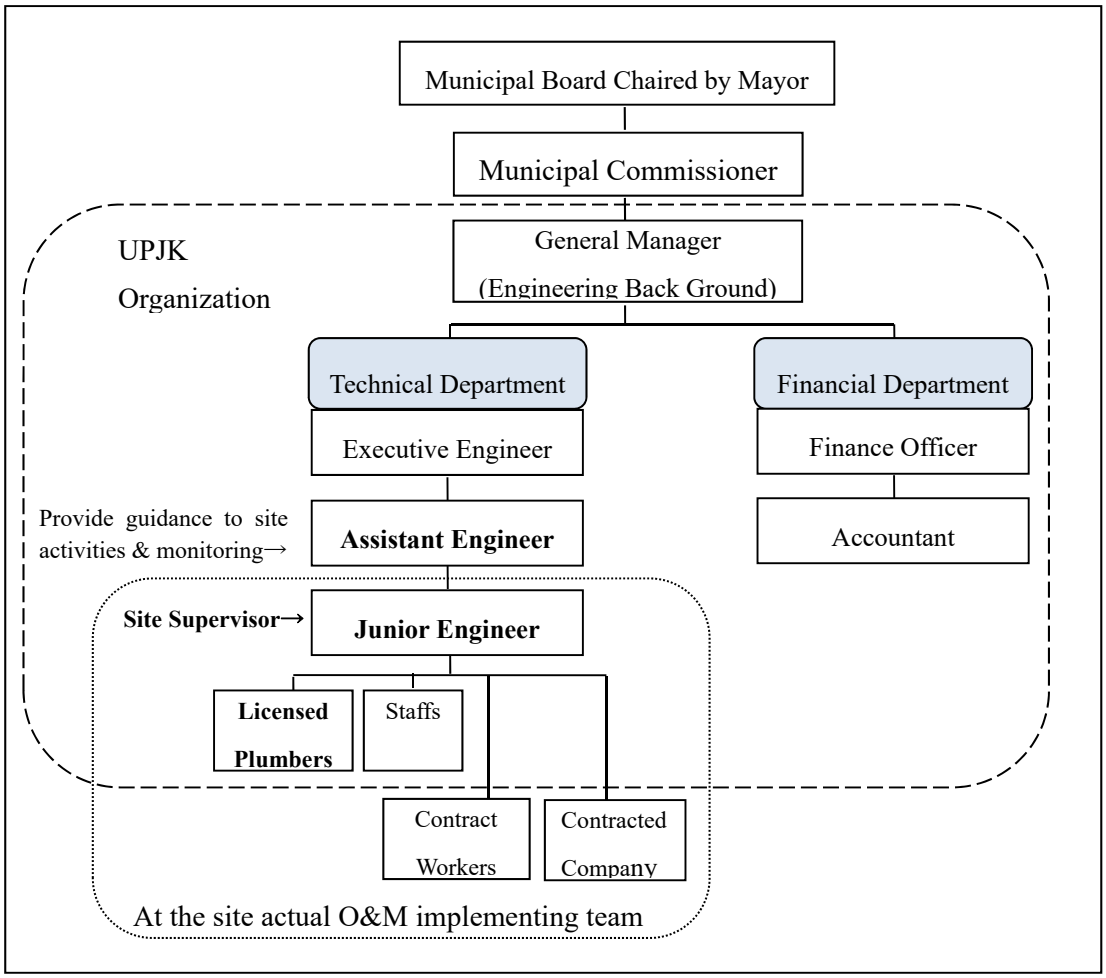


Figure 16.5.1 Typical JKV Organogram Icluding the Site O&M Team

According to UPJK managers, for daily sewer system maintenance activities that include cleaning, inspection, correspondence for sewer line clogging and minor repairs, they said there are necessary technical officers and technicians. In terms of technical aspects including needed skill and capability, shortages and need to be tackled by increasing number of site staffs and supervising officers in the future were confirmed during the interviews. The shortage is partly due to the aging sewer system that needs periodical inspection, cleaning and maintenance activities. To overcome this situation, many maintenance activities are outsourced or non-skilled

part-time workers were employed by recruiting through public announcement.

Some examples of sewer system difficulties in the case of Varanasi City are that there are sewers that are more than 100 years old and hydrogen sulphide acid gas problem due to the increase in population and human wastes, synthetic detergents and chemical products erode sewer main pipeline and concrete surfaces, that require major repair work. In the case of large-scale sewer system repair work, Nagar Nigam usually entrusts the work to UPJN for the re-construction or large maintenance/repair project.

For UPJK's managers, there are training opportunities about once a year, at outside training institutes to enhance their capacity. However, these opportunities are provided on seniority basis. Thus the actual site O&M implementing supervisors (Junior Engineer), with their busy daily work and schedule, usually cannot receive the needed training. Also city-employed staffs called "Licenced Plumber" are the expert on sewer O&M activities who support Junior Engineer (site supervisor) from technical aspect at the site operation. Licenced Plumber receives training at technical school for about 2 to 3 years, mainly in the field of the sewer O&M and then pass the exam and are certified. Licenced Plumbers are not managers and thus they too are not entitled to receive periodical training.

With all those conditions in mind, the training program for actual at the site O&M implementing supervisors such as Junior Engineer, Licensed Plumber and Assistant Engineer are needed. Also, the training program can be implemented in-house or outsourced to UPJN.

2) UPJN O&M Staff s'Technical Level and Training

Daily O&M activities are conducted at both STP and SPS with supervision of district level UPJN offices. UPJN also receive entrusted construction projects such as re-construction of sewer main pipeline or sewer system large maintenance/repair work from state government.

a) O&M staff at STP and SPS (Sewer Pumping Station) at UPJN

From hearing conducted to UPJN managers, there are training demands and needs for O&M site operators as a periodical refresher training for once a year or twice a year. Also newly assigned operator and manager may need new-comer training for smooth take over of position and for O&M implementation.

b) Sewere System Construction and Maintenance / Repair Staffs at UPJN

At India, for the sewer main pipeline construction and renewal work, the major method is by digging from top side by excavator or by manually to bury sewer piles and for those

traditional construction, the technique is already available at India and thus there are no problem in terms of technical aspect.

On the other hand, at the hearing conducted to UPJN managers, there are some demands for new technologies such as Pipe Jacking Technology which is under the proposed scheme in Varanasi and Mirzapur. The technology is used in Japan and in the western countries very often. The request of the training was more like introductory course on how the technology can be utilized and construction sequences, etc.

16.5.4 Training Plan and Capacity Development for O&M

For sewer O&M operator and supervisors, and for newly assigned manager, the needed training programs can be categorized into 4 types. The details of those training courses are lited below.

It should be noted that the contents of overseas and local training mentioned in this report show the ideas of the consultants.

(1) O&M Personnel Training of Newly Assigned Supervisors, Operators and Managers for Sewer Network

Training Purpose:	The purpose of this training course is to make aware of the importance of O&M of Sewer System, overall sewer system and function of each section, i.e. sewarage pipeline, SPS, and STP, and to make smoth implementation of various tasks at assigned destination (position) for newly assigned supervisors, operators, and managers.
Training Target:	For Nagar Nigam, UPJK, UPJN, and SPE(V). For Newly Assigned Supervisors, Operators, and for Managers who will involve in Sewerage facility O&M.
Training Pediod:	About 5 days (Within 5 days of training period, the main lecture is morning session only and for afternoon session the site visit and O&M activities observation will be conducted.)
Training Offering Time/Frequency	At Start-up phase, and once a year or once in two years
Training Instructor:	Can be in-house instructor or can be outsourced to UPJN, etc
Training Schedule:	5 days full day program. (See **Table 16.5.5**)

Table 16.5.5 Training Program for Newly Assigned Sewer O&M Operator, Supervisor and Manager

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	**9:00 Registration** **9:10 Orientation** Purpose of the Training **9:15 Lecture 1** What is Sewer, what is the benefit of sewer system? (Basic system) **10:45 Tea Break** **11:00 Lecture 2** The policy of Indian Government and preservation of nature of Ganga River	**9:00 Registration,** **9:10 Icebreaking,** Information Shearing **9:15 Lecture 4** Function of sewerage main pipe line **10:45 Tea Break** **11:00 Lecture 5** Maintenance of main pipe line.	**9:00 Registration,** **9:10 Icebreaking,** Information Shearing **9:15 Lecture 6** Function of sewage pumping station (SPS) Introduction of Simultaneous plural distanced monitoring and control system for **10:45 Tea Break** **11:00 Lecture 7** Operation and maintenance of SPS.	**9:00 Registration,** **9:10 Icebreaking,** Information Shearing **9:15 Lecture 8** Function of Sewage Treatment Plant (STP) **10:45 Tea Break** **11:00 Lecture 9** Operation and maintenance of STP	**9:00 Registration,** **9:10 Icebreaking,** Information Shearing **9:15 Lecture 10** Daily, weekly, monthly, quarterly and annual O&M activities planning for sewerage pipe line, SPS, STP and project planning **10:45 Tea Break** **11:00 Case Study and Group Exercise** (Assignment given for annual schedule planning of pipe line, SPS and/or STP)
Lunch	**12:30 Lunch**	**12:30 Lunch**	**12:30 Lunch**	**12:30 Lunch**	**12:30 Lunch**
PM	**13:30 Lecture 2** What is the purpose of maintenance? Traditional Maintenance Methodology. **15:00 Tea Break** **15:30 Lecture 3** Preventive maintenance Periodical maintenance Schedule control **17:30 Class ending**	**13:30 Moving by Car** **14:30 Field Survey 1** Sewage Main Pipeline Site or Pipeline Construction site Visit Visit to the sewage unconnected river / creek (example: Varanasi) **17:30 Class ending**	**13:30 Moving by Car** **14:30 Field Survey 2** Sewage Pumping Station Visit and observation of O&M activities (example: Varanasi) **17:30 Class ending**	**13:30 Moving by Car** **14:30 Field Survey 3** Sewage Treatment Plant Visit and observation of O&M activities (example: UPJN Varanasi) **17:30 Class ending**	**13:30 Group Exercise continue** Group work Each group write & display planed results **15:15 Tea Break** **15:30 Presentation** Presentation by each group. Q & A Session **Certificate Giving** **Picture Taking** **17:45 Class ending**

(2) O&M Personnel Training of Newcomers for Sewer Network

Training Purpose: The purpose of this refresher training is to enhance O&M supervisor and operator's ability, knowledge and skills, and also to deepen the understanding of inportance of Sewer system maintenance.

Training Target: For UPJK Junior Engineer, Licenced Plumber and Assistant Engineer, and SPV's O&M staffs

Training Pediod: For 3 days~ 5 days (In the case of 3 days training, the course will be

held in both morning and aftenoon session. In case of 5 days of training,only mornign session will be conducted, and after lunch is for their daily work. The reason of short period is due to O&M supervisors' day to day busy O&M work and activities. Therefore if the time are allowed, full 5 days shall be utilzed including actual sewere cleaning machine practice / OJT can be implemented in afternoon session.)

Training Offering Time/Frequency: Once a year or Twice a year

Training Schedule: 3 days full day program, or 5 days mornig session program. The contents of those course are listed in **Table 16.5.6.**

Table 16.5.6 Training Program for Sewerage O&M Supervisor for 3 days Concentration

	Monday	Tuesday	Wednesday
AM	**8:45 Registration** **9:00 Orientation** Purpose of the Training **9:15 Lecture 1 Sewer Function** 10:45~ 11:00 Tea Break **11:00 Lecture 2 Policy**	**8:45 Registration** 9:00 Icebreaking and Information Shearing **9:15 Lecture 5 Sewerage Cleaning techniques ②** 10:45~ 11:00 Tea Break **11:00 Lecture 6 Sewerage Cleaning techniques ③**	**8:45 Registration** 9:00 Icebreaking and Information Shearing **9:15 Lecture 7 New Equipment for Sewerage O&M** 10:45~ 11:00 Tea Break **11:00 Lecture 8 Sewerage Damage Investigation and Repairing Techniques and New Technology**
Lunch	12:30 ~ 13:30 Lunch	12:30 ~ 13:30 Lunch	12:30 ~ 13:30 Lunch
PM	**13:30 Lecture 3 Purpose of O&M, Patrol and Pipe Inspection** 15:00 ~ 15:30Tea Break **15:30 Lecture 4 Sewerage Cleaning Techniques ①** 17:30 Class ending	13:30 Moving by Car **14:00 Field Survey 1** 17:30 Class ending	**13:30 Lecture 9 New Technology, Future Technology and Way Forward** 15:00 ~ 15:30Tea Break **15:30 Group Exercise and Discussion** 17:30 Class ending

Table 16.5.7 Course content for Training Program for Sewerage O&M Supervisor

No.	Name of the Course	Course Content
Orientation	Orientation	Appreciation to daiy hardwork. Purpose of the refresher and new staff training. Importance of sewerage and O&M activities for the society.
Lecture 1	Sewer Function	Sewerage system and each facility's function. Function of Sewage Main Pipe Line
Lecture 2	Policy	The policy of Indian Government and preservation of nature of Ganga River
Lecture 3	Purpose of O&M, patrol and pipe inspection	What is the purpose of maintenance? Patrol of sewerage system from road side and inside pipe inspection using worker entering visual checking and TV camera checking (for

		main pipes and for lateral pipes)
Lecture 4	Sewerage cleaning techniques ①	Inside pipe cleaning techniques ①: Large diameter pipe: traditional method by human power
Lecture 5	Sewerage cleaning techniques ②	Inside pipe cleaning technology ②: Small diameter pipe: water – jetting sewer cleaner
Lecture 6	Sewerage cleaning techniques ③	Inside pipe cleaning techniques ③: Inverted siphon pipe: submerged stretcher and horizontal small bucket operation.
Field Survey 1	Field Survey 1	Sewage Main pipeline maintenance site visit using new machines and new methods (example: in Varanasi)
Lecture 7	New Equipment for Sewerage O&M	Maintenance of Main Pipe Line using New Technology and Equipment (i.e. horizontal bucket machine, high pressure sewage washing machine, and vacuum car, etc.)
Lecture 8	Sewerage Damage Investigation and Repairing Techniques and New Technology	Type of sewerage damages (type of clogging, damage by other construction, and erosion by sulfuric aside gas, etc.) and repairing techniques.
Lecture 9	New Technology, Future Technology and Way Forward (Using Japan's existing technologies as an example)	1 Pipe jacking technology, 2 Sewerage pipe relying technology for existing pipeline and automated robot coating (as a similar effect as new pipeline construction), 3 Sewerage main pipe inspection and damage information computer database (mapping), 4 Priority of improvement and repair work analysis using computer database (mapping), and 5. Way forward

(3) O&M Personnel Training for STP and SPS Operators and Engieer (for UPJN Regional Officers and SPV')

Training Purpose: The purpose of this refresher training course is to enhance O&M supervisor and operator ability, knowledge and skills, and also to deepen the understanding of inportance of SPS and STP maintenance.

Training Target: For UPJN's actual operators and engineers in STP and SPS, and O&M staffs in SPV.
(In the case of UPJN, 1. ASP / Biofiltration Operators, 2. Power Plant Opperators, 3. Aerated Lagoons Operator, and 4. UASB Treatment Plant Operator if UASB plant exist). For newly assined operators and managers, both are eligible to receive the training. In the case of SPE (SPV) officers, the eligible trainer will be equivalent to UPJN cases)

Training Pediod: For 3 days~ 5 days (In the case of 3 days training, the course will be held in both morning and aftenoon session. In case of 5 days of training,only mornign session will be conducted and after lunch is for daily work. The purpose of short training period such as 3 days or 5 days morning session is due to the busy O&M supervisors' day to day work schedule. If the time are allowed, then actual machine peration OJT activities at the site can be implemented in afternoon session and utilize 5 days folly.)

Training Offering Time/Frequency: Once a year or Twice a year

Training Schedule: 3 days full day program, or 5 days mornig session program. The contents of those course are listed in **Table 16.5.8**.

Table 16.5.8 Training Program for STP and SPS Operator for 3 days Concentration

	Monday	Tuesday	Wednesday
AM	**8:45 Registration** **9:00 Orientation** Purpose of the Training **9:15 Lecture 1 Sewer Function** 10:45~ 11:00 Tea Break **11:00 Lecture 2 Policy of Indian Government**	**8:45 Registration** 9:00 Icebreaking and Information Shearing **9:15 Lecture 5 Details of aeration and its types, and involved bacteria** 10:45~ 11:00 Tea Break **11:00 Lecture 6 Facility cleaning and 5S activities**	**8:45 Registration** 9:00 Icebreaking and Information Shearing **9:15 Lecture 7 Machine cleaning and maintenance** 10:45~ 11:00 Tea Break **11:00 Lecture 8 Machine and facility maintenance principle (periodical and preventive maintenance principle)**
Lunch	12:30 ~ 13:30 Lunch	12:30 ~ 13:30 Lunch	12:30 ~ 13:30 Lunch
PM	**13:30 Lecture 3 Purpose of O&M, Patrol of SPS and STP, and Inspection** 15:00 ~ 15:30Tea Break **15:30 Lecture 4 Mechanism of each system in STP** 17:30 Class ending	13:30 Moving by Car **14:00 Field Survey 1** Visit of model STP and SPS 17:30 Class ending	**13:30 Lecture 9 Safety measure and precaution. Safe environment and in case of emergency** 15:00 ~ 15:30Tea Break **15:30 Group Exercise and Discussion, and Case Study** 17:30 Class ending

Table 16.5.9 Course contents for STP and SPS Operator

No.	Name of the Course	Course Content
Orientation	Orientation	Appreciation to daiy hardwork. Purpose of the refresher and new staff training. Importance of STP and SPS, and O&M activities for the society.
Lecture 1	Sewer Function	Sewerage system and each facility's function. Function of Sewage Pipe Line, SPSs and STP.
Lecture 2	Policy of Indian Government	The policy of Indian Government and preservation of nature of Ganga River
Lecture 3	Purpose of O&M, patrol of SPS and STP and inspection	What is the purpose of maintenance? Prolonging equipment life and cost reduction for long run. Daily patrol of SPS and STP and inspection. What need to be inspected and maintained, etc.
Lecture 4	Mechanism of each system in STP	Pretreatment, primary treatment, secondary (advanced) treatment and aeration, and tertiary treatment. Details of each mechanism and functions.

Lecture 5	Details of aeration and its types (biological nutrient removals types), and involved bacteria	Biological nutrient removals and type of secondary (advanced) treatment process and differences in each design (Standard process, AO process, A2O process, Step A2O process and AOAO process). Process involved bacteria and fungi, for Nitrogen and phosphorus removal.
Lecture 6	Facility cleaning and 5S activities	Concept of 5S (sorting, set-in-order, shining/sweeping/cleaning, standardize, and sustain the good practice) and importance of clean facilities at STP and SPS.
Field Survey 1	Field Survey 1	Visit of model STP and SPS (example: in Varanasi)
Lecture 7	Machine cleaning and maintenance (Electrical device, hydraulic equipment, mechanical moving devices, electrical components, etc)	Methodology of how to clean and maintain each machine by types (i.e. Electric motor, gear, hydraulic piston and hydraulic equipment, mechanical moving devices, diesel engine, electrical components, PLC, computer, monitor and electrical instrumental panel, etc). Use of cleaning cloth, cleaning tool, air pressure and water pressure machine. Place where you cannot use air pressure and water pressure cleaning device: hydraulic piston and equipment) Use of cleaning chemical, oil change and lubricating. Type of oil lubricant and grease. Periodical filter change, etc.
Lecture 8	Machine and facility maintenance principle (Periodical Maintenance, and Preventive Maintenance Theory)	Periodical maintenance schedule planning and maintenance theory. Contents can be following; 1. Introduction, 2. What conditions are necessary so that operator does not cause anybreakdowns?, 3. What is Productive Maintenance (PM)?, 4. Classification of maintenance methods: a) Preventive Maintenance: a1) Time Based Maintenance, and a2) Condition Based Maintenance, b) Breakdown Maintenance: b1) Planned Breakdown Maintenance, b2) Emergency Maintenance, c) Corrective Maintenance,and d) Maintenance Prevention, 5. Total Productive Maintenance (TPM), 6. Reasons why everyone should participate in Productive Maintenance, 7. Six Major Losses (i.e. Loss due to failure, Loss due to arrangement and adjustment, Loss due to idling and a short shutdown, loss due to speed reduction, loss due to defect and correction, and loss due to starting up and yield), 8. Relations between Minor Defects and Major Defects (How do these losses occure? and Heinrich's Law), 9. From Forced Deterioration to Natural Deterioration, 10. For Zero Failure: a) Maintenance of basic condition, b) Observe the operating conditions, c) Recover deterioration, and d) Increase opration and maintenance skills.
Lecture 9	Safety measure and safety precausion. How to development of safe working environemt. What to do in case of emergency occured	Presentation on safety device (working uniform / clothes, helmet, grove, eye goggles, mask, safety shoes / boots and safety belt), reliable devices and facilities (ladder, stepladder, scaffold (plank), and handrail), separation of working area and walkway, signboard, danger zone, and enclosed space (CO2 and sulphuring aside gas) and caution for hazardous chemicals, etc. Where to call and what to do when emergency occurred (emergency contact list (telephone tree), facility damage, and human injury (first aid), etc.).
Lecture 10	Group Exercise and Discussion, and Case Study	Assignment given for annual schedule planning of STP and SPS maintenance.

(4) Consideration of Training in Japan and Sharing of Japanese Experience

As a part of the project, consideration of corroboration activities between Japanese side and India side needed to be considered. On August 30th, 2014, in the presence of Mr. Narendra Modi, the Prime Minister of India and Mr. Shinzo Abe, the Prime Minister of Japan, Varanasi City and Kyoto City signed a letter of intent for cooperation as partner cities and confirmed the intents of enhanced collaboration and promotion of interactions between the two cities in the area of cultures, arts, academics, conservation of historical heritages and modernization of city. Through interactions followed thereafter at workshop conducted on January 2015, both cities have shared the understanding on severe issues of waste management systems in Varanasi City, and hereby confirm the collaboration to the following extent.

With above bilateral cooperation ongoing, for India's governmental officers who develop water related environmental policy and/or decision making, and for engineers and managers who want to introduce new sewer related technology and river cleaning technology, to shear Japan's municipality level sewerage knowledge, the consideration of future workshop and Japan training at Kyoto City can be considered. The tentative visiting plan for sewer and river cleaning related organizations in Kyoto City and in Kansai Area is listed in **Table 15.5.10**.

It should be noted that the contents of overseas and local training mentioned in this report show the ideas of the consultants

Sample plan of Japan Training in Kyoto underb ODA Loan Scheme (Reference Plan) is descrobe below.

Training Purpose:	The purpose of Japan training is for India's governmental officers who develop river water and sewer related environmental policy and/or decision making, and for engineers and managers who want to introduce new sewerage related technology and river cleaning technology, to shear Japan's municipality sewerage know-how. With the consideration of information shearing workshop and survey activities, the Japan training at Kyoto City can be considered.
Component of Japan Training Plan	Effect that construction of a sewage system has on a city ・ Construction of a sewage tailored to city's conditions ・ Measures to enhance residents' awareness of the importance of maintaining the aquatic environment ・ Cutting-edge sewage treatment technology and examples of its application ・ Concept of sewage tariff levy and status of implementation ・ Sludge treatment ・ Reuse of reclaimed wastewater

Objectives

- Use of empty upper area at sewage treatment plant
- Sewer construction

a) To understand the history of sewage systems in cities and the effect of their installation
b) To learn about cutting-edge technology used with sewage treatment and environmental protection
c) To understand the importance of improving residents' awareness

Details of sample visiting sites**:** As listed in **Table 16.5.10**.

Table 16.5.10 Details of Japan Training in A City (Sample Plan: Using Yen Credit Scheme)

No	Subject	Type	Lecturer request	Content	Objective
1	Activity of A City: (Part 1)	Lecture and discussion (for information shearing)	City of A, Sewer Department Planning Division	Hearing of activities conducted by A City and their continuous water related activities namely "Live Together with Water (Symbiosis) Plan (City wide activities)" and history of improvements to aquatic environment in A	a)
2	Activity of A City: (Part 2) XX River Rejuvenation Pilot Activities	Visit to XX River and site observation	City of A, River Development Section / Sewer Department	Visit to XX river site and lecture on "XX River Rejuvenation Pilot Activities" with citizens participation type development for river water flow planning and cleaning activities involving citizens.	a), c)
3	YY Sewage Treatment Plant	Visit	City of A, Environmental Department	To observe the STP to see how energy is efficiently used in a sewage treatment plant (Solar and Waste Gas Generator)	b), c)
4	Recent Sewer and Environmental Clean Technology Development activities at Research Institutes (A University Graduate School of Engineering, Department of Environmental Engineering)	Visit	A University Graduate School of Engineering,	To learn about cutting-edge technology used with sewage treatment and environmental protection	b)
5	ZZ Sewage Treatment Plant	Visit	E City	To observe sewage treatment plant, applying the membrane treatment on the largest scale in Japan, and learn about the difference with standard treatment methods and plant condition during operations.	b)
6	C Museum	Visit	C Museum in D Prefecture	To hear the natural functions of Lake C which is one of the world's oldest lakes, and the source for the metropolitan district, as well as its history and people's lifestyle. Training participant will be given a tour of the museum, which raises	c)

				residents' awareness about environmental conservation at the lake.	

16.5.4 Conclusion

At the central government level, it has been recognized through the experience with past programmes that once projects are completed the ULBs pay little attention to the operation and maintenance of infrastructure assets created. Therefore, the NGRBA Guidelines as well as the AMRUT schemes require the tender to include O & M for five years. The NGRBA will share 70% of the O&M cost for the first five years, and the ULB is to then on pay the full amount of O&M through user fees. The Guidelines provide clear instructions and methodology for determining the O&M cost, and these methodologies will be followed once the construction costs are determined during the course of this Preparatory Survey.

The NGRBR/AMRUT recommended O&M arrangement is much different to the current arrangement where the Nagar Nigam performs the O&M of the sewerage assets through its own staff; the Jal Kal staffs perform the O&M of sewer lines whereas the UP Jal Nigam performs the O&M of the sewage pump stations and the treatment plants. This arrangement will need to change, and the Nagar Nigam will have a more of a supervisory role for the O&M of the assets. A policy decision in this regard is required at the Government level through discussions with UP Jal Nigam and Nagar Nigams (Municipal Bodies).

CHAPTER 17 Construction Cost Estimates and Implementation Plan

<Object of the Study>

Construction cost for the projects was estimated and implementation plan was established.

<Result of the Study>

For the construction cost, refer to the relevant tables. Design-Build method for STP is recommended from the current practices in the similar projects in India. While for the construction of sewers, Design-Bid-Construction method shall be adopted, since this work needs to adjust/arrange right of way for pipe laying and house connections with beneficiaries. ICB would be applied for all packages in view of securing the quality assurance and time management for constructing the facilities. On the other hand, supporting components of the Project for Capacity Development for UPJN in application of GIS and MIS, and Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of Environmental Management Plan, LCB is recommended instead of applying ICB.

17.1 Project cost of each DPR

17.1.1 Collected Project cost

UPJN provided 11 DPRs to JST for conducing the review of their contents in the first field survey whereas some DPRs were under preparation by UPJN. **Table 17.1.1** to **Table 17.1.15** show the cost and construction duration of each DPR. The project cost on each DPR contains not only the construction and other relative costs but also several taxes and O&M cost. **Table 17.1.16** summarises the planned construction commencement year and construction period of the projects mentioned in each DPR. Most of construction works are completed within 30 months, however there are no detailed implementation plan in each DPR.

Table 17.1.1 Rehabilitation and Upgradation of Existing STPs at Dinapur & Bhagwanpur

Confidential

Confidential

Table 17.1.2 Ramna STP (Comprehensive)

Confidential

Table 17.1.3 Mirzapur (comprehensive)

Confidential

Table 17.1.4 Mirzapur (I&D-part 1)

Confidential

Table 17.1.5 Mirzapur (I&D-part 2 A-1)

Confidential

&D)

Table 17.1.6 Mirzapur (I&D-part 2 A-2)

Confidential

Table 17.1.7 Chunar (Comprehensive)

Confidential

Table 17.1.8 Chunar (I&D)

Confidential

Table 17.1.9 Ghazipur (Comprehensive DPR)

Confidential

Table 17.1.10 Saidpur (Comprehensive DPR)-in preparation

Confidential

Table 17.1.11 Varanasi District I (Comprehensive DPR)

Confidential

Table 17.1.12 Varanasi District II (Comprehensive DPR)

Confidential

Table 17.1.13 Varanasi District III (Comprehensive DPR)

Confidential

Table 17.1.14 Ram Nagar (Comprehensive DPR)

Confidential

e)

Table 17.1.15 Ramnagar (I&D DPR)

Confidential

Table 17.1.16 the planned construction commencement year and construction duration on project mentioned on each DPR

Confidential

17.1.2 Review of each DPR

1) General

Based on the review of DPRs conducted by JST during the first and second field surveys, following items are revealed.

- Construction cost on each DPR is estimated based on SOR and quotation and unit price on piping work is calculated from SOR.

- Cost estimation method for project cost is 'buildup approach' on each DPR, which is similar to that of being applied in Japan.

-However, lack of documents, miscalculation on MS-excel sheet are seen on each item in DPRs. Therefore, it is difficult to check/track where each figure comes from on each unit price.

- JST also requests to UPJN to wrap up the unit price on the table. (See **Table 17.1.17**)

-JST requests to recheck/revise the unit price for each item and acquire quotations that is utilized on cost estimation on DPR.

- There are some difficulties of acquiring a quotation of each item from the contractor/supplier.

The reasons for this are as follows:

1. The contractor/supplier knows that submitted quotation is only used for budgetary purposes,
2. The contractor/supplier considers that the price of each item is his intellectual asset so that he hesitates to submit his information to the third party, and
3. The contractor/supplier is afraid of being come out his information to his opponents.

- Detailed implementation schedule such as bar charts is not specified whereas most of construction period of each project are set at three years in each DPR. Construction period of sewer networks is not mentioned in its report as well.

Table 17.1.17 Price checking sheet (reference)

Material rate Unit: Rs

Code	Description of Item	Unit	Rate
M.1			

Note: this type of table is made by each item such as material, labour, electrical equipment and mechanical equipment. SOR is also wrapped up in the table.

2) STP Cost

Estimated STP construction cost in Mirzapur and Chunar DPRs is calculated by using the cost function referred to the book titled "Sewage Treatment in Class I Towns: Recommendation and Guidelines (*Report Code: 003_GBP_IIT_EQP_S&R_02_Ver 1_Dec 2010*)" published in 2010. The reference book indicates the construction cost per MLD of several wastewater treatment process such as SBR, Water Stabilization Pond, etc., which is commonly used for estimating STP cost with consideration of price escalation in India. However, there is a doubt whether cost estimation using the cost function per MLD is appropriate, although it is utilized for estimating STP cost in India.

In this regard, JST examines 1) STP cost estimated by tender awarded price on Current project implemented in UPJN and 2) STP cost per MLD by existing projects on detailed design stage and Tender awarded price on existing projects. If both STP cost per MLD are close figure, it is concluded that unit function by using STP cost per MLD is appropriate for estimating STP cost.

a) Project cost on Current project in UPJN

There is only one STP construction project, the capacity of wastewater flow is 140 MLD, tendered in Dinapur on 2014 and it is under construction in current whereas there are many construction work on sewer network and pumping stations in Varanasi and surrounding areas.

Table 17.1.18 shows STP cost estimated by detailed design stage and tender awarded price on Dinapur STP. The difference between two costs is 8 Crores and Tender awarded price is approximately 5%.

Table 17.1.18 STP cost estimated by detailed design stage and tender awarded price on Dinapur STP

Item	STP Cost per MLD (Crores)	Tender Awarded price (Crores)	Remarks
Dinapur STP	162	170	

Source: NJS EI Office

b) Project cost on existing project in India

i) MLD cost on Detailed Design stage

Table 17.1.19 shows STP cost per MLD by existing projects on detailed design stage. The number of existing projects on detailed design stage is 11 projects in India and wastewater flow on projects ranges from 7 MLD to 125 MLD. All projects were conducted in 2013.

STP cost per MLD by existing projects on detailed design stage is 135 lacs Rs.

Table 17.1.19 STP cost per MLD by existing projects on detailed design stage

Item	STP Cost per MLD (Lacs)	Number of project	Wastewater flow (MLD)
Detailed Design	135	11	7-125

Source: NJS EI Office

ii) MLD cost by Tender awarded price

Table 17.1.20 shows STP cost per MLD by Tender awarded price on existing projects. The number of Tender awarded cost on existing projects is 20 projects in India and wastewater flow amount on projects ranges from 20 MLD to 202 MLD. All projects were conducted between 2006 and 2013.

STP cost per MLD by Tender awarded price on existing projects is 149 lacs Rs.

Table 17.1.20 STP cost per MLD by Tender awarded price on existing projects

Item	STP Cost per MLD (Lacs)	Number of project	Wastewater flow (MLD)
Tender awarded	149	20	20-202

Source: NJS EI Office

c) Conclusion

The result of comparison on 1) STP cost by tender awarded price on Current project imple-

mented in UPJN and 2) STP cost per MLD by existing projects on detailed design stage and Tender awarded price on existing projects show that tender awarded price is 5 to 10% higher than estimated cost on detailed design stage. However, it is considered that 5 to 10% difference is in tolerance because the actual cost such as tender price is normally affected external factors such as price escalation on market and economical condition in India. In conclusion, cost function for estimating STP cost on DPR is applicable on this project.

17.2 Procurement plan

17.2.1 General Condition of Bidding

All biddings for public works in India should follow the India tender laws and Tender Transparency Act stipulated by the government of India. Each state of India has a general guideline for bidding for public works for its Local Bodies that is called the Procurement Guidelines. Currently, bidding is conducted based on notification of "The e-Procurement Solution of National Informatics Centre (NIC) of the Government of India" by each State. According to the interview survey to local engineers, 50% of tendering is conducted through e-procurement in UPJN for reducing the time and paper saving purposes. **Table 17.2.1** shows the e-Procurement trends in India, in which the number of tenders has been increasing year by year so that it is assumed that e-procurement is going to be the mainstream tendering method nationwide.

Table 17.2.1 e-Procurement trends in India

Financial Year	No. of Tenders	Value in Crores (INR)
2003 - 2004	1549	3623
2004 - 2005	4901	30822
2005 - 2006	9930	11892
2006 - 2007	21985	31487
2007 - 2008	33904	75119
2008 - 2009	44883	130061
2009 - 2010	26062	28208
2010 - 2011	47182	19675
2011 - 2012	49354	24436
2012 - 2013	67593	25191
2013 - 2014	93566	36845

Reference: http://www.eprocurement.gov.in/

E-Procurement system is introduced for processing of procuring the items/services by the Internet based on the IT Act 2000 in India to reduce 1) tendering cycle, 2) indirect cost and enhancing the transparency of the tender processing.

For the registration of e-procurement, local and foreign contractors which registered as eligible company access to e-procurement website and input necessary information (company name, company profile, physical address, size of the company etc.) on-line. The enrolment is completed once the applicant finishes required information inputted on the website, and then UP Government issues DSC (Digital Signature Certificate) to the applicant within 24 hours.

Registered contractor/ supplier finishes the enrolment of e-procurement and acquires DSC, the contractor/ supplier is able to participate tenders through the U.P Government website. Necessary procedure of participating the tender such as instruction manual and required documents for tender procedure are documented on the website and the contractor/ supplier enables to download the documents easily.

Reference: https://etender.up.nic.in/nicgep/app

17.2.2 General Situation of Local Consultants (Detail Design, Construction Supervision)

The municipal clients in India appoint consultants in various phases of a project. It can be categorised as follows:

- Planning Phase: in this phase, consultants are appointed for preparation of Feasibility Study Reports, Master Plans, and Detailed Project Reports.
- Pre-tendering Phase: consultants are appointed for doing the preliminary or detailed design based on the type of contract works. This is generally accompanied by preparation of bid document, evaluation of bids and award of contract.
- Post-Tendering Phase: consultants are appointed for doing project management, construction supervision, quality control, assistance during testing and commissioning, O&M planning etc.

In many case the last two bullets scope are submitted and the client appoints the Project Management and Construction Supervision Consultants (PMSC). However, the opportunity can come in any combination.

In India there is abundance of local as well as international consultants. Based upon the type of the project, funding source and client requirement, consultants get involved in the project both Local as well as International.

There are various local consultancy firms in India in which some are sector specific and some are multi-sectorial. The size of local consultants varies from small, medium to big. In case of externally funded projects, international consultants make partnership arrangements with local consultants. In most cases, the local consultants are associated with local funded projects as they are having a cost advantage and limited tax liability over international consultants. Presently the consultants are appointed using the QCBS (Quality and Cost Based Selection) procedure.

In many cases, international consultancy firms have opened their India subsidiaries to mitigate these constraints considering the immense market potential India provides. All the design and construction supervision are conducted as per the guidelines provided by the CPHEEO (Central Public Health and Environmental Engineering Organization). In some cases, the turnkey contractor also appoints local consultants for doing their detailed design and engineering.

17.2.3 General Situation of Local Contractor

There are a number of local contractors from a small- to large-scale in India and they correspond to a wide range of construction works such as road, bridges, water and wastewater infrastructures, buildings, factories etc. **Table 17.2.2** shows top 10 construction companies in water/wastewater sector in India. Most of the big construction companies have their own heavy machineries, leasing arrangement for the machineries and their own route for construction material procurement.

Table 17.2.2 Top 10 construction companies in water/wastewater sector in India

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UPJN categorises local contractors as Class A to Class C, based on the ability of construction works and size of the company. **Table 17.2.3** shows the number of contractors listed by UPJN. A Class A contractor is able to conduct any work with no concern of project budget. There are 101 Class A contractors and 6 Class C contractors listed by UPJN. Even class A contractors are not suitable for big budget project such as construction of a wastewater treatment plant and/or a sewer network, therefore they participate as a sub-contractor that works under major contractors if they request to be involved in the project.

Table 17.2.3 Number of contractors listed by UPJN

Class Category	Number of Company	Project Budget Allowance*
A	101	No limit
B	*Unknown (No Data)*	120 lacs
C	8	-

**Note: the allowance varies. Table shows the project budget allowance of STP construction work*

Source: UPJN office

17.2.4 Construction Method

The Government of India stipulates the IS (Indian Standard) Codes for implementing various public works in the country and the codes defines the detailed technical specification of equipment/materials to be procured and construction method to be applied for the public works.

The bidding documents for all public works provide reference to the respective IS codes to be followed which stipulates the detailed construction methods to be adopted for that activity. The measurement for works is approved by the client or client's representative only after proper scrutiny that compliance to the codes is met with.

17.2.5 Material and Equipment Procurement

Table 17.2.4 shows the status of material and equipment in Varanasi. All civil and building work materials, mechanical and electrical equipment are able to be procured in Varanasi and its surrounding areas easily. For instance, as for pipe materials, any type of piping material such as PVC, RCC, DI and GI are easily procured therein. If there is a shortage of necessary materials in Varanasi and its surrounding areas, there is no issue for back-order the suppliers in other areas and procure them. However, occasionally the imported mechanical/electrical equipment is used from other countries on the project basis.

Table 17.2.4 Status of Material and Equipment Procurement in Varanasi

Work Type	Material/Equipment	Varanasi and surrounding areas	Other Area in India	Foreign Country
(1) Civil Work	Worker	O		
	Sand	O		
	Cement	O		
	Form	O		
	Reinforcement Bar	O		
	Pile in situ	O		
(2) Pipe Material	PVC Pipe	O	O	
	RCC Pipe	O	O	
	DI Pipe	O	O	
	GI Pipe	O	O	
(3) Mechanical・Electrical	Pump	O	O	O
	Gate	O	O	O
	Valve	O	O	O
	Control Panel	O	O	O
	Transformer	O	O	O

Work Type	Material/Equipment	Varanasi and surrounding areas	Other Area in India	Foreign Country
	Generator	O	O	O
(4) Construction Machinery	Excavator	O		
	Crane	O		
	Dump Truck	O		
(5) Building Material	Brick	O		
	Interior Material	O		

17.2.6 Material and Equipment Procurement

Table 17.2.5 shows the list of national highways to Varanasi. There are two types of transportation of material/ equipment to Varanasi, which is national highways and the other is a railway.

1) National Highway

Construction materials and equipment is basically transported by the national highways NH-56, NH-2 and NH-29. The condition of national highways is almost paved, which is utilized for commuting, community road and commercial activity. However, the traffic jam is caused chronically due to unpaved and narrow roads in some parts of national highways. In addition, there is a restriction on NH-56, in which the transportation by heavy trucks is banned from 8 a.m. to 10 p.m. because of avoiding the traffic congestion by heavy trucks. Therefore, heavy trucks passing through NH-56 drive at night. There is no such a regulation on NH-29, but the traffic congestion occurs at night due to the movement of the heavy trucks.

Table 17.2.5 List of National Highway to Varanasi

National Highway	Route	Remarks
NH-56	Lucknow to Varanasi (via Jounpour)	No Entry for heavy truck from 8 a.m. to 10 p.m.
NH-2	Kolkata to Varanasi (via Delhi)	Small traffic congestion throughout the day
NH-29	Varanasi to Ghazipur (via Saidpur)	Traffic congestion during night time period

2) Railway

Indian Railway network covers all over the nation, which is utilized for commuting, traveling and transporting material because it cost cheaper than any other transportation method such as truck and airplane. However, the contractors/suppliers rarely use the railway for transporting construction material/equipment and they only use the railway for transporting a large amount of cement

for construction. The reasons for this are that 1) the local market cannot absorb the large amount of supply by train shipment and 2) there is a lot of delay on railway transportation. Thus, the contractors/ suppliers prefer to adopt trucks for transporting material and equipment even it is costlier than using railway transportation.

17.3 Implementation Plan and Construction Cost Estimates

17.3.1 General

This chapter describes the implementation plan for construction/ rehabilitation of sewerage facilities such as STP, IPS and sewer network and consulting service in the project, which contributes for improving the sewerage system in Varanasi and its surrounding area. Considerable issues occur in India, countermeasures for prompt accomplishment of the project are taken into account from the tendering stage to the completion of the project. The present cost utilized for the project is calculated on the basis of preliminary design for sewerage facilities. The final cost will be further considered through the discussion between the Indian side and the JICA so as to cover the required items by the assistance of Japanese ODA loan.

17.3.2 Conditions and Assumptions for Preparation of Implementation Plan

Establishment of the implementation plan for the project needs to consider the lessons from past projects or similar projects conducted in India. Considerable conditions and assumptions are outlined as follows.

(1) Needs for the improvement in the project implementation based on the experiences on the similar projects in India

1) Modification on the Scope of the Project

a) For preventing the modification on the scope of the project, site conditions such as topographic and geotechnical conditions needs to be confirmed before commencing the construction works and it is desirable to clarify the conditions during D/D stage.

2) Delay of land acquisition and/or legal authorization on the site

a) Land use agreement on the site should be concluded between UPJN and representative land owner prior to the Loan Agreement
b) If planned facility site needs to be relocated from the original site, necessary measures should be taken in the early stage including the legislative countermeasures.

3) Delay in processing of acquiring the concurrence

a) Selection of Consultants: NRCD should appoint a procurement specialist and the person

in charge should arrange to accomplish the selection procedure in the shortest time. As the result, approval procedure for nominating the consultant simplifies in the GoI.

b) Selection of Contractors: As Required conditions of eligible bidders of the project, the bidders should have the work experience and procurement experience on similar projects in India and/or other countries. Therefore, necessary documents should be submitted by the bidders, which declares the relevant work experience. The required documents should also include the completion certificate issued from the clients on the similar projects. The procurement specialist needs to take necessary training courses such as on-the-job training (OJT) arranged by the Consultant prior to bidding stage for selecting the contractor.

c) For shortening the approval process in UPJN, a short cut way for acquiring the approval of the procurement should be considered as follows;

- Establishment of approval committee for simplifying the approval process,
- Preparation of concise documentation format by the type of approval, which is classified to technical, administrative and accounting parts, and
- Conducting training courses for procurement specialists in UPJN before commencing the Consulting service.

4) Countermeasure for low respond to the biddings from the eligible contractors

a) Eligible contractors for the Project should be listed up in UPJN and other states in India based on the scope of work on the project.

b) For acknowledgement of the bidding of the project, the bidding announcement should be informed by any type of media such as newspaper, radio or TV.

5) Setting up the PQ conditions on the Project

a) Eligibility of bidders: The prime contractor should be selected through International Competitive Bidding (ICB). However, local contractors by the prime contractor may be employed on civil/architectural work as sub-contractors.

b) Eligible bidders for STP construction should have the work experience on large-scale construction projects which cost is more than 3 billion yen to ensure the quality of the work. The bidders should experience on O&M of STPs.

c) Qualification of staff: The condition of qualification for Project Manager and other engineer in the bidders should comprehend and communicate in English. For presenting the capability of the Project Manager and other engineers, the bidders need to submit not only the PQ, bid documents but also 1) pictures of experienced project(s) done by the bidder, 2) completion certificate(s) from the client(s) and 3) the scope of work on the project in Asian countries.

(2) Other condition on the Project

a) Downpour occurs during rainy season in Project area and it may cause flood in the city area. Therefore, weather conditions in project sites shall be taken into account for setting the construction period/months, especially for the construction of sewer networks.

b) Bidding method for sewerage facilities such as sewer network, IPS and STP should be determined by complying with procurement manners conducted in India.

17.3.3 Scope of Work for the Project

Table 17.3.1 shows the scope of work for the Project.

Table 17.3.1 Project Components for Ganga Rejuvenation Project in Uttar Pradesh

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17.4 Detailed Study on Implementation Plan

17.4.1 Packaging for Project Component

Each DPR consists of following components: (1) sewers, (2) STPs/pump stations and (3) consulting services, for instance, sewer network, IPS and STP in Chunar DPR and sewer network only in Varanasi District-1 DPR. It is easy to compile the work by DPR, not by the type of work.

The packaging of contracts mentioned in this report is proposed by the consultants. It will be further considered through the discussion between the Indian side and the JICA

Sewer

Sewerage service area in Varanasi is divided into three areas, namely District-1, District-2 and District-3. It is recommended that three districts in Varanasi should be combined in three (3) packages for sewer construction and each sewer construction work in Ramnar and Chunar should be included in STP construction work.

A. Sewage Treatment Plant (STP) including a central SCADA system

Five packages in total are recommended for the construction of STPs and PS, and the rehabilitation of STPs based on the project locations.

B. Capacity Development for UPJN

C. Strengthening in public awareness/participation and institutional capacity, and facilitation of implementation of Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP)

D. Consulting Services

Consulting firm will be employed for the two kinds of construction components of the Project; design-bid-construction for sewers; and design-built for IPSs and STPs. In addition, two components for supporting requirements (people's participation, institutional development and environmental management) are included covering TOR preparation for selection of the contractors, bidding assistance and supervision of the contractors.

Based on the contents of the work, project packages by component are divided as follows;

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bidding system and organization are applied.

The construction works for Packages 2 to 6 will include O&M of STPs for five years after the completion of facilities.

17.4.2 Procurement Method for the Implementation of the Project

(1) Contract method for the construction of sewerage system

It is considerable that all packages in the project are implemented by applying the procedure that is

utilized on typical loan project such as Japanese Yen loan. Therefore, re-measurement contract method shall adopt for the construction of sewers.

However, for the construction/rehabilitation work for STPs and IPSs, design-built method is recommended following current practices in the similar projects in India.

(2) Possibility of adopting Local Bidding

Local Competitive Bidding (LCB) does not require much time for concluding the contract comparing with International Competitive Bidding (ICB) in general so that it takes advantage for LCB rather than implementing the project by ICB. Thus, it is recommended that supporting components of the Project for Capacity Development for UPJN in application of GIS and MIS, and Strengthening in Public awareness/participation and institutional capacity, facilitation of implementation of Environmental Management Plan are conducted by LCB.

For constructing STP, ISP and sewer network, it is inappropriate to adopt LCB because the implementation of the project requires not only a wide range of knowledge and but also abundant working experience for sewerage system and it is considered that local contractors do not match with these conditions.

(3) Procurement Methods

Table 17.4.1 summarizes the procurement methods both for Consultants and Contractors.

Table 17.4.1 Procurement Method

Procurement	Scope of Work	Manner of Procurement with required process/ events
Consultants	One consultancy package: D/D, Assistance for Bidding and C/S for sewer packages of work and Basic Design, Assistance for Bidding and C/S for IPSs & STPs	ICB (Short list, QCBS)
Contractor	Construction of sewers: Design-Bid-Construction	ICB (PQ, Single stage with two envelope)
Contractor	Construction/rehabilitation of IPSs and STPs, and Central SCADA System: Design-Built	ICB (PQ, Single stage with two envelope)
Contractor	Capacity Development for UPJN and Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of EMP and EMoP	ICB/LCB (PQ, Bid, Approval)

Table 17.4.2 shows eligible contractors for the implementation of sewerage projects in India through ICB. Large number of eligible contractors in India and/or other countries is eligible for executing the project. Noted contractors have work experience on ODA typed projects in India and they are financially secured companies earn more than 500 million INR as annual income. For sewer construction, they (Indian contractors) have experiences including the construction of more than 10 km sewers as well as financial soundness (more than 500 million INR annual income).

Table 17.4.2 Potential Contractors for the Implementation of the Project

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17.4.3 Implementation Schedule by Major Component /Procurement Case

(1) Conditions of Implementation Schedule

Appraisal of the Project and Exchange of the Note between GoI and GOJ and Loan agreement are assumed to be concluded by March 2017, as shown in **Table 17.4.3**.

Table 17.4.3 Loan Agreement Schedule

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Table 17.4.4 shows the required months for the implementation of the Project under the following site conditions and assumptions.

- Rainy season from July to September and a series of national holidays usually affect the civil

works in Varanasi area. Therefore, non-working time during the construction works takes into consideration for setting the construction period.

Table 17.4.4 Package and Construction Periods

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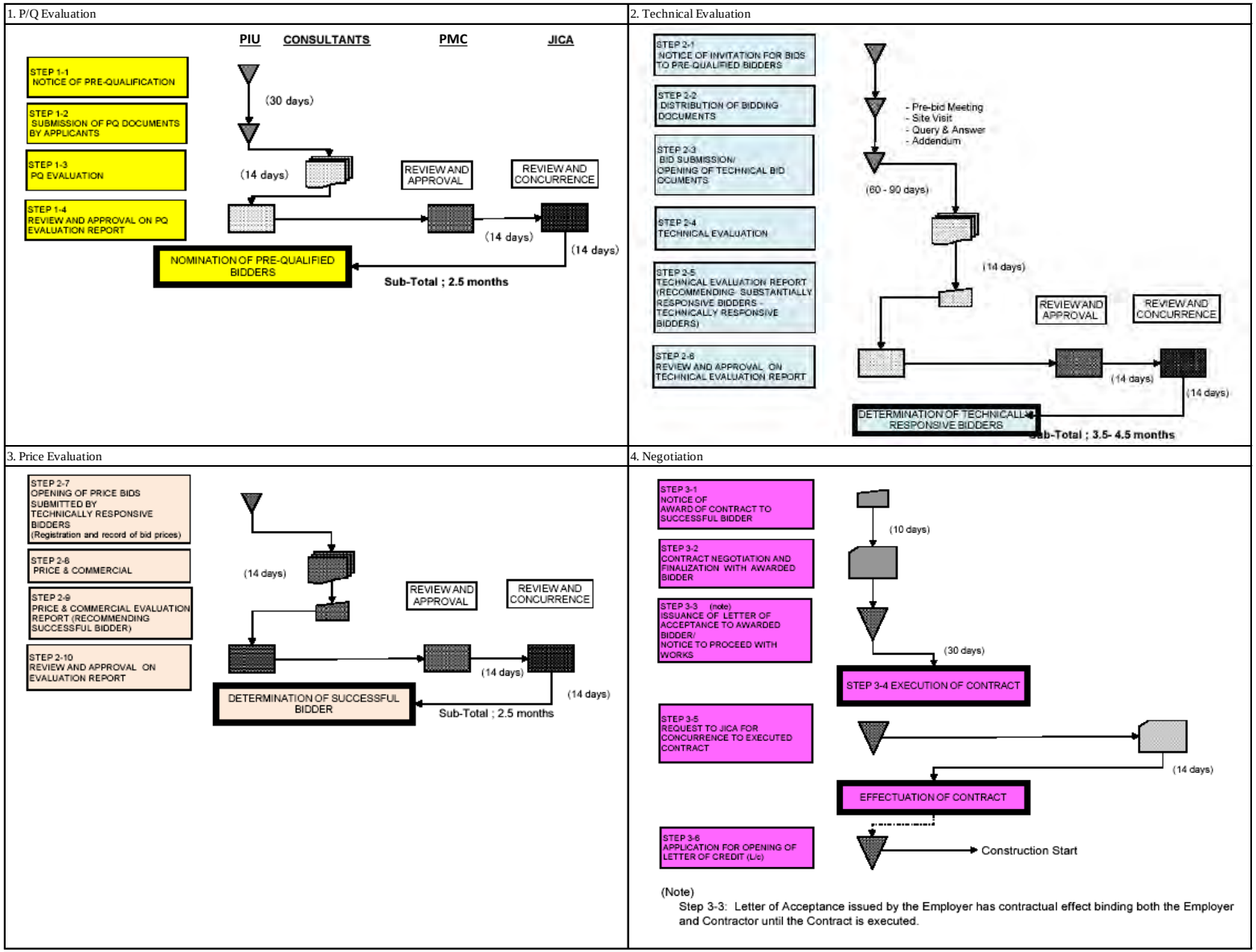
Figure 17.4.1 shows the Work-flow of bidding procedure to select contractors (Two-Envelope Bidding under JICA Procedure) and the required time by major work is summarized below.



➢ **Figure 17.4.1 Work-Flow of Bidding Procedure to Select Contractors**

- P/Q; 3 months
- Preparation of Bidding Document including JICA concurrence; 3 months
- Submission of Bid; 2 months
- Technical Evaluation/Price Evaluation including JICA concurrence; 5 months
- Negotiation to L/C; 2 months

Figure 17.4.2, Figure 17.4.3 and **Figure 17.4.4** show the implementation schedule for the Project. The construction periods for each package are set based on submitted DPRs. The duration of the construction period mentioned in the DPR is adequate compared with other Indian projects done under the ODA loan. Therefore, the construction period in each DPR is adopted as it is.

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Figure 17.4.2 Implementation Schedule (1/4)

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Figure 17.4.3 Implementation Schedule (2/4)

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Figure 17.4.4 Implementation Schedule (3/4)

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Figure 17.4.5 Implementation Schedule (4/4)

17.5 Consulting Services

17.5.1 Terms of Reference

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Table 17.5.1 Estimated Cost for Consulting Services

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17.6 Preliminary Cost Estimates

17.6.1 Conditions and Assumptions for Cost Estimates

Following conditions were assumed for the cost estimates of construction, and administration cost and tax.

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17.6.2 Construction Costs

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Table 17.6.1 Total Project Cost

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17.6.3 Comparison of construction cost on STP/ Sewer Network between DPR and Revised DPR

Table 17.6.2 shows comparison of construction cost on STP/ Sewer Network cost between DPR and revised DPR prepared by JICA study team.

Table 17.6.2 Comparison of Total Project Cost between DPR and Revised DPR using JICA Method

Unit: Lakhs Rs

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CHAPTER 18 Measures for Climate Change

<Fundamentals and applied Model>
This chapter first introduces the scenario, projection model, target year for projection, parameters for projection, and summary of climate change in Uttar Pradesh referring to "the State Action Plan on Climate Change" prepared by the Department of Environment, the State of Uttar Pradesh in 2014. Global Circulation Models (GCM) is applied.
<Measures and influence Proposed>
Description of the measures for climate change involves the project such as utilization of treated sewage for irrigational use and sewage sludge for power generation with an total Greenhouse Gas (GHG) reduction of 2,435.6 MWh per pear at three STPs namely Dinapur, Bhagwanpur and Ramna STPs in Varanasi as well as the measure for floods and droughts frequently occurs in Varanasi and its surrounding areas.

18.1 Projection of Future Climate

The Department of Environment under the State Government of Uttar Pradesh has studied on greenhouse gas (GHG) emission, sustainable agriculture, solar energy, energy efficiency, green (forest), water resources, strategic knowledge, sustainable urban habitat and prepared the Report for State Action Plan on Climate Change in 2014 (herein referred to as "State Action Plan". Since the sewerage sector is deeply concerned with water resources and sustainable urban habitat, the measures against climate change shall be studied focusing thereon.

The description in **18.1** is based on that in "State Action Plan on Climate Change" prepared by, the Department of Environment, Government of Uttar Pradesh in 2014

The State Action Plan was prepared under the following scenario,

18.1.1 Scenario[1]

Indian RCM PRECIS (Providing Regional Climates for Impact Studies) has been configured for a domain extending from about 1.5°N to 38°N and 56°E to 103°E. For the analysis the weather conditions of the present and future have been provided by the IITM Pune as the output of a regional climate model (RCM-PRECIS) at daily interval at a resolution of about 50 km. Simulated climate outputs from PRECIS regional climate model for present (1961-1990, BL) near term (2021-2050, MC) and long term (2071-2098, EC) for A1B IPCC SRES socio-economic scenario (characterized by a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and rapid introduction of new and more efficient technologies, with the development balanced across energy sources) has been used. Q14 QUMP (Quantifying Uncertainty in Model

[1] Department of Environment, Government of Uttar Pradesh, "State Action Plan on Climate Change", 2014

Predictions) ensemble has been used for the simulation.

18.1.2 Projection Model[1]

Climate models are mathematic models used to simulate the behaviour of climate system. The latter, known as Global Circulation Models (GCM), incorporate oceanic and atmospheric physics and dynamics and represent the general circulation of the planetary atmosphere or ocean. The GCMs are usually run at very course grid (about 3° X3°) resolution. These GCMs are strengthened with the incorporation of local factors and downscaled, in general with a grid resolution of about 0.5°X0.5° or less. The downscaling can be of dynamic or statistical type. These models are referred to as Regional Climate.

18.1.3 Target Year for Projection[1]

The projected climate change in 2030 (average of 2021-2050) and in 2080 (average of 2071-2098) over Uttar Pradesh using IPCC SRES A1B scenario have been studied.

18.1.4 Parameters for Projection[1]

The following parameters are projected:

- Climate Change scenario rainfall Statistics – Annual Average and inter annual variation
- Climate Change scenario rainfall Statistics – Seasonal and inter annual variation in rainfall
- Climate Change scenario Temperature Statistics – Average and inter annual variation
- Climate Change scenario Temperature Statistics – Seasonal average and inter annual variation
- Exposure related vulnerability
- Vulnerability due to climate sensitivity
- Adaptive Capacity
- Climate Vulnerability Index (Combined) for UP
- Green water and blue water availability
- Change in Average Minimum Temperature during Winter, Pre-monsoon, Monsoon & Post-monsoon seasons across U.P.
- Change in Average Maximum Temperature during Winter, Pre-monsoon, Monsoon & Post-monsoon seasons across U.P.

18.1.5 Summary of Climate Change in Uttar Pradesh[1]

Climate change poses uncertainties to the supply and management of water in the State. The following summarize the critical situation of water resources in the state and how climate change will act as an additional stressor:

- Many semi-arid and arid areas are particularly exposed to the impacts of climate change and are projected to suffer a decrease of water resources.
- Changes in climate variables like temperature increases can affect the hydrologic cycle by directly increasing evaporation of available surface water and vegetation transpiration.
- Changes in climate variables can influence precipitation amounts, timings and intensity rates, and indirectly impact the flux and storage of water in surface and sub-surface reservoirs i.e. lakes, soil moisture, and groundwater.
- Climate change can impact surface water resources directly through changes in the major long-term climate variables such as air temperature, precipitation, and evapo-transpiration.
- Annual rainfall predicted to increase by 15% to 20% in the 2050's as compared to the baseline and the increase is higher towards 2080's (25% to 35%). Inter annual variability is higher towards 2080's.
- Greater variability in rainfall could result in frequent and prolonged periods of high or low groundwater levels, and saline intrusion in aquifers.
- The direct effect of climate change on groundwater resources depends upon the change in the volume and distribution of groundwater recharge.
- The change in blue water availability show spatial variation from marginal reduction (5%) to 20 % increase across the state towards 2050's as compared to the baseline and there is almost 40 to 50% increase towards 2080's.
- The green water flow also shows increase but the magnitude is marginal under both MC and EC scenario and may increase to 25% for some of the area.
- The green water storage can potentially benefit the agriculture in months with little or no precipitation. This information is quite helpful in planning cropping season and helps to model scenarios of changing cropping seasons and patterns and arriving at appropriate adaptation measures.

18.2 Measures for Climate Change in the Proposed Project

The measures for climate change in the sewerage project is roughly classified into the following four categories:

(1) Emission through energy consumption of power, fuel, etc.
(2) Emission from treatment processes accompanied with the operation of treatment facilities
(3) Emission accompanied with the consumption of clean water, industrial water, chemicals and so on
(4) Reduction of emission amount through the utilization of sewerage resources

Out of the above, (1) to (3) should be reviewed in the stages of detailed design and operation and maintenance. The focus is herein placed on "(4) Reduction of emission amount through the utilization of sewerage resources which is considered as the measures through the contribution to the reduction in greenhouse effect gas as the whole of society by the utilizing energy and resources held in sewerage.

(1) Promotion of sewerage development and sewage treatment

Annual rainfall predicted to increase by 15% to 20% in the 2050's as compared to the baseline and the increase is higher towards 2080's (25% to 35%). Maximum temperature is predicted to increase by 2.1 ^{O}C during pre-monsoon followed by monsoon (1.8 ^{O}C) towards 2050's. Predicted increase in maximum temperature during post-monsoon (5.3^{O}C) followed by winter (4.5^{O}C) towards 2080's. These climate change is supposed to have a bad influence on the urban environment. In the survey area, Ghazipur, Ramnagar and Chunar have no sewerage network at present and the sewer networks cover only 30% of the area even in Varanasi. In such low coverage by sewerage network, it is afraid of a deterioration of living environment by climate change. The implementation of sewerage projects itself is one of important measures against climate change.

For this purpose, the primary and secondary sewers will be installed together with connection chambers to be provided near the road boundary to collect wastewater, currently discharged into open drains, through house connections for treatment at the sewage treatment plants and reduce the pollution loads to be discharged into the River Ganga. The people awareness campaign will be extended to promote the connection of individual houses to a sewer system in parallel with the construction works mentioned-above.

By the construction of sewerage facilities, the living environment in the urban area will be improved as well as the water environment which runs in the urban rea

(2) Utilisation of Treated Sewage

In the upstream of the River Ganga, about eighty percent (80%) of river water is abstracted for irrigational purpose which results in the significant reduction in the river flow and causes the deterioration of river water quality in the stretch of Kanauji-Kanpur-Allahabad-Varanasi over the primary water quality criteria for outdoor bathing in the holy Ganga. For this reason, the reuse of treated sewage for irrigation purpose has been executed aggressively at the existing sewage treatment plants so far. The central government has also encouraged the reuse of treated sewage for industrial purpose.

To respond the population increase in Uttar Pradesh, the agricultural sector is required to increase the crop product which leads to the water demand for irrigational use. The supply of treated sewage for irrigational purpose will contribute to the reduction in water demand for river water.

Table 18.2.1 Measure for Climate Change in the Proposed Projects

City/Town	STP	Capacity (MLD)	Treated Sewage	Sewage Sludge	Flood HFL (Varanasi): 73.90m (1978)	Project Contents
Varanasi	Dinapur	80	Irrigation S.: Irrigational Use Non-irrigation S.: Discharge to Ganga	Digestion-Drying Bed-Sold as Manure Power Generation by Digested Gas		Upgradation
	Bhagwanpur	9.6	Irrigational Use	Digestion-Drying Bed-Sold as Manure Power Generation by Digested Gas		Upgradation
	Ramna	50	Irrigation S.: Irrigational Use Non-irrigation S.: Discharge to Ganga	Power Generation by Digested Ga	As the proposed STP site will be submerged during high water level, it will be protected by surrounding the 4.5m high embankment	Construction
Ramnagar	Ramnagar	14	Irrigation S.: Irrigational Use Non-irrigation S.: Discharge to Ganga	Digestion-Centrifuge-Sold as Manure	HFL is 73.90 m in 1978 which is lower than the ground level of the proposed STP site and other areas in Ramnagar. Therfore, safe against flood.	Construction
Mirzapur	Mirzapur	14 (UASB) 18 (SBR)	Dischage to Irrigation Channel	Digestion-Centrifuge-Carrying		Augmentation
	Vindhyachal	4 (WSP) 6 (WSP)	Dischage to Irrigation Channel	Drying Bed-Sold as Manure		Augmentation
Chunar	Chunar	6.5 (WSP)	Discharge to Ganga（Irrigational Use to surrounding farmland, if required)）			Construction
Ghazipur	Ghazipur	18 (C-Tech)	Discharge to Ganga	Centrifuge-Sold as Manure		Construction

Source: Flood Forecast Monitoring Directorate, Central Water Commission, "Flood Forecasting and Warning Network Performance Appraisal Report 2012", October 2011

As shown in **Table 18.2.1**, all the sewage treatment plants except for that in Ghazipur in the survey area will address the reuse of treated sewage for irrigational purpose.

(3) Utilisation of Sewage Sludge

Sewage sludge generated in the process of sewage treatment is used for power generation by digestion gas and as manure for agricultural use in the address utilizing the sewage value as a resource. The power obtained is used for the operation of mechanical equipment as well as lighting and results in the reduction of external power consumption as the whole of a STP. The agricultural reuse of biomass-derived sewage sludge as manure will bring the emission reduction of greenhouse effect gas in other industries

As shown in **Table 18.2.1**, in the survey area, the power generation is proposed at three sewage treatment plants in Varanasi, or at Dinapur, Bhagwanpur and Ramna STPs. In addition, five STPs out of seven STPs have plan to sold sewage sludge as the manure for agricultural use

(4) Greenhouse Gas Reduction

As mentioned above, the power generation is planned at three STPs in Varanasi, namely Dinapur, Bhagwanpur and Ramna, The greenhouse gas reduction at theses STPS is calculated as shown in **Table 18.2.2** under the following assumptions.

- The power generation directly lead to carbon-dioxide (CO_2) gas reduction.

- The CO_2 gas emission factor from a power generation station is set at 0.82 based on the data of the Indian Government.
- There is a somewhat fear of operation in winter with no heating, the methane gas generation to be used for bio-gas power generation is discounted to 80% of the value obtained from the volume calculation.
- The sewage treatment processes assumed are based on that proposed in the Ramna STP DPR by UPJN and those recommended by the JICA survey team against those proposed in the revised DPR for Dinapur and Bhagwanpur STPSs by UPJN to meet the new effluent standards.
- The calculated values simply show the difference between with- and without power generation facilities/equipment,

Table 18.2.2 Greenhouse Gas Reduction

City STP	Varanasi Dinapur	Varanasi Bhagwanpur	Varanasi Ramna	Varanasi
Flash Mixer	-	-	-	
Flow Rate at Average in m^3/d Treatment Process	80,000 D-CND	8,000 CND	50,000 CND	
Power Consumption Availability: 80%	9,695.9 MWh/y	1,176.1 MWh/y	3,889.7 MWh/y	14,761.8
Power Generation	7,763.4 MWh/y	672.8 MWh/y	38,90.0 MWh/y	12,326.2
Chlorine Dosing Rate: 10 mg/l	800.0 kg-gas/day	114.3 kg/day	500.0 kg/day	
De-chlorine Sodium Thiosulfate	190.4 kg/day	19.0 kg/day	131.3 kg/day	
Polyelectrolyte Dosing Rate: 1.5kg/t	30.21 kg/day	2.99 kg/day	0.00 kg/day	
	112.07 m^3/day	11.09 m^3/day	101.00 m^3/day	
GHG Reduction Factor: 0.82				2,435.6 Total

(5) Flood

Due to excess rains on the foot hills of Himalayas and trans-boundary flows from the rivers originating from Nepal and other neighbouring states floods occur in certain parts. Floods are the most common annual occurrences in the state, due to overflowing of its main rivers like Ganga, Yamuna, Ramganga, Gomti, Sharda, Ghaghra Rapti and Gandak, affecting one or the other part of the state the most affected being Eastern Uttar Pradesh and the Tarai region.

It is important to protect the sewerage treatment plants from flooding and to maintain the sewage treatment function even during the flood, so that they will contribute to restore the living environment and hygiene condition in the damaged area after the flood will go out.

As shown in **Figure 18.2.1**, the surrounding area of the River Ganga is classified into the flood prone area. The historical highest flood level of the River Ganga in Varanasi is +73.90 m in 1978 and recently 72.16 m was recorded in August 18, 2013. The sewage treatment plants which may be attacked by the flood have taken the measures as shown in **Table 18.2.1**

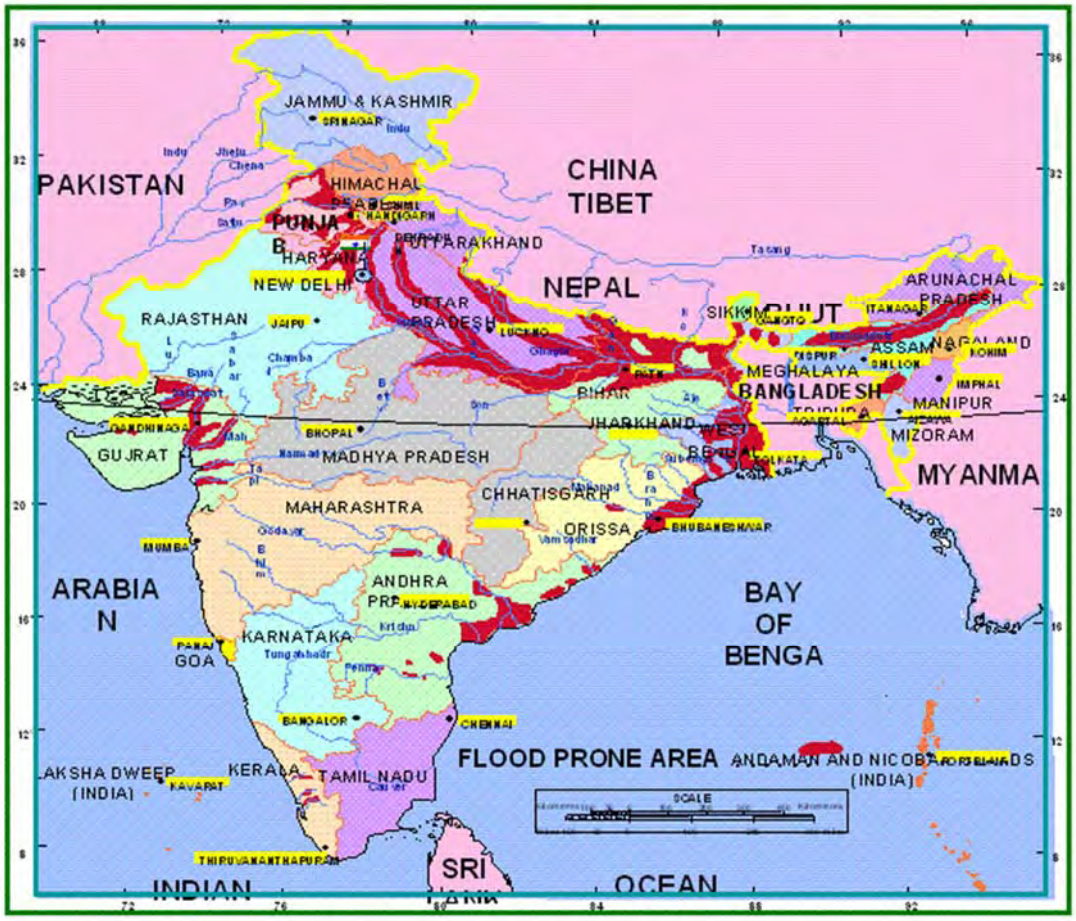


Figure 18.2.1 Flood Prone Area in India

(6) Drought

The recurrence of a major deficiency in annual rainfall follows a 6-8 year cycle in Eastern U.P. whereas in Western U.P., it is a 10 years cycle. Droughts are experienced due to deficient rainfall in the certain parts of the state. Bundelkhand and part of Mirzapur and Allahabad commissionaires are the most drought prone areas.

The survey area is classified into the frequently drought prone area as shown in **Figure 18.2.2**.

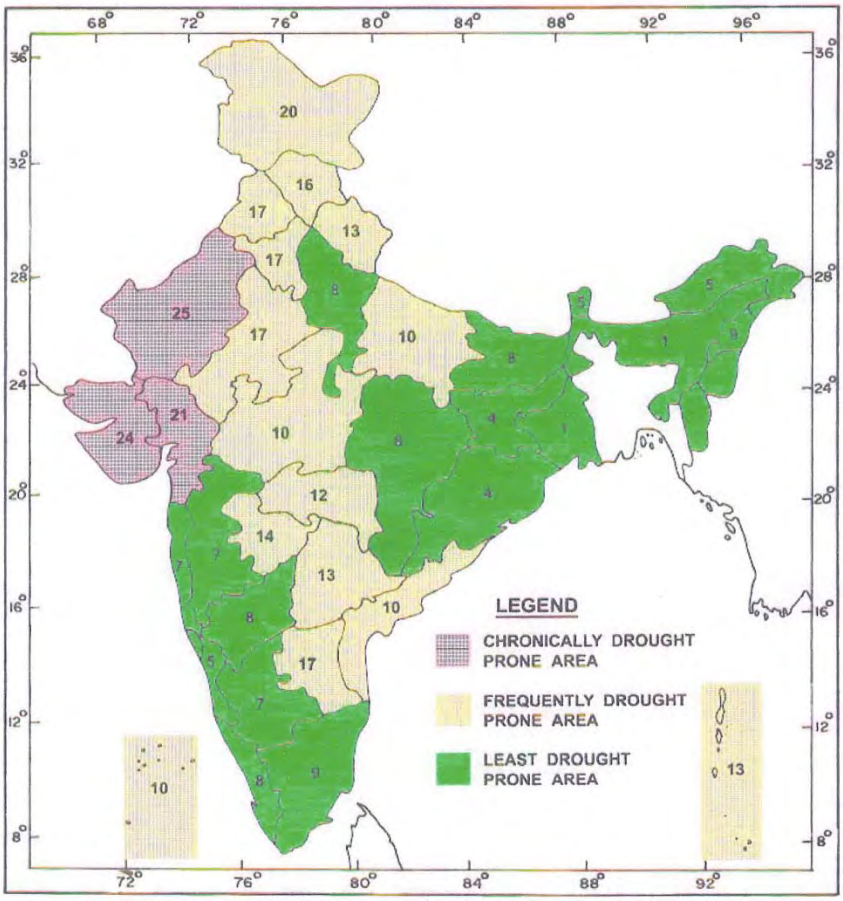


Figure 18.2.2 Drought Prone Area in India

During the drought period, sewage treatment can supply the treated sewage with good quality for irrigational use.

CHAPTER 19 Selection of Phase-II Project Sites

<Objective of the Study>
Project site of the Phase II for Ganga Rejuvenation Project was studied from 118 towns identified by NMCG.
<Methodology>
Compliance status of primary water quality criteria set for the Ganga in selecting the target area for the Phase-II Project was evaluated for the selection.
<Result of the Study>
Considering the impact on water qualityKanpur is recommended as the target area for the Phase-II Project together with Unnao (additional STP capacity requirement: 50.1 MLD) and Gangaghat (16.2 MLD). Unnao and Gangaghat are located on the opposite side of the River Ganga from Kanpur. Moradabad is secondly proposed as the target area.

PART-1: COLLECTION OF EXISTING INFORMATION

19.1 Introduction

19.1.1 Towns to Be Studied

NMCG identified 118 river front towns near the main stem of the River Ganga as the priority towns for Clean Ganga, which shall be set as the candidates for the selection of Phase-II Project sites. NMCG comments the present situation of "incomplete sewerage infrastructure"[1] as follows:

- 118 priority towns identified
- Only 21% of existing sewage is treated
- 30% of existing sewage treatment plants is non-functional
- Huge gap in sewage generation and available treatment capacity
- 100% sewerage infrastructure needs to be created in next 5 years – huge operational, financial and technological challenge

19.1.2 Information Required

The information to be collected is as follows:

(1) Natural conditions (climate, topography, geology, hydrology and hydrogeology)
(2) Socio-economic conditions (population, slum population, livestock, land use, industrial movement, conditions of public hygiene and status of ghats and crematoria)
(3) Irrigation, water supply and other water use
(4) Existing and under-planning sewerage facilities, discharge point

[1] NMCG, "Overview of India's Priorities and Needs – River Ganga Rejuvenation", February 5, 2016

(5) Status of industrial wastewater
(6) Status of solid waste plant
(7) Movement of other donors concerning water pollution control, measures for water pollution sources, environmental education and improvement in sanitary conditions, etc.
(8) Status of DPR preparation and structure of project implementation
(9) Flow and water quality of the River Ganga and its tributaries
(10) Status of water quality monitoring in the River Ganga and its tributaries
(11) Status on institutional structure concerning water quality control of the River Ganga

19.2 Natural Conditions of the River Ganga Basin

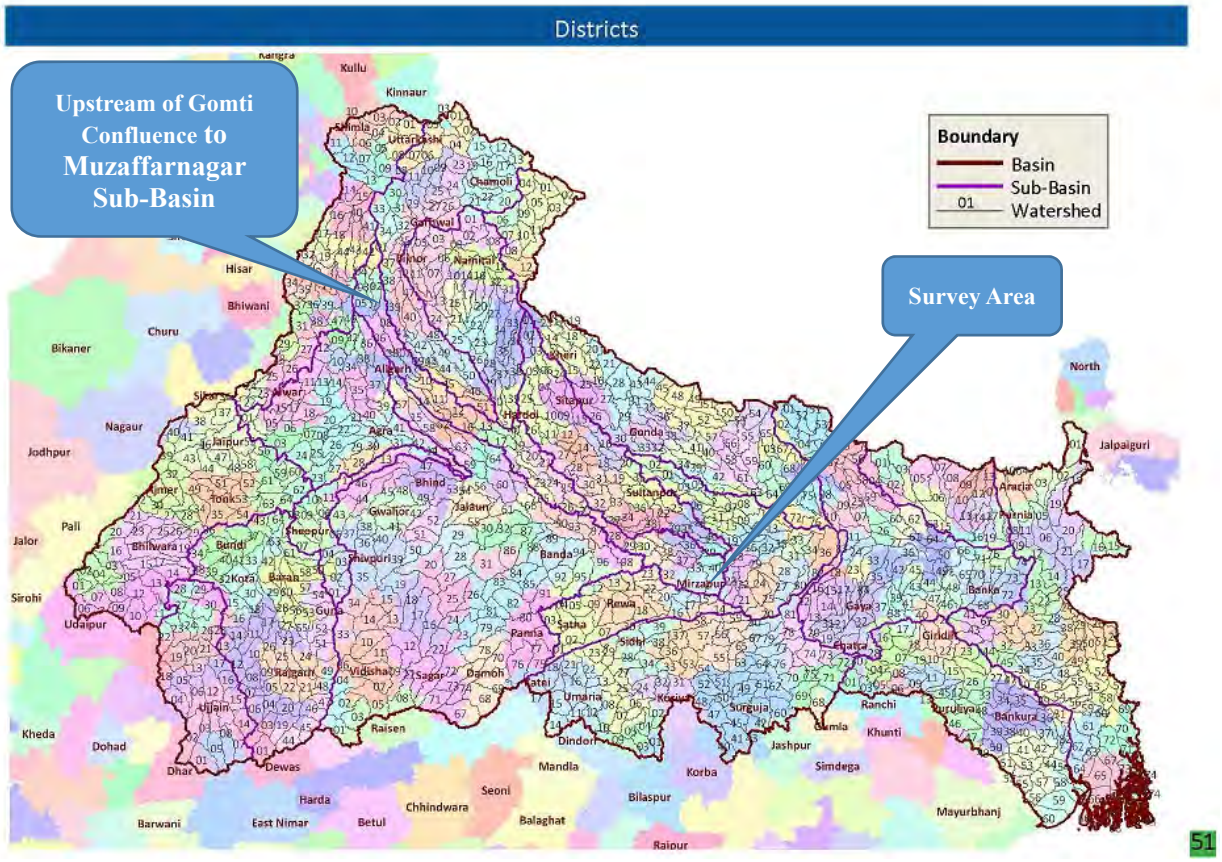
19.2.1 River Ganga Basin

The Ganga basin outspreads in India, Tibet (China), Nepal and Bangladesh over an area of 10,86,000 km^2. In India, it covers states of Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar, West Bengal, Uttarakhand, Jharkhand, Haryana, Chhattisgarh, Himachal Pradesh and Union Territory of Delhi draining an area of 8,61,452 km^2 which is nearly 26% of the total geographical area of the country. The basin lies between east longitudes 73°2' to 89°5'and north latitudes 21°6' to 31°21' having maximum length and width of approx. 1,543 km and 1024 km. The basin is bounded by the Himalayas on the north, by the Aravalli on the west, by the Vindhyas and Chhotanagpur plateau on the south and by the Brahmaputra Ridge on the east. The Ganga rises in the Gangotri glacier in the Himalayas at an elevation of about 7,010 m in the Uttarkashi district of Uttarakhand. At its source, the river is called as the Bhagirathi. It descends down the valley upto Devprayag where after joining another hill stream Alaknanda, it is called Ganga. The total length of river Ganga (measured along the Bhagirathi and the Hooghly) up to its outfall into Bay of Bengal is 2,525 km. The principal tributaries joining the river from right are the Yamuna and the Son. The Ramganga, the Ghaghra, the Gandak, the Kosi and the Mahananda join the river from left. The Chambal and the Betwa are the two other important sub-tributaries.

Table 19.2.1 Salient Features of Ganga Basin

Basin Extent: Longitude	73° 02' to 89° 05' E
: Latitude	21° 06' to 31° 21' N
Length of Ganga River (Km)	2,525
Catchment Area (km^2)	861,452
Average Water Resource Potential (MCM)	525,020
Utilizable Surface Water Resource (MCM)	250,000
Live Storage Capacity of Completed Projects (MCM)	42,060
Live Storage Capacity of Projects Under Construction (MCM)	18,600
Total Live Storage Capacity of Projects (MCM)	60,660
No. of Hydrological Observation Stations	318
No. of Flood Forecasting Stations	83

The survey area is located in the westernmost part of the upstream of Gomti confluence to Muzaffarnagar sub-basin.



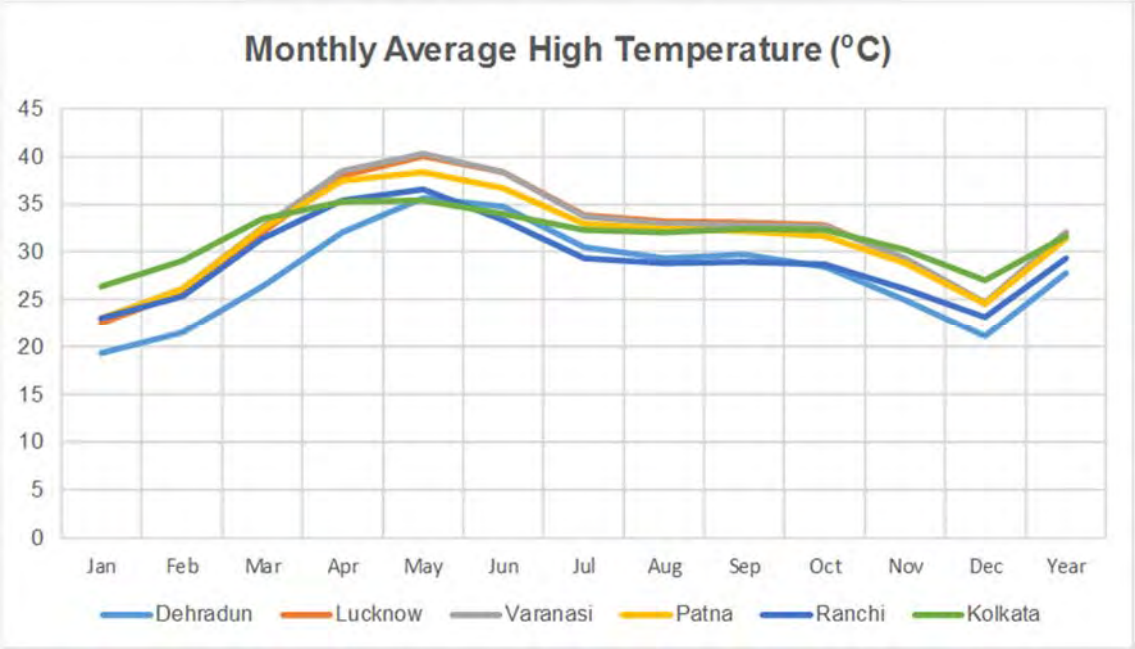
Source: Ministry of Water Resources, "Watershed Atlas of India (Version 2.0)", April 2014

Figure 19.2.1 Sub-basins of the River Ganga

19.2.2 Climate

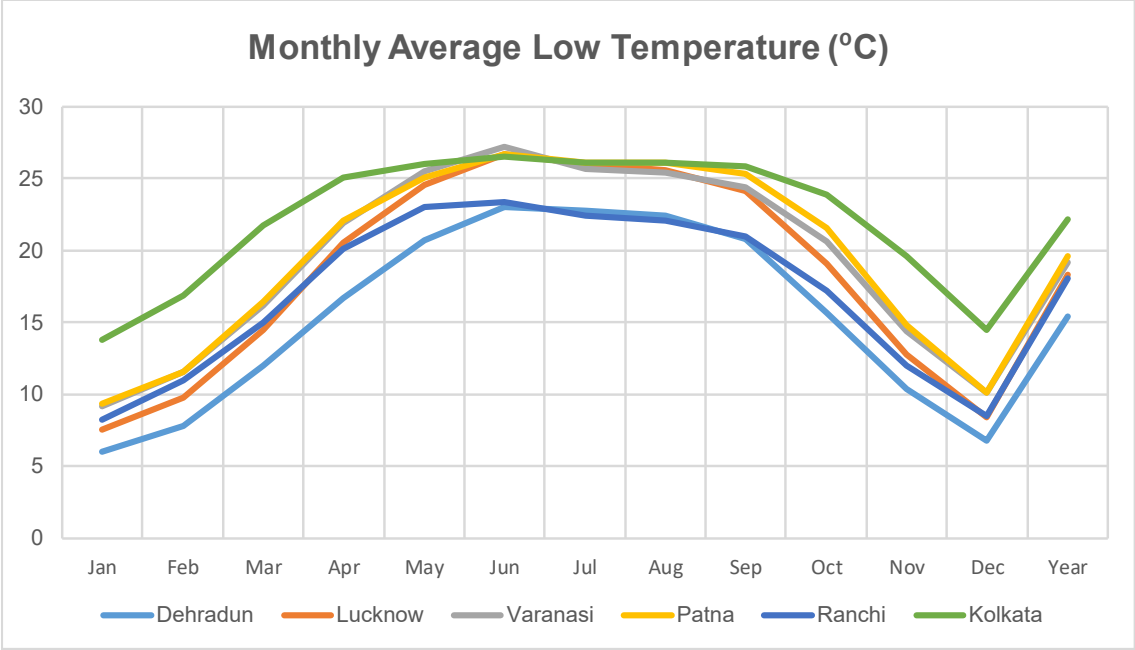
(1) Temperature

Figures 19.2.2 and **19.2.3** shows the monthly average high and low temperatures, respectively, at the four state capitals such as Uttarakhand, Uttar Pradesh, Bihar and West Bengal involved in the River Ganga Basin. As found from those figures, there is no significant change in the trend of monthly variation. The temperature is high in Kolkata with an elevation of 64 m and low in Dehradun with an elevation of 682 m in general,



Source: Prepared by JICA Survey Team based on Wikipedia town-wise data

Figure 19.2.2 Monthly Average High Temperature Variation at State Capitals Located in the River Ganga Basin

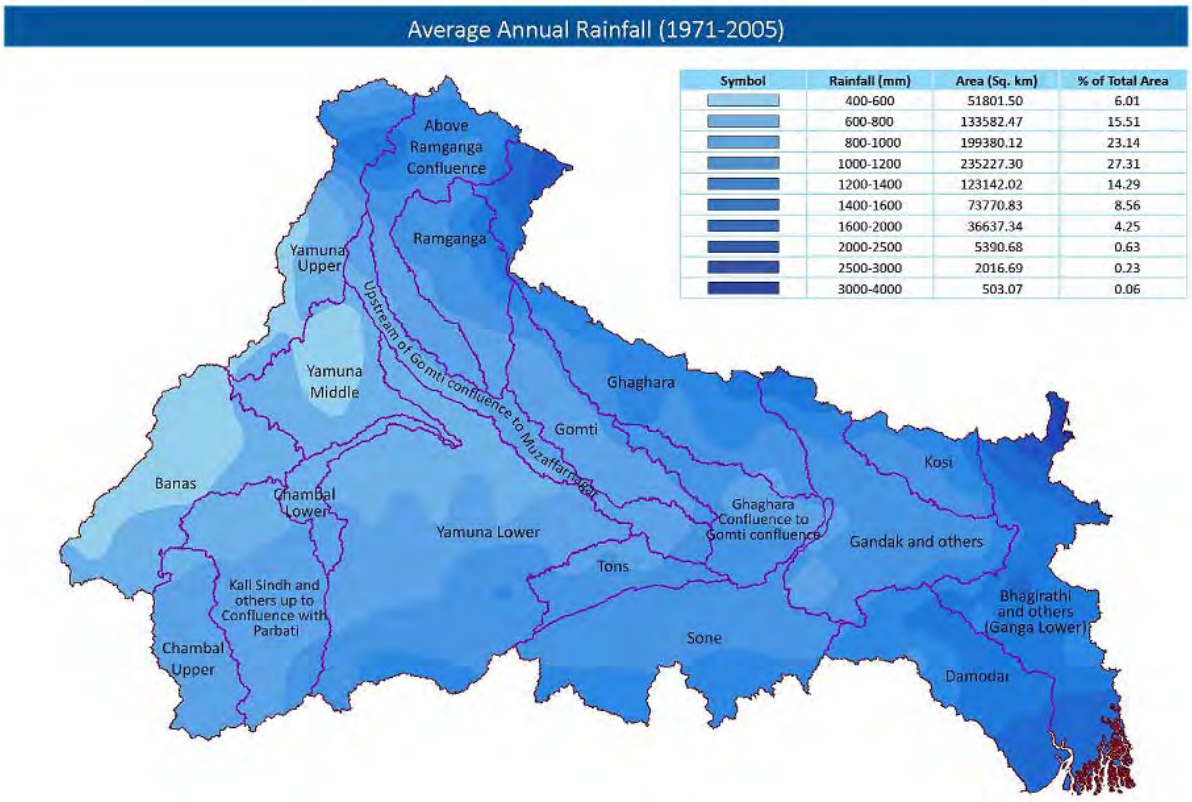


Source: Prepared by JICA Survey Team based on Wikipedia town-wise data

Figure 19.2.3 Monthly Average Low Temperature Variation at State Capitals Located in the River Ganga Basin

(2) Rainfall

The Ganges basin receives nearly 1,000 mm of precipitation annually. The greatest amount of rain – 84% of the annual total – falls during the monsoon season. Of the remainder, 7% falls during the premonsoon season, 5% in the post-monsoon season, and 4% in winter. There are some differences in precipitation between the upper and lower Ganga basins. Although there is not much difference between the annual amount of precipitation in the lower and upper parts of the basin, the number of rainy days varies considerably. In the upper basin, there are 179 rainy days, whereas in the lower basin there are 152 rainy days. The monsoon season accounts for 75% of the rain in the upper basin and 85% of the rain in the lower basin.[2]



Source: Ministry of Water Resources, "Watershed Atlas of India (Version 2.0)", April 2014

Figure 19.2.4 Average Annual Rainfall of the River Ganga Basin

As shown in **Figure 19.2.4**, the distribution of rainfall zone is bigger northwards and southwards from the main stem of the River Ganga and downstream-wards. The rainfall zone of 1,000-1,200 mm is largest sharing 27.31% of the total Ganga Basin followed by 800-1,000 mm zone of 23.14%

[2] ***http://www.grida.no/graphicslib/detail/ganges-basin-climate-indicators-rainfall-temperature_b9f6***

19.2.3 Topography

The Ganga sub-basin extends over an area of 1,086,000 km^2 and lies in India, Tibet, Nepal and Bangladesh. The drainage area lying in India is 861404 km^2 which is nearly 26.2% of the total geographical area of the country. The sub-basin is bounded on the north by the Himalayas, on the west by the Aravalis and the ridge separating it from Indus basin, on the south by the Vindhas and Chhotanagpur plateaus and on the east by the Brahmaputra ridge. The sub-basin lies in the States of Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan, West Bengal, Haryana, Himachal Pradesh and the Union Territory of Delhi. The State-wise distribution of the drainage area is given below:

Table 19.2.2 State-wise Distribution of Drainage Area

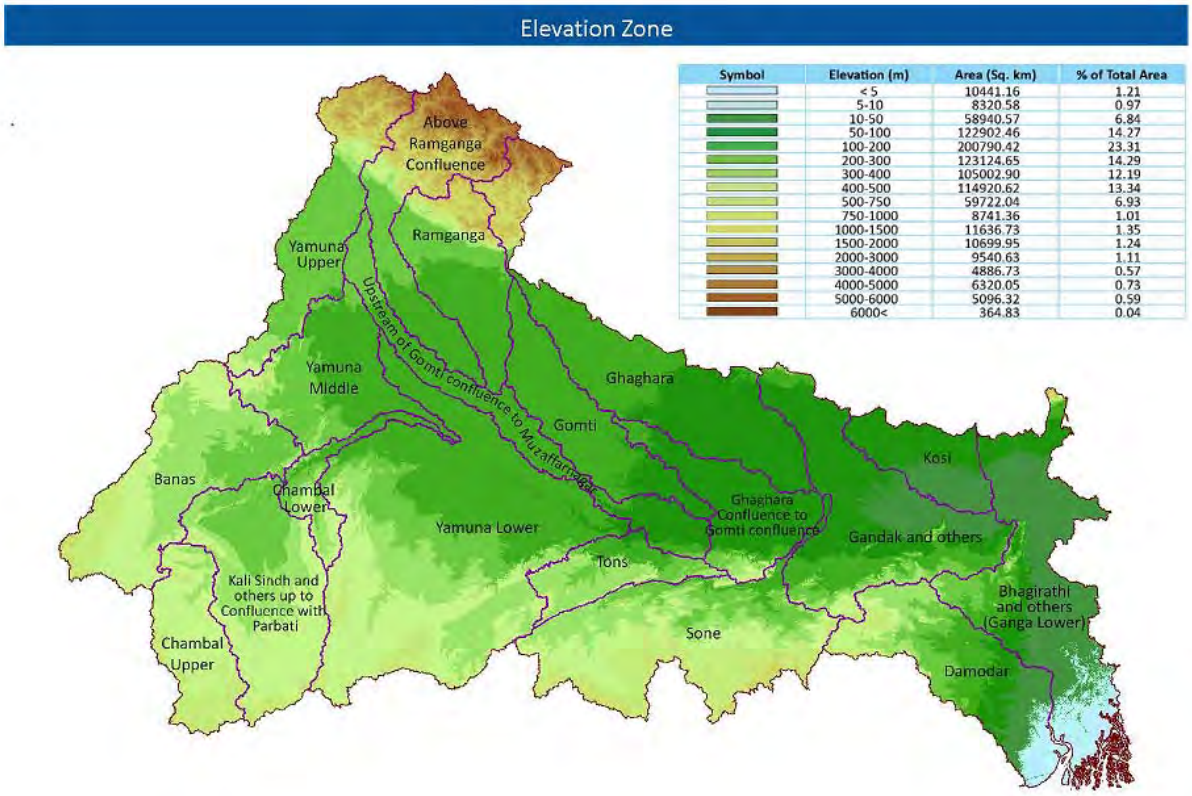
S. No.	State	Drainage Area (km^2)	S. No.	State	Drainage Area (km^2)
1	Uttar Pradesh	294,364	5	West Bengal	71,485
2	Madhya Pradesh	198,962	6	Haryana	34,341
3	Bihar	143,961	7	Himachal Pradesh	4,317
4	Rajasthan	112,490	8	U.T. of Delhi	1,484
				Total	861,404

The main physical sub-divisions are the Northern Mountains, the Gangetic Plains and the Central Highlands. Northern Mountains comprises the Himalayan ranges including their foot hills. The Gangetic plains, situated between the Himalayas and the Deccan plateau, constitute the most of the sub-basin ideally suited for intensive cultivation. The Central highlands lying to the south of the Great plains consists of mountains, hills and plateaus intersected by valleys ad river plains. They are largely covered by forests. Aravali uplands, Bundelkhand upland, Malwa plateau, Vindhyan ranges and Narmada valley lies in this region.

Predominant soil types found in the sub-basin are sandy, loamy, clay and their combination's such as sandy loam, salty clay loam and loamy sand soils. The culturable area of Ganga sub-basin is about 57.96 M. has which is 29.5% of the total culturable area of the country.[3]

The River Ganga Basin lies between the Himalaya Mountains with an elevation of higher than 7,000 m northwards and the Mahadeo and Ramgarh Hills with an elevation of 600-1,000 m southwards and has a slope eastwards from the west and them southwards. The elevation of Haridwar located at the entrance to Indo-Gangetic Plains from mountains is lowered to about 290 m. The 50-100 m high zone extends west of Indo-Gangetic Plains, while the 10-50 m high zone spreads eastwards. The elevation is below 10 m near the Bengal Bay.

[3] *http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Ganga*



Source: Ministry of Water Resources, "Watershed Atlas of India (Version 2.0)", April 2014

Figure 19.2.5 Topography of the River Ganga Basin

19.2.4 Geology[4]

The Ganga basin consists of a wide variety of soils. While soils of the high Himalayas in the north are subject to continuous erosion, the Gangetic plain provides a huge receptacle into which thousands of meters of thick layers of sediments have been deposited to form a wide valley plain. The Deccan plateau on the south has a mantle of residual soils of varying thickness arising out of weathering of ancient rocks of the peninsular shield. Some of the soils are highly susceptible to erosion. Mountain soils, submontane soils and alluvial soils, covering 58% of the basin area, have very high erodibility; red soils covering 12% of the basin area have high erodibility, red & yellow soils and mixed red and black soils covering an area of 8% have moderate erodibility, and deep black soils and medium black soils covering an area of 14% have low erodibility Shallow black soils and lateritic soils covering an area of 6% have very low erodibility.

[4] *https://nmcg.nic.in/soil.aspx*

Broadly, it can be said that soils in Haryana, Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, through which the main stem of Ganga and all its tributaries flow, have very high erodibility.

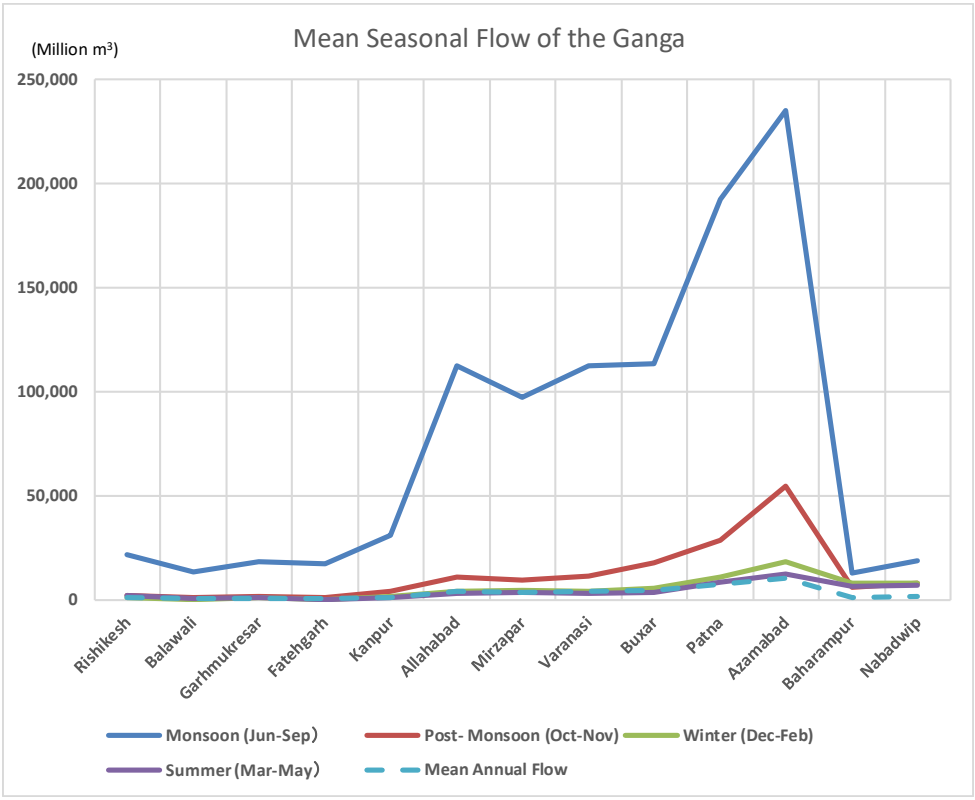
19.2.5 Hydrology[5]

Rainfall, subsurface flows and snow melt from glaciers are the main sources of water in river Ganga. Surface water resources of Ganga have been assessed at 525 billion cubic meter (BCM). Catchment area, annual yield of water and mean flow of tributaries of Ganga are given in **Table 19.2.3**. Out of its 17 main tributaries Yamuna, Sone, Ghagra and Kosi contribute over half of the annual water yield of the Ganga. These tributaries meet the Ganga at Allahabad and further downstream. The river has a problem of low flows between the Haridwar - Allahabad stretch in **Figure 19.2.6**. December to May are the months of lean flow in the Ganga. The lean flow during these months, at some important towns along the river Ganga, is shown in **Figure 19.2.6**.

Table 19.2.3 Mean Annual Flow Rate of Streams in Ganga Basin.

S. No.	Sub-Basin	Mean Annual Flow (BCM)	Percentage contribution
1.	Ramganga	17.789	3.39
2.	Yamuna (excluding Chambal)	57.241	19.90
3.	Chambal	32.554	6.20
4.	Tons-Kararmnasa	10.609	2.02
5.	Gomti-Ghaghra	113.511	21.62
6.	Sone-East of Sone	44.144	8.41
7.	Gandak-Burhi Gandak	58.967	11.23
8.	Kodi-Mahananda	81.848	15.59
	Total (Tributaries)	416.663	79.36
9.	Ganga Main Stem	84.980	16.19
10.	Evaporation * (attributable to Ground Water)	23.380	4.45
	Total Ganga (Upto Indian Border)	525.023	100.00

[5] Source: NRCD. “Status Paper on River Ganga – State of Environment and Water Quality”, August 2009



Enlargement

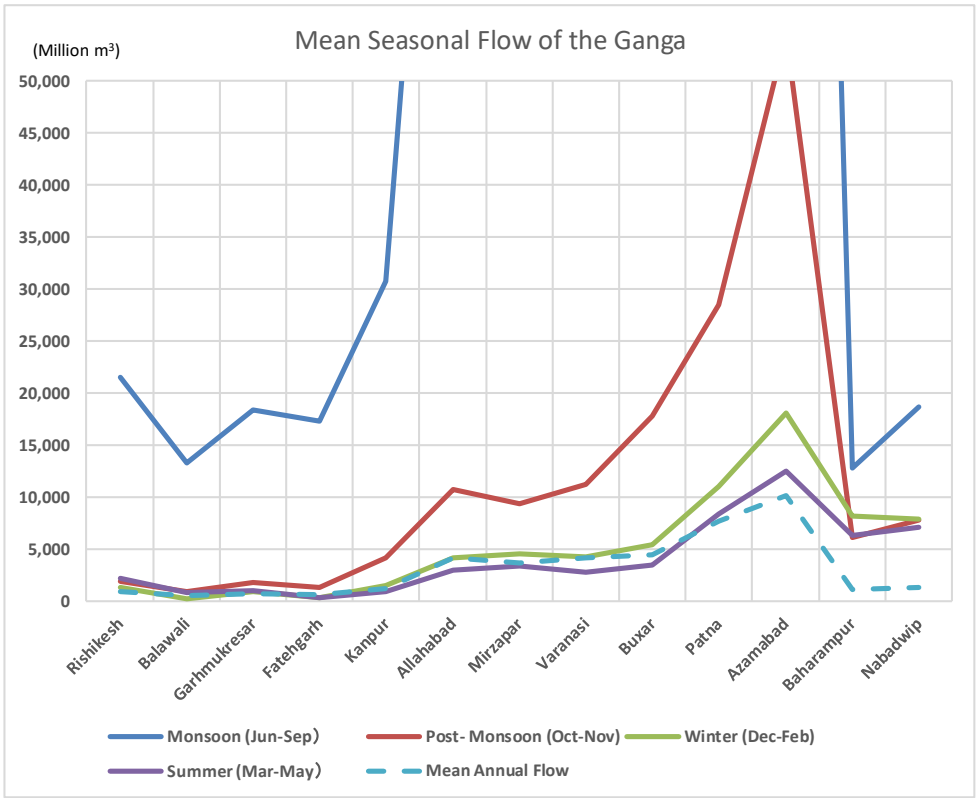


Figure 19.2.6 River Discharge of the River Ganga

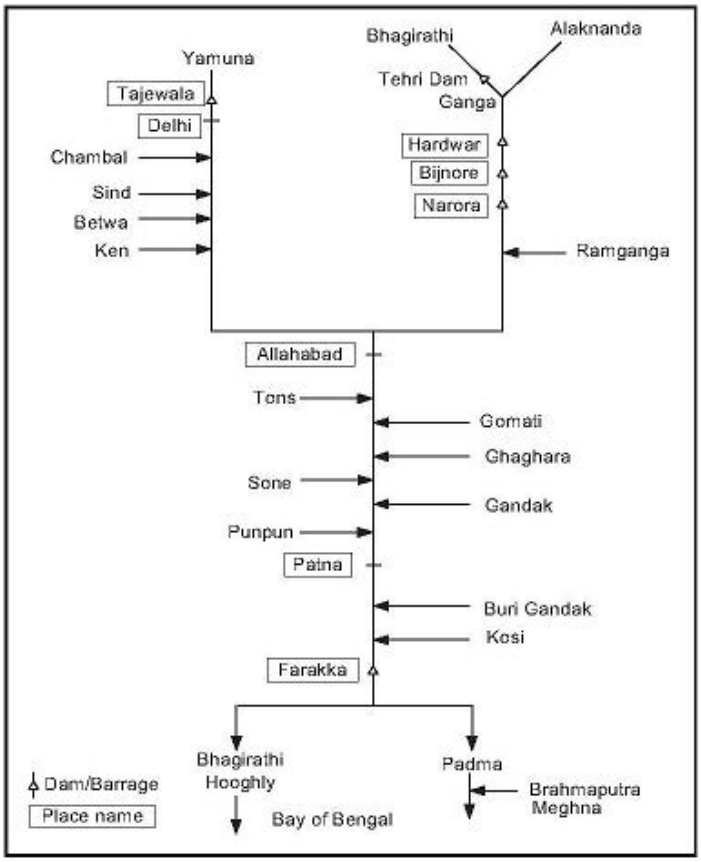


Figure 19.2.7 Line Diagram of Ganga with its Major Tributaries and Water Management Structures

19.2.6 Hydrogeology[6]

The Indian sub continent is occupied by major geological rock types such as metamorphics of pre Cambrian period, Igneous rocks represented by basaltic rocks of Cretaceous-Eocene period, Gondwana & Vindhyan rocks which are overlain by quaternary to recent sedimentary deposits .The distribution of these rock types are given in geological map (**Figure 19.2.8**).

[6] Source: B.M.Jha, Chairman & S.K.Sinha, Scientist D, CCWB, " Towards Better Management of Ground Water Resources in India", Source: B.M.Jha, Chairman & S.K.Sinha, Scientist D, CCWB, " Towards Better Management of Ground Water Resources in India",

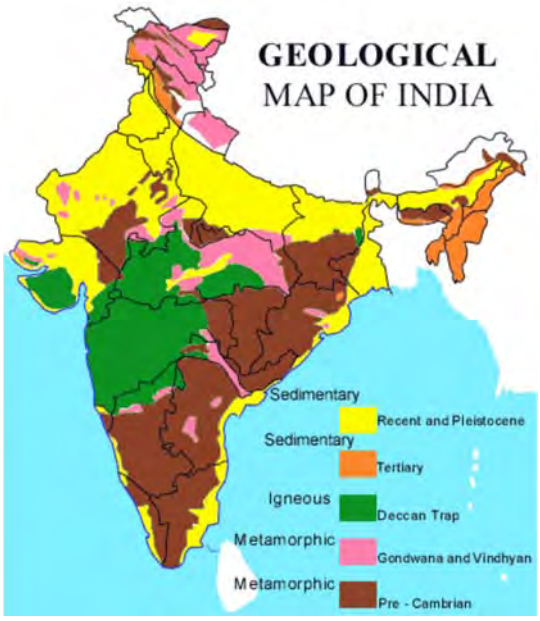


Figure 19.2.8 Geological Map of India (Source: GSI)[6]

Based on the formation characteristics and hydraulic properties to store and transmit ground water hydrogeologically all the litho units can be placed under two broad groups of water bearing formations Viz. ***Porous Formations*** which can be further classified into unconsolidated and semi consolidated formations having the primary porosity and ***Fissured Formation*** **or Consolidated** formations which has mostly the secondary or derived porosity. The Hydrogeological map showing the broad group of consolidated and unconsolidated water bearing formations along with their yield prospects are shown in **Figure 19.2.9**.

Physiographic and geomorphologic settings are among the important factors that control the occurrence and distribution of ground water. Based on these factors, the country has been broadly divided into five distinct regions.

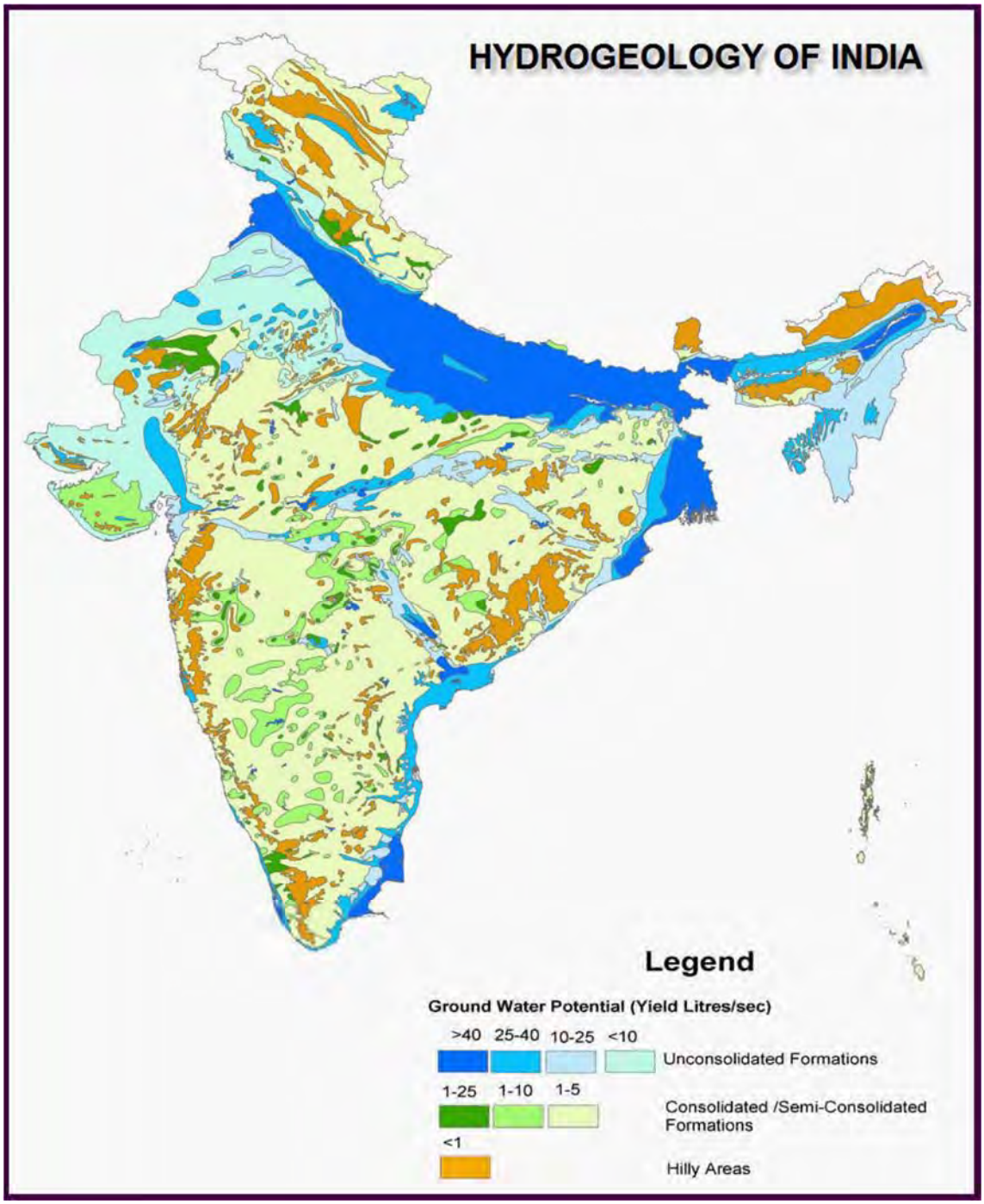


Figure 19.2.9 Hydrogeological Map of India[6]

Among others, the region of **Indo-Gangetic-Brahmaputra Alluvial Plains** encompasses an area of about 850,000 km^2 covering states of Punjab, Haryana, Uttar Pradesh, Bihar, Assam and West Bengal, accounting for more than one fourth of country's land area, comprises the vast plains of *Ganges* and *Brahmaputra* rivers and are underlain by thick piles of sediments of Tertiary and Quaternary age. This vast and thick alluvial fill, exceeding 1000 m at places, constitute the most potential and productive ground water reservoir in the country. These are characterized by regionally extensive and highly

productive multi-aquifer systems. The ground water development in this region is still sub-optimal, except in the states of Haryana and Punjab. The deeper aquifers available in these areas offer good scope for further exploitation of ground water with suitable measures. In Indo-Gangetic- Brahmaputra plain, the deeper wells have yield ranging from 25-50 lps.

19.3 Socio-economic Conditions

19.3.1 Population

In India, the census has been carried out every ten years like 1981, 1991, 2011 and 2011. The latest one is the Census 2011 and according to it, the total population of India was 1,210,854,977 persons, increasing by 182,117,541 persons from 1,028,737,436 persons of the Census 2001, which is the secondary biggest country in the world following China. The annual average population growth rate for 2001-2011 was 1.64%.

The total population of 118 River Front Towns identified by NMCG was 26,170,235 persons with an increase of 2,602,986 persons from 23,567,249 persons in 2001. The annual average population growth rate for this period was 1.05% which was 0.59% lower than the above national average.

For the state-wise annual average population growth rate of 118 towns, the biggest one is 2.44% of Bihar, followed by 1.90% of Uttarakhand, 1.41% of Uttar Pradesh, 1.22% of Jhakhand and 0.29% of West Bengal. Among others, the growth rate of West Bengal is extremely low.

Table 19.3.1 State-wise Annual Average Population Growth Rate of 118Towns

State	No. of towns	Census 2001	Census 2011	Annual Avg. Growth Rate (%)	No. of Towns	
					P.> 1 mil.	P> 1 lakh
Uttarakhand	15	423,747	511,403	1.90	0	1
Uttar Pradesh	31	7,354,925	8,457,577	1.41	3	8
Bihar	26	3,859,693	4,913,428	2.44	1	11
Jhakhand	2	98,131	110,728	1.22	0	0
West Bengal	44	11,830,753	12,177,099	0.29	1	31
118 owns	**118**	**23,567,249**	**26,170,235**	**1.05**	**5**	**51**

Source: Prepared by JICA Survey Team Based on Census 2011 data

For the town-wise annual average population growth rate of 118 towns, the biggest one is 17.84% of Barauni in Bihar, followed by 15.26% of Rudraprayag in Uttarakhand, 10.39% of Begusarai in Bihar, 4.69% of Bihar Sharif in Bihar and 4.34% of phulwari Sharif in Bihar.

19.3.2 Slum Population

According to the Census 2011, the total slum population in India was 65,494,604 persons equivalent to 5.41% of the total population.

The total slum population of 118 River Front Towns identified by NMCG was 5,367,885 persons equivalent to 20.5% of the total population, which was approximately four times bigger than the above national percentage. The percentage of slum population in 118 towns is substantially high.

According to the state-wise percentage of the slum population to the total population, the biggest one is 30.7% in West Bengal, followed by 14.3% in Uttar Pradesh, 9.2% in jhakhand, 8.6% of Uttarakhand and 7.5% in Bihar.

Table 19.3.2 State-wise Percentage of Slum Population in 118 Towns

State	Total Population	Slum Population	Percentage (%)
Uttarakhand	511,403	44,090	8.6
Uttar Pradesh	8,457,577	1,210,574	14.3
Bihar	4,913,428	368,037	7.5
Jhakhand	110,728	10,150	9.2
West Bengal	12,177,099	3,735,034	30.7
118 owns	**26,170,235**	**5,367,885**	**20.5**

Source: Prepared by JICA Survey Team Based on Census 2011 data

For the town-wise percentage of the slum population to the total population in 118 towns, the biggest one is 96.6% of Titagarh in West Bengal, followed by 79.1%% of both Dhulian and Champdani in West Bengal, 70.5% of Rishra in West Bengal and 70.4% of Devprayag in Uttarakhand.

Rudraprayag in Uttarakhand, 10.39% of Begusarai in Bihar, 4.69% of Bihar Sharif in Bihar and 4.34% of phulwari Sharif in Bihar.

19.3.3 Livestock

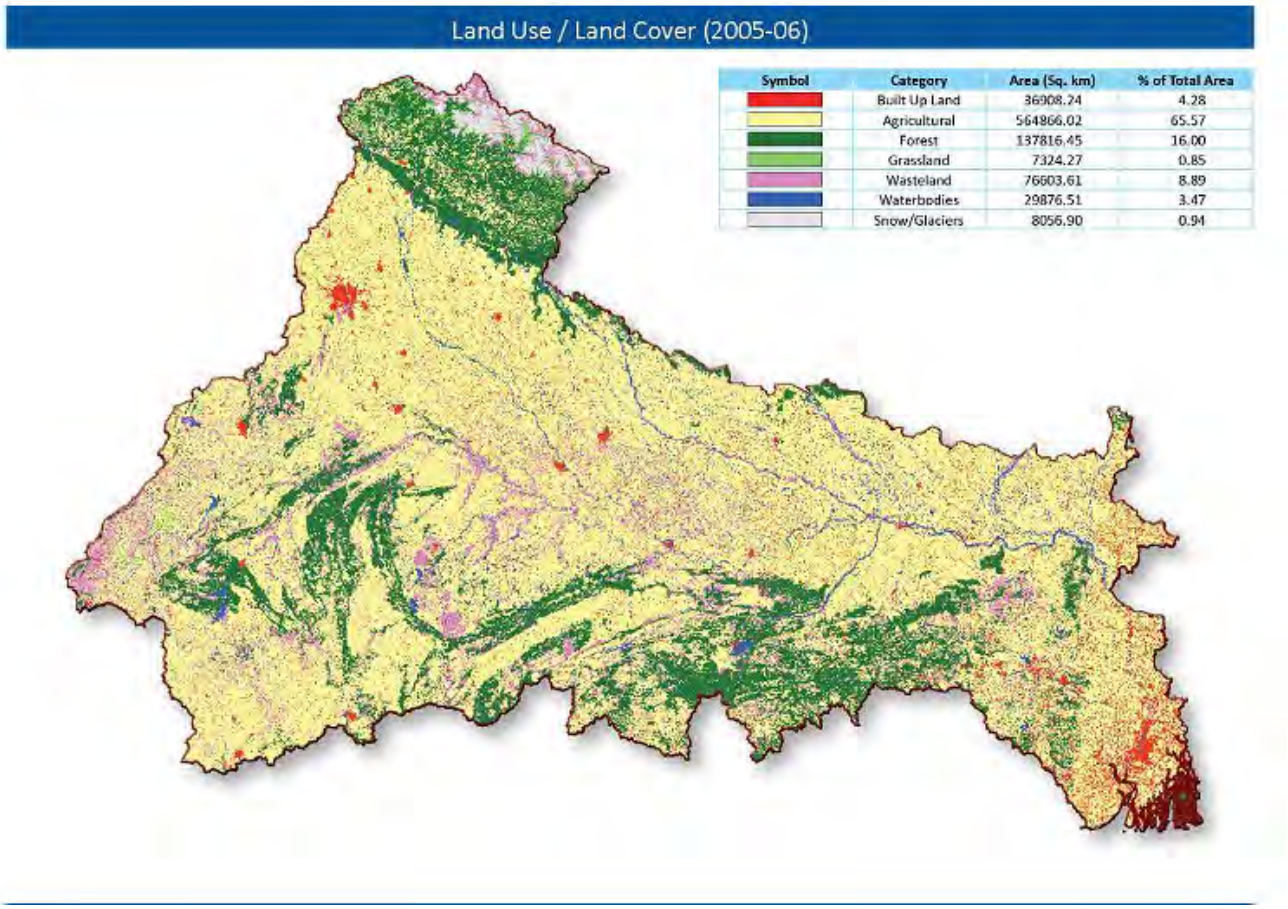
(1) Livestock Census 2012

The Livestock Census 2012 Report gives the district-wise number of livestock, but not town-wise one. For only bovine, the classification of “rural” and “urban” is given. Since the most livestock is farmed in the rural area, the district-wise data does not reflect the exact situation of each town.

Source: Department of Husbandry, Dairying and Fisheries, “19th Livestock Census District Wise Report 2012”
Note: The website PDF file covering the States of Uttarakhand, Uttar Pradesh and West Bengal (Volume III) is not available due to “Broken” as of March 1, 2016.

19.3.4 Land Use

The major part of basin in Indian territory is covered with agricultural land accounting to 65.57% (564,866 km^2) of the total area and 16.00% (137,816 km^2) of the basin is covered by forests, followed by 8.89% (76,604 km^2) by wasteland, 4.28% (36,908 kn^2) by built-up land and 3.47% (29.877 km^2) by water bodies.



Source: Ministry of Water Resources, "Watershed Atlas of India (Version 2.0)", April 2014

Figure 19.3.1 Land Use in the Ganga River Basin

19.3.5 State-wise Gross Domestic Product (GDP)

The percentage of the Gross Domestic Product (GDP) by five states related to the Ganga River Basin to the national GDP has been in the relatively stable range of 20.2% to 21.8% for these seven years (2007-2014) as shown in **Table 19.3.3.** Taking into account the fact that the population percentage of five states to the national population was XX% in the Census 2011, the five states within the Ganga river basin are rather contributed to the nation GDP.

Watching state-wisely them, the GDP percentage of Uttar Pradesh to all India was biggest as 8.2% (ranked at the 2nd), followed by 6.6% of west Bengal (6th), 3.3% of Bihar (13th), 1.8% of Jhakhand (16th) and 1.2% of Uttarakhand (19th).

19.3.6 Below Poverty Line (BPL)

The percentage of the poverty population to the total population was 21.92% in 2011-12, while that of five states related to the Ganga River Basin was 47.3%, which was almost double higher than the national average. It is hard to say the people within the Ganga River Basin is rich.

Watching the state-wisely them, the Jhakhand was highest as 37.8% among five states, followed by 33.7% in Bihar, 29.4% in Uttar Pradesh, 20.0% in west Bengal and 11.3% in Uttarakhand as shown in **Table 19.3.4**. Even the lowest Uttarakhand is ranked at the 14th out of thirty states in India.

Table 19.3.3 Gross State Domestic Product (GSDP) at Current Prices (as on 31-05-2014) Gross

Sl. No.	States/UTs	(Rupee in Crores) - (Data from 2004-05 at 2004-05 Prices)							(% Growth over previous year)							2012-2013 Rank	2012-2013 (%)
		2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-14	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	Andhra Pr.	364,813	426,765	476,835	583,762	662,592	754,409	857,364	21.19	16.98	11.73	22.42	13.50	13.86	13.65	3	8.0
2	Arunachal Pr.	4,810	5,687	7,474	9,013	10,619	12,091	13,382	17.09	18.23	31.42	20.59	17.82	13.86	10.68	28	0.1
3	Assam	71,076	81,074	95,975	112,688	125,820	141,621	162,652	9.87	14.07	18.38	17.41	11.65	12.56	14.85	18	1.5
4	Bihar	113,680	142,279	162,923	204,289	247,318	313,995	368,337	12.85	25.16	14.51	25.39	21.06	26.96	17.31	13	3.3
5	Chattisgarh	80,255	96,972	99,364	119,420	132,872	153,621	175,961	20.01	20.83	2.47	20.18	11.26	15.62	14.54	17	1.6
6	Goa	19,565	25,414	29,126	33,605	36,025	34,965	NA	18.41	29.90	14.61	15.38	7.20	2.94	NA	22	0.4
7	Gujarat	329,285	367,912	431,262	521,519	594,563	670,016	NA	16.07	11.73	17.22	20.93	14.01	12.69	NA	5	7.1
8	Haryana	151,596	182,522	223,600	260,621	301,959	345,238	392,894	17.76	20.40	22.51	16.56	15.86	14.33	13.80	12	3.7
9	Himachal Pr.	33,963	41,483	48,189	57,452	64,957	73,710	82,585	12.19	22.14	16.17	19.22	13.06	13.48	12.04	21	0.8
10	J & K	37,099	42,315	48,385	58,073	65,759	75,574	87,319	11.64	14.06	14.34	20.02	13.24	14.93	15.54	20	0.8
11	Jharkhand	83,950	87,794	100,621	127,281	143,891	164,876	189,208	25.42	4.58	14.61	26.50	13.05	14.58	14.76	16	1.8
12	Karnataka	270,629	310,312	337,559	410,703	458,894	524,502	593,811	19.10	14.66	8.78	21.67	11.73	14.30	13.21	7	5.6
13	Kerala	175,141	202,783	231,999	263,773	307,906	349,338	NA	13.89	15.78	14.41	13.70	16.73	13.46	NA	10	3.7
14	Madhya Pr.	161,479	197,276	227,984	263,396	311,670	372,171	450,900	11.69	22.17	15.57	15.53	18.33	19.41	21.15	9	4.0
15	Maharashtra	684,817	753,969	855,751	1,035,086	1,199,548	1,372,644	NA	17.16	10.10	13.50	20.96	15.89	14.43	NA	1	14.6
16	Manipur	6,783	7,399	8,254	9,137	10,504	11,983	NA	10.53	9.08	11.56	10.70	14.96	14.08	NA	29	0.1
17	Meghalaya	9,735	11,617	12,709	14,583	16,412	18,135	20,808	12.87	19.33	9.40	14.75	12.54	10.50	14.74	25	0.2
18	Mizoram	3,816	4,577	5,260	6,388	7,198	8,053	NA	15.99	19.94	14.92	21.44	12.68	11.88	NA	31	0.1
19	Nagaland	8,075	9,436	10,527	11,759	13,203	14,832	NA	11.27	16.85	11.56	11.70	12.28	12.34	NA	27	0.2
20	Odisha	129,274	148,491	162,946	197,530	214,583	255,459	288,414	26.94	14.87	9.73	21.22	8.63	19.05	12.90	15	2.7
21	Punjab	152,245	174,039	197,500	226,204	256,430	286,809	319,117	19.76	14.32	13.48	14.53	13.36	11.85	11.26	14	3.1
22	Rajasthan	194,822	230,949	265,825	338,348	403,422	459,215	513,688	13.90	18.54	15.10	27.28	19.23	13.83	11.86	8	4.9
23	Sikkim	2,506	3,229	6,133	7,412	8,616	9,957	NA	15.96	28.85	89.93	20.85	16.24	15.56	NA	30	0.1
24	Tamil Nadu	350,819	401,336	479,733	584,896	665,312	744,474	850,319	12.98	14.40	19.53	21.92	13.75	11.90	14.22	4	7.9
25	Tripura	11,797	13,573	15,403	17,868	20,982	23,855	NA	8.09	15.05	13.48	16.00	17.43	13.69	NA	24	0.3
26	Uttar Pradesh	383,026	444,685	523,394	600,164	679,007	768,930	886,410	13.89	16.10	17.70	14.67	13.14	13.24	15.28	2	8.2
27	Uttarakhand	45,856	56,025	70,730	83,969	97,696	113,958	132,969	24.63	22.18	26.25	18.72	16.35	16.65	16.68	19	1.2
28	West Bengal	299,483	341,942	398,880	460,959	538,209	620,160	707,848	14.45	14.18	16.65	15.56	16.76	15.23	14.14	6	6.6
29	A & N islands	2,990	3,480	4,120	4,345	4,746	5,067	5,351	17.81	16.39	18.39	5.46	9.23	6.76	5.60	32	0.1
30	Chandigarh	13,669	15,334	17,717	20,017	23,211	26,162	NA	11.35	12.18	15.54	12.98	15.96	12.71	NA	23	0.3
31	Delhi	157,947	189,533	219,396	252,753	296,957	348,221	404,576	16.49	20.00	15.76	15.20	17.49	17.26	16.18	11	3.7
32	Puducherry	9,251	10,050	12,304	13,092	14,630	17,192	21,500	10.99	8.64	22.43	6.40	11.75	17.51	25.06	26	0.2
All-India GDP 04-05 base)		**4,582,086**	**5,303,567**	**6,108,903**	**7,248,860**	**8,391,691**	**9,388,876**	**10,472,807**	**15.91**	**15.75**	**15.18**	**18.66**	**15.77**	**11.88**	11.54		96.9
Five States		**925,995**	**1,072,725**	**1,256,548**	**1,476,662**	**1,706,121**	**1,981,919**	**2,284,772**									
Five States / All India		**20.2%**	**20.2%**	**20.6%**	**20.4%**	**20.3%**	**21.1%**	**21.8%**									

Source: For Sl. No. 1-32 -- Directorate of Economics Statistics of respective State Governments, and for All-India — Central Statistical Organisation; Released on 1st March, 2014; Estimates from 2004-05 to 2010-11 have been discussed with States DES

Table 19.3.4 Number of Persons Below Poverty Line in 2011-12

S. No.	States	Number of Persons in 2011-12			Percentage of Persons 2011-12			Rank
		Rural (lakh)	Urban (lakh)	Total (lakh)	Rural (%)	Urban (%)	Total (%)	
1	Andhra Pradesh	61.80	16.98	78.78	10.96	5.81	9.20	8
2	Arunachal Pradesh	4.25	0.66	4.91	38.93	20.33	34.67	31
3	Assam	92.06	9.21	101.27	33.89	20.49	31.98	28
4	Bihar	320.40	37.75	358.15	34.06	31.23	33.74	30
5	Chhattisgarh	88.90	15.22	104.11	44.61	24.75	39.93	35
6	Delhi	0.50	16.46	16.96	12.92	9.84	9.91	11
7	Goa	0.37	0.38	0.75	6.81	4.09	5.09	3
8	Gujarat	75.35	26.88	102.23	21.54	10.14	16.63	19
9	Haryana	19.42	9.41	28.83	11.64	10.28	11.16	13
10	Himachal Pradesh	5.29	0.30	5.59	8.48	4.33	8.06	5
11	Jammu & Kashmir	10.73	2.53	13.27	11.54	7.20	10.35	12
12	Jharkhand	104.09	20.24	124.33	40.84	24.83	36.96	33
13	Karnataka	92.80	36.96	129.76	24.53	15.25	20.91	24
14	Kerala	15.48	8.46	23.95	9.14	4.97	7.05	4
15	Madhya Pradesh	190.95	43.10	234.06	35.74	21.00	31.65	27
16	Maharashtra	150.56	47.36	197.92	24.22	9.12	17.35	20
17	Manipur	7.45	2.78	10.22	38.80	32.59	36.89	32
18	Meghalaya	3.04	0.57	3.61	12.53	9.26	11.87	16
19	Mizoram	1.91	0.37	2.27	35.43	6.36	20.40	23
20	Nagaland	2.76	1.00	3.76	19.93	16.48	18.88	21
21	Orissa	126.14	12.39	138.53	35.69	17.29	32.59	29
22	Punjab	13.35	9.82	23.18	7.66	9.24	8.26	7
23	Rajasthan	84.19	18.73	102.92	16.05	10.69	14.71	18
24	Sikkim	0.45	0.06	0.51	9.85	3.66	8.19	6
25	Tamil Nadu	59.23	23.40	82.63	15.83	6.54	11.28	15
26	Tripura	4.49	0.75	5.24	16.53	7.42	14.05	17
27	Uttarakhand	8.25	3.35	11.60	11.62	10.48	11.26	14
28	Uttar Pradesh	479.35	118.84	598.19	30.40	26.06	29.43	26
29	West Bengal	141.14	43.83	184.98	22.52	14.66	19.98	22
30	Puducherry	0.69	0.55	1.24	17.06	6.30	9.69	9
31	Andaman & Nicobar Islands	0.04	0.00	0.04	1.57	0.00	1.00	1
32	Chandigarh	0.00	2.34	2.35	1.64	22.31	21.81	25
33	Dadra & Nagar Haveli	1.15	0.28	1.43	62.59	15.38	39.31	34
34	Daman & Diu	0.00	0.26	0.26	0.00	12.62	9.86	10
35	Lakshadweep	0.00	0.02	0.02	0.00	3.44	2.77	2
	All India	**2,166.58**	**531.25**	**2,697.83**	**25.70**	**13.70**	**21.92**	
	Five States	**1,053.23**	**224.02**	**1,277.25**				
	Five States / All India	48.6%	42.2%	47.3%				

Source: Open Government Data (OGD) Platform India (https://data.gov.in/catalog/below-poverty-line-india)

19.3.7 Status of Public Hygiene

The houselisting and housing census 2011 was carried out on the sources of drinking water, holding status and type of latrine, use of electricity, and so on. Since the survey area was the same as that for population census, the houselisting and housing census data is directly expressed the situation of 118 towns.

(1) Holding Status of Latrines by Houses

The percentage of households having a latrine within its premises is highest as 88.7% in UK, followed by 74.1% in UP, 71.6% in BH and 46.5% in JK. The average of 118 towns except for those in WB due to no data availability is 77.6%. (It should be noted that this figure will be changing depending on that of WB, since its population share is as high as 46.5% in 118 towns.)

The households not having a latrine within premises will borrow the neighbour's latrine for use, use a public toilet or make a defecation outdoors within or out of premises. Depending on its form, it may cause the deterioration of surrounding public hygiene. Even 4.9% of households within 118 towns make a defecation outdoors within premises and threaten their own living environment.

Table 19.3.5 Availability of Latrine by Households

State	Latrine Location	Households (HH)			Percentage (%)		
		No. of HHs	Latrine		No. of HHs	Latrine	
			Available	Not Available		Available	Not Available
Uttarakhand	Total number of households	105,465	97,988	7,477	100.0	92.9	7.1
	Within premises	96,017	93,501	2,516	91.0	88.7	2.4
	Near premises	6,244	3,361	2,883	5.9	3.2	2.7
	Away	3,204	1,126	2,078	3.0	1.1	2.0
Uttar Pradesh	Total number of households	1,379,752	1,210,217	169,535	100.0	87.7	12.3
	Within premises	1,072,619	1,022,607	50,012	77.7	74.1	3.6
	Near premises	241,967	155,235	86,732	17.5	11.3	6.3
	Away	65,166	32,375	32,791	4.7	2.3	2.4
Bihar	Total number of households	806,978	645,942	161,036	100.0	80.0	20.0
	Within premises	636,104	577,549	58,555	78.8	71.6	7.3
	Near premises	119,140	53,091	66,049	14.8	6.6	8.2
	Away	51,734	15,302	36,432	6.4	1.9	4.5
Jhakhand	Total number of households	21,541	13,194	8,347	100.0	61.3	38.7
	Within premises	11,812	10,025	1,787	54.8	46.5	8.3
	Near premises	5,209	1,997	3,212	24.2	9.3	14.9
	Away	4,520	1,172	3,348	21.0	5.4	15.5
West Bengal	Total number of households	0	0	0	0.0	0.0	0.0
	Within premises	0	0	0	0.0	0.0	0.0
	Near premises	0	0	0	0.0	0.0	0.0
	Away	0	0	0	0.0	0.0	0.0
Total	Total number of households	2,313,736	1,967,341	346,395	100.0	85.0	15.0
	Within premises	1,816,552	1,703,682	112,870	78.5	73.6	[illegible]
	Near premises	372,560	213,684	158,876	16.1	9.2	6.9
	Away	124,624	49,975	74,649	5.4	2.2	3.2

Note: Data for West Bengal is not available due to the broken file on the website。
Source: Prepared by JICA Survey Team based on Houselisting and Housing Census Data 2011 (http://censusindia.gov.in/2011census/hlo/HLO_Tables.html)

(2) Type of Latrine Facility

Table 19.3.6 shows the type of latrine facility within premises. According to this, the connection rates to a piped sewer system are 64.6% in UK, 47.1% in UP, 28.5% in WB,

11.3% in BH, and 1.8% in JK with a big difference among states concerned. The coverage by a septic tank is highest as 59.5% in BH, followed by 48.5% in WB, 48.3% in JK, 35.0% in UP and 22.5% in UK. The pour flush latrine is generally used for a septic tank which have a water seal unit to avoid the smell emission. The four states except for JK, more than 70% of households use the sanitary latrine with a water seal unit including the flush latrine. In addition, the ventilation-improved pit latrine with a slab is relatively much used at 13.0% households in WB

Out of the households not having latrine facility within premises, 37.8% use the public toilets and remaining 62.2% make a defecation at the vacancy. The open defecation rates to the total households are relatively high as 37.5% in JK and 17.2% in JK. Especially, the Jhakhand State has a big problem in public hygiene

Table 19.3.6 Type of Latrine Facility Used Households in 118 Towns

Number of Households (HHs)

S. No.				Uttarakhand	Uttar Pradesh	Bihal	Jhakhand	West Bengal	Total
(1)	Total number of households			105,465	1,380,980	817,752	21,541	2,569,541	4,895,279
(2)	Number of households having latrine facility within the premises			97,988	1,210,085	656,874	13,194	2,360,374	4,338,515
(3)	Type of latrine facility within the premises	Flush/pour flush latrine connected to	Piped sewer system	68,138	650,681	92,656	379	584,455	1,396,309
(4)			Septic tank	23,721	482,974	486,213	10,394	1,369,749	2,373,051
(5)			Other system	374	23,564	29,235	978	44,142	98,293
(6)		Pit latrine	With slab/ ventilated improved pit	5,168	22,901	30,298	828	334,460	393,655
(7)			Without slab/ open pit	88	5,762	8,465	198	10,021	24,534
(8)		Night soil disposed into open drain		347	13,685	6,050	399	6,813	27,294
(9)		Service Latrine	Night soil removed by human	62	6,539	1,968	11	2,171	10,751
(10)			Night soil serviced by animal	90	3,979	1,989	7	8,563	14,628
(11)	Number of households not having latrine facility within the premises			7,477	170,895	160,878	8,347	209,167	556,764
(12)	No latrine within premises	Alternative source	Public latrine	2,485	50,470	20,445	268	136,663	210,331
(13)			Open	4,992	120,425	140,433	8,079	72,504	346,433

Percentage (%)

S. No.				Uttarakhand	Uttar Pradesh	Bihal	Jhakhand	West Bengal	Total
(2)	Total number of households			100.0	100.0	100.0	100.0	100.0	100.0
(3)	Number of households having latrine facility within the premises			92.9	87.6	80.3	61.3	91.9	88.6
(4)	Type of latrine facility within the premises	Flush/pour flush latrine connected to	Piped sewer system	64.6	47.1	11.3	1.8	22.7	28.5
(5)			Septic tank	22.5	35.0	59.5	48.3	53.3	48.5
(6)			Other system	0.4	1.7	3.6	4.5	1.7	2.0
(7)		Pit latrine	With slab/ ventilated improved pit	4.9	1.7	3.7	3.8	13.0	8.0
(8)			Without slab/ open pit	0.1	0.4	1.0	0.9	0.4	0.5
(9)		Night soil disposed into open drain		0.3	1.0	0.7	1.9	0.3	0.6
(10)		Service Latrine	Night soil removed by human	0.1	0.5	0.2	0.1	0.1	0.2
(11)			Night soil serviced by animal	0.1	0.3	0.2	0.0	0.3	0.3
(12)	Number of households not having latrine facility within the premises			7.1	12.4	19.7	38.7	8.1	11.4
(13)	No latrine within premises	Alternative source	Public latrine	2.4	3.7	2.5	1.2	5.3	4.3
(14)			Open	4.7	8.7	17.2	37.5	2.8	7.1

Source: “Houselisting and Housing Census 2011”

19.3.8 Status of Ghats, Crematoria, etc.

Table 19.3.7 Status of Ghats and Crematoria

Towns	State	No. of Ghats	No. of Crematoria	Source
Haridwar	Uttarakhand	12		Website
Kanpur	Uttar Pradesh	29	N/A	CDP (2006)
Allahabad	Uttar Pradesh			
Varanasi	Uttar Pradesh	84	(2)	CDP (2015)
Patna	Bihar	20	3	DPR, CDP (2010-30)
Kolkata	West Bengal		7	Website
Kamarhati	West Bengal	13		DPR
Kanchrapara	West Bengal	16		DPR
Panihati	West Bengal	16		DPR
Howrah	West Bengal	7	1	DPR
Bally	West Bengal	7		DPR
Bansberia	West Bengal	?		DPR
Titagarth	West Bengal	4		DPR

CDP: City Development Plan DPR: Detailed Project Report

19.4 Irrigation, Water Supply and Other Water Use

19.4.1 Irrigation

The Ganga Basin happens to be one of the most widely and heavily irrigated agricultural lands in the world. The net area irrigated through all available sources is roughly 3,61,100 km^2 (2008) which constitutes about 57% of the total net irrigated area across the country. The farmers of this region practice multiple cropping in large parts of the basin, hence the fields get irrigated more than once a year. The sum of these multiple irrigated areas can be estimated to be about 4,84,240 km^2 which is the gross irrigated area. Precipitation through the atmosphere is the sole source of water which falls as rain, snow, sleet, or hail and acts as a water resource to the flowing river as well as the recharging of the Gangotri glacier. Much of the water runs off the land surface and also seeps through the subsoil layer eventually recharging the groundwater. A portion of the water amounting to about 30% is lost to the atmosphere through transpiration and evaporation. During its movement either on the surface or at the subsurface level, it absorbs large number of chemical constituents, some of which are the residues of pesticides and fertilizers which are used to supplement the growth of crops.

Table 19.4.1 State / Source-wise net area irrigated (2000-2001) in the Ganga Basin

S. No.	Name of the State/UT	Canals (Km^2)	Tank (Km^2)	Wells (Km^2)	Other Sources (Km^2)	Total Area (All Sources) (Km^2)
1	**Bihar**	**11360**	**1550**	**20390**	**2410**	**36250**
2	Haryana	14760	10	14670	140	29580
3	Himachal Pradesh	30	(a)	140	1070	1240
4	Madhya Pradesh	8080	850	26510	5910	41350
5	Rajasthan	13540	380	34730	420	49070
6	**Uttar Pradesh**	**30910**	**820**	**93840**	**2590**	**128160**
7	**West Bengal**	**2610**	**1730**	**13970**	**5230**	**23540**
8	Delhi	20	-	300	20	340
	Ganga Basin States	81310	5340	205090	17790	309530
	India as a Whole	159890	25240	332770	28920	546820

Source: Water Data- Complete Book, Central Water Commission, GoI, 2005
Note: (a): Below 5000 km^2 Total may not tally due to rounding off.

The net irrigated area in the Ganga Basin constitutes nearly 56.6 percent of India's 546, 820 km^2 of net irrigated area. About 41.4 per cent of the basin's irrigated area lies in Uttar Pradesh alone. In fact, the three Gangetic States - Uttar Pradesh, Bihar and West Bengal - have between them 60.7 per cent of the basin's total area irrigated.[7]

Table 19.4.2 shows the breakdown of water sources for irrigation in Uttar Pradesh in 2012-13. The use of irrigation canals is stayed at 16.7%, compared with 67.0% from private tubewells, 4.0% from governmental tubewells and 12.3% from others.

Similarly, in Bihar in 2009-10, the water sources for irrigation are 68.8% from private tubewells, 23.0% from irrigation canals, 1.9% from tanks, 0.2% from other wells and 5.4% from other sources.

[7] http://agropedia.iitk.ac.in/content/agricultural-characteristics-ganga-basin

Table 19.4.2 Breakdown of Water Sources for Irrigation in Uttar Pradesh (2012-13)

S. No.	District	Net Irrigated Area	Canal	Govt. Tubewell	Private Tubewell	Other Sources
1	Saharanpur	256,216	41,200	9,569	205,447	0
2	Muzaffarnagar	219,617	54,098	2,674	139,489	20,356
3	Shamli	**	**	**	**	**
4	Bijnor	307,157	16,642	6,114	186,249	98,152
5	Moradabad	182,286	12,391	8,590	64,643	96,662
6	Sambhal	**	**	**	**	**
7	Rampur	189,062	644	183	88,524	99,711
8	Amroha	170,595	0	213	113,939	56,443
9	Meerut	196,462	33,299	2,459	160,512	192
10	Baghpat	107,927	3,554	15,491	88,597	285
11	Ghaziabad	52,655	8,903	4,313	38,045	1,394
12	Hapur	**	**	**	**	**
13	Gautam Buddha Nagar	57,909	13,210	1,774	27,305	15,620
14	Bulandshahar	298,076	25,755	2,956	260,982	8,383
15	Aligarh	303,127	26,860	5,225	270,689	353
16	Hathras	149,515	12,680	1,439	135,371	25
17	Mathura	266,472	84,417	161,234	20,821	0
18	Agra	257,401	22,175	4,503	230,438	285
19	Firozabad	175,871	17,404	625	156,390	1,452
20	Etah	180,643	21,792	7,516	151,335	0
21	Kasganj	140,981	12,532	3,407	73,890	51,152
22	Mainpuri	183,294	54,679	9,182	116,817	2,616
23	Budaun	336,392	4	7,319	177,669	151,400
24	Bareilly	314,776	18,472	1,670	181,403	113,231
25	Pilibhit	230,142	35,130	433	194,574	5
26	Shahjahanpur	322,827	11,488	385	288,717	22,237
27	Kheri	412,165	16,743	2,467	392,955	0
28	Sitapur	394,610	18,640	6,192	369,591	187
29	Hardoi	391,993	54,956	4,197	332,818	22
30	Unnao	295,777	71,736	628	222,809	604
31	Lucknow	128,743	23,020	4,786	100,856	81
32	Rae Bareli	161,048	61,655	1,941	97,319	133
33	Amethi	173,978	84,926	6,176	70,473	12,403
34	Farrukhabad	138,195	2,982	5,322	129,891	0
35	Kannauj	139,896	11,253	4,466	121,036	3,141
36	Etawah	130,000	63,274	5,164	61,488	74
37	Auraiya	121,537	48,781	2,151	70,313	292
38	Kanpur Dehat	155,705	55,255	7,879	92,501	70
39	Kanpur Nagar	120,760	25,409	6,798	87,489	1,064
40	Jalaun	235,700	149,784	19,069	40,780	26,067
41	Jhansi	247,182	100,657	2,121	16,772	127,632
42	Lalitpur	282,099	93,832	530	65,478	122,259
	Total	**8,425,791**	**1,410,232**	**337,161**	**5,644,415**	**1,033,983**
	Percentage (%)	**100.0**	**16.7**	**4.0**	**67.0**	**12.3**

Source: Economics and Statistics Division, State Planning Institute, Planning Department、UP, "Statistical Diary – Uttar Pradesh 2014"

19.4.2 Water Supply

The data herein handled is based on the results of Houselisting and Housing Census 2011. Accordingly, the total population and the served population by water supply are not necessary follow the actual service area exactly defined in a water supply scheme, but reflect the rough figure of service coverage in the urban area.

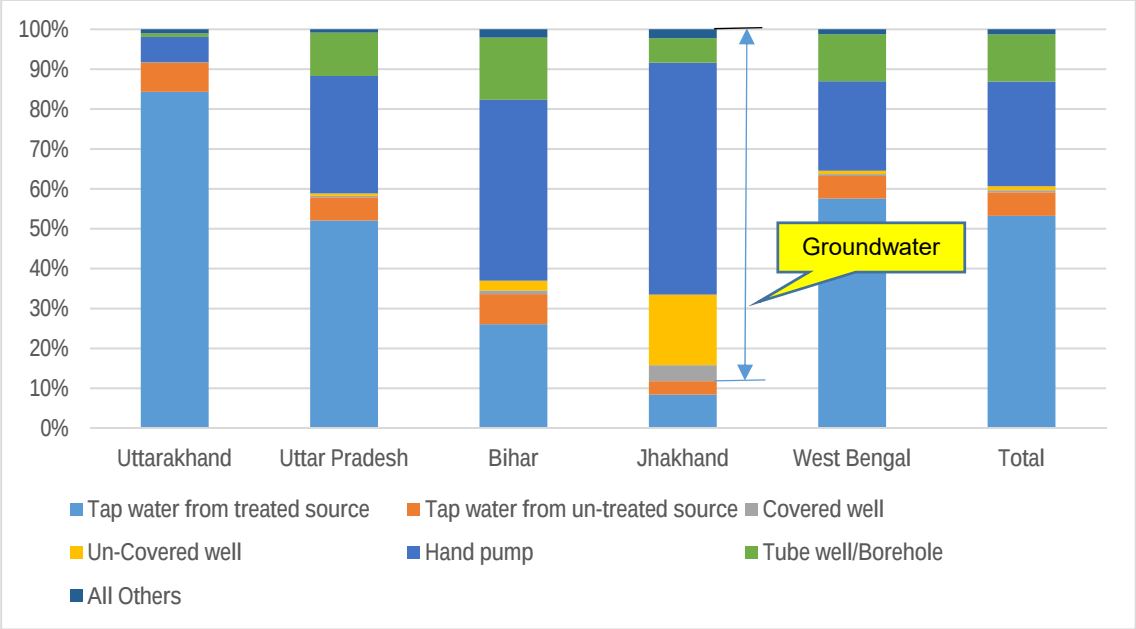
Table 19.4.3 Main Source of Drinking Water in 118 River Front Towns

(Unit: HHs)

Main source of drinking water	Uttarakhand	Uttar Pradesh	Bihar	Jhakhand	West Bengal	Total
All sources	105,465	1,379,752	806,978	21,541	4,881,805	7,195,541
Tap water from treated source	88,923	717,949	210,319	1,809	2,808,705	3,827,705
Tap water from un-treated source	7,709	80,595	60,744	730	277,028	426,806
Covered well	51	5,137	7,538	858	22,759	36,343
Un-covered well	22	7,882	19,629	3,816	41,760	73,109
Hand pump	6,705	406,493	365,881	12,522	1,095,393	1,886,994
Tube well/borehole	944	149,902	126,055	1,324	574,721	852,946
All others	1,111	11,794	16,812	482	61,439	91,638

Source: JICA Survey Team based on Houselisting and Housing Census 2011

The percentage of tap water from treated source is highest as 84.3% in UK, which is declined towards the downstream of the River Ganga such as 52.0% in UP, 26.1% in Bihar, only 8.4% in JK and then restored to 63.2% in WB with an average of 53.2% in the Ganga Basin. Adversely, the use of hand pumps is high as 58.1% in JK, 45.3% in Bihar, 29.5% in UP and 22.4% in WB and the use of tubewells is high as 15.6% in BH, 11.8% in WB and 10.9% in UP. Especially in JK and BH, the dependence on groundwater is very high as 86.0% and 64.3%, respectively. This supports that the Gangetic Plain is blessed with groundwater as stated in "**19.2.5 Hydrogeology**".



Source: Prepared by JICA Survey Team based on the results of "Houselisting and Housing Census – 2011"

Figure 19.4.1 State-wise Main Source of Drinking Water in 118 River Front Towns

19.5 Existing and Proposed Sewerage Facilities

19.5.1 Existing Sewerage Facilities

Tables 19.5.1 and **19.5.2** shows the status of sewerage project implementation in the River Ganga basin and their details, respectively.

Table 19.5.1 Status of Sewerage Project Implementation in the River Ganga Basin

State	Class							Total Capacity (MLD)
	I	II	III	IV	V	VI	Total	
Uttarakhand	1	1	3	3	3	4	15	
	1	1	2	2	2	2	10	94.30
Uttar Pradesh	11	10	8	2			31	
	6	2	3	1			12	1197.86
Bihar	12	9	5				26	
	5						5	282.00
Jhakhand		1	1				2	
		1					1	12.00
West Bengal	32	10	2				44	
	20	6	2				28	557.13
Total	56	31	19	5	3	4	118	
	32	10	7	3	2	2	56	2143.29
STP-Existing/Sanctioned Town								
Uttarakhand	Haridwar	Rishikesh	Tehri, Srinagar	Uttarkashi, Muni ki Reti-Dhaluwara	Kamaprayag, Rudraprayag	Badrinath, Devprayag		
Uttar Pradesh	Allahabad, Kanpur, Mirzapur, Varanasi, Moradabad, Ballia	Bijnor, Kannauj	Anupshahar, Garhmukteshwar, Narara	Bithoor				
Bihar	Buxar, Hajipur, Munger, Patna, Begusarai							
Jhakhand		Sahebganj						
West Bengal	Kolkata, Nabadwip, Barackpore, Baidyahati, Champdani, Bhadreshwar, Baranaagar, Naihati, Serampore, Maheshtala, Panihati, Bally, Khardah, Howrah, Bansberia, Chandannagar, Titagarh, Halishahar, Kalyani, Bhatpara	Jiaganj-Azimganj, Katwa, Konnagar, Budge Budge, Gayespur, Gaulia	Murshidabad, Diamond Harbour					

Table 19.5.2 Details of Sewerage Facilities in the River Ganga

S. No.	State	Class of Town	District	Town	Type	Date of Sanction	Name/ Nature of Works	EAP	STP Capacity			Sewer Network		Total Expenditure	Overall Physical Progress (%)	
									To be created (MLD)	To be created through rehab. (MLD)	Created (MLD)	To be laid (km)	Laid (km)			
1	Uttarakhand	I	Haridwar	Haridwar	NPP + OG + ITS	23/03/2011	SN		-			13.49	11.81	16.72	100	
						23/03/2011	STP (Sarai)		18.00		18.00			18.94	100	
						28/09/2015	STP (Jagjeetpur)		40.00							
2		II	Dehradun	Rishikesh (including Tapovan)	NPP	23/03/2011	SN		-			1.02	1.02	3.53	100	
3		III	Chamoli	Gopeshwar	NPP	18/03/2010	I&D		-			35.63	20.31	8.72	61	
4			Tehri Garhwal	Tehri	NPP	23/03/2011	SN, STP		3.50			11.04	10.00	12.34	92	
6		IV	Chamoli	Joshimath	NPP	17/03/2010	I&D		-			27.66	4.67	4.32	40	
			Uttarkashi	Uttarkashi (Budkot)	NPP	23/03/2011	SN, STP									
7						25/06/2015	SN *1									
8			Tehri Garhwal	Muniki Reti - Dhaluwala	NP + CT	26/12/2013	SN, STP	World Bank	7.50			29.52		0.26		
10		V	Chamoli	Karnaprayag	NP	24/12/2008	STP		1.40					0.00	0	
						20/07/2009	I&D		-			1.50	1.35	0.96	12	
11			Rudraprayag	Rudraprayag	NPP	22/09/2009	I&D		-			6.69	1.62	0.68	12	
						22/09/2009	STP		3.00					0.00	0	
14		Vi	Chamoli	Badrinath(puri)	NP	16/10/2008	I&D									
						22/08/2008	STP		3.00							
15			Tehri Garhwal	Devprayag	NP	08/07/2009	I&D		-			7.61	4.50	2.99	58	
						22/07/2009	STP		1.40					2.91	95	
						20/06/2015	SN *1									
									77.80		18.00	134.16	55.28	72.37		
17		I	Allahabad	Allahabad	M Corp. + OG + CB	06/05/2010			85.00		85.00	10.88	10.77	161.66	93	
						06/05/2010	SN, STP, RFD, LCS	World Bank	20.00		20.00	9.24	8.31	82.30	93	
						22/02/2011	SN ("E")	World Bank				109.20	108.00	117.99	93	
						27/11/2013	STP (Salori)	World Bank	14.00					6.33	25	
						27/11/2013	SN ("C" & Allahpur)	World Bank				134.19		12.60	7	
						20/02/2014	SN ("A")	World Bank				241.63		24.22		
						30/12/2014	SN ("B")	World Bank				214.88				
21			Varanasi	Varanasi	M Corp.	29/03/2011	RFD							0.72	12	
						29/08/2011										
						14/07/2010	SN, STP, RFD, LCS	JICA	140.00			28.00	12.00	144.84	27	
23			Moradabad	Moradabad (Ramganga)	M Corp	24/02/2011	SN, STP		58.00		52.00	264.25	213.53	124.01	73	
28		III	Kannauj	Kannauj	NPP	24/02/2011	SN, STP		1.00			62.50	46.25	19.77	48	

Table 19.5.2 Details of Sewerage Facilities in the River Ganga (Cont'd)

S. No.	State	Class of Town	District	Town	Type	Date of Sanction	Name/ Nature of Works	EAP	STP Capacity			Sewer Network		Total Expenditure	Overall Physical Progress (%)	
									To be created (MLD)	To be created through rehab. (MLD)	Created (MLD)	To be laid (km)	Laid (km)			
37			Bulandshahr	Anupshahar	NPP	19/05/2014	STP (Shahar)	World Bank	2.50			58.88				
40		III	Ghaziabad	Garhmukhteshwar	NPP	22/02/2011	SN, STP		9.00			69.00	55.20	25.78	74	
42			Bulandshahar	Narora	NP	04/04/2014	SN, STP	World Bank	4.00			21.03				
45		IV	Kanpur Nagar	Bithoor	NP	26/12/2013	SN, STP	World Bank	2.40			32.00				
									335.90		157.00	1255.68	454.06	720.22		
49			Buxar	Buxar	NP	08/03/2010	SN, STP	World Bank (Retroactive)	16.00			95.21	38.00	13.45	36	
51			Vaishali	Hajipur	NP	08/03/2010	SN, STP		22.00			198.00	61.50	32.48	47	
52			Munger	Munger	M Corp.	20/05/2010	SN, STP	World Bank (Retroactive)	27.00			143.00	14.50	3.24	21	
53			Patna	Patna	M Corp. + OG	19/06/2013	RFD	World Bank						50.14	53	
						26/12/2013	STP (Pahari)	World Bank	35.00	25.00				0.00		
						26/12/2013	SN (Zone IVA)	World Bank				87.69		0.00		
		I				20/02/2014	SN (Zone V)	World Bank				110.65		0.00		
						15/07/2014	STP (Beur)	World Bank	8.00	35.00						
						15/07/2014	STP (Kamalichak)	World Bank	33.00	4.00						
						30/12/2014	SN (Beur)	World Bank				179.74				
						30/12/2014	SN (Kamalichak)	World Bank				96.54				
						01/04/2015	SN, STP (Saidpur)	World Bank	60.00			55.10				
						01/04/2015	SN (Saidpur)	World Bank				172.50				
55			Begusarai	Begusarai	M Corp	08/03/2010	SN, STP	World Bank (Retroactive)	17.00			105.00	26.00	13.93	32	
									218.00	64.00		1243.43	140.00	113.24		
73	Jhakhand	II	Sahebganj	Sahebganj	NP	26/12/2013	SN, STP (Sahibganj)	World Bank	12.00			55.00		0.75	0	
									12.00			55.00		0.75		
75			Kolkata	Kolkata	M Corp.	10/01/2010	I&D, Afforestation							8.65	100	
						10/01/2010	RFD							13.00	100	
						29/01/2010	RFD, CRE							14.00	100	
	Westb Bengal	I				29/01/2010	RFD *2							8.30	100	
83			North 24 Parganas	Barrackpore	M	22/02/2011	RFD							6.23	100	
						30/12/2014	SN, STP	World Bank	24.00			247.14				
84			8.77	Uttarpara Kotrung	M	22/02/2011	RFD							8.77	100	

Table 19.5.2 Details of Sewerage Facilities in the River Ganga (Cont'd)

S. No.	State	Class of Town	District	Town	Type	Date of Sanction	Name/ Nature of Works	EAP	STP Capacity			Sewer Network		Total Expenditure	Overall Physical Progress (%)	
									To be created (MLD)	To be created through rehab. (MLD)	Created (MLD)	To be laid (km)	Laid (km)			
85			Hugli	Rishra	M	03/02/2010	RFD							2.33	100	
86			Hugli	Baidyabati	M	02/02/2010	RFD							4.72	100	
89			North 24 Parganas	Kamarhati	M	24/06/2010	RFD							11.33	100	
91			North 24 Parganas	Naihati	M	01/02/2010	RFD							10.57	100	
93			Hugli	Serampore	M	29/01/2010	RFD							3.62	100	
94			Hugli	Hugli-Chinsurah	M + OG	22/02/2011	RFD, CRE							9.99	100	
95			South 24 Parganas	Maheshtala	M	16/11/2010	RFD, CRE							7.82	100	
96			North 24 Parganas	Panihati	M	24/06/2010	RFD							11.70	100	
97			Haora	Bally	M	29/06/2010	RFD							4.55	100	
99			Haora	Howrah	M Corp	27/01/2010	CRE							2.40	100	
						02/02/2010	RFD							9.00	100	
100			North 24 Parganas	Khardah	M	01/02/2010	RFD							3.53	100	
101			Hugli	Bansberia	M	27/01/2010	RFD							11.75	100	
102			Hugli	Chandannagar	M Corp	01/02/2010	RFD							4.30	100	
103			North 24 Parganas	Titagarh	M	29/06/2010	RFD									
104			North 24 Parganas	Halishahar	M	22/02/2011	RFD, CRE							11.81	100	
						28/02/2014	SN, STP	World Bank	16.00			226.99		0.16		
105			Nadia	Kalyani	M	01/03/2011	SN, STP		5.00			51.00	4.30	58.77	59	
106			North 24 Parganas	Bhatpara	M + OG	01/03/2011	SN, STP		31.00			125.00	34.00	116.96	57	
113		II	Hugli	Konnagar	M	22/02/2011	RFD							5.32	100	
114			South 24 Parganas	BudgeBudge	M	22/02/2011	RFD							4.63	100	
						11/07/2014	SN, STP	World Bank	9.30			131.59		0.12		
115			Nadia	Gayespur	M	22/02/2011	SN, STP		8.23			61.00	20.00	77.24	100	
									93.53			842.72	58.30	431.57		

I&D: Interception and Divergence
SN: Sewer Network
CRE: Electric Crematoria
RFD: River Front development
DR: Disaster Restoration
LCS: Low Cost Sanitation
*1 Restoration and Reconstruction of SN due to Disaster
*2 Resuscitation of Chelta Boat Canal joining Ganga
Source: *https://nmcg.nic.in/Uttrakhand_Project.aspx*
https://nmcg.nic.in/writereaddata/fileupload/8_MPR%20NGRBA_Projects__statusUP_September-2015%20A4%20pg.pdf
Note: The sanction date is based on "Project Sanctioned" data of NMCG official website.

19.6 Status of Industrial Wastewater

19.6.1 Grossly Polluting Industries

The National River Conservation Authority (NRCA) in its meeting held on July 12, 1997 under the Chairmanship of the Prime Minister, decided that the polluting industries which are directly discharging their effluents into rivers and lakes, without requisite treatment, should be asked to install the requisite effluent treatment systems within three months, failing which closure notices should be issued.

The criteria defined for the National River Conservation Plan (NRCP) was to include those industries which (I) discharge their effluents into a water course including rivers and lakes, and (ii) are either involved in manufacture & use of hazardous substances or discharge effluents with a BOD load of 100kg/day or more, or both. These industries are called as Grossly Polluting Industries.

As on September 2009, a total of 478 GPIs were identified in Ganga Basin, out of which 348 industries have installed ETPs and operating satisfactorily, 56 industries are not operating satisfactorily and 74 industries have been closed down.

Table 19.6.1 Grossly Polluting Industries in the Ganga Basin

No.	Rivers	OPRS	OPRNS	UCL	Total
1	Betwa	0	1	0	1
2	Chambal	0	0	0	0
3	Damodar	3	0	0	3
4	Gandak	0	0	0	0
5	Ganga	95	22	38	155
6	Ghaghra	2	0	1	3
7	Gomti	21	5	4	30
8	Hindon	26	0	4	30
9	Kali	45	0	10	55
10	Khan	0	0	0	0
11	Kosi	1	3	0	4
12	Kshipra	0	0	0	0
13	Ramganga	30	17	4	51
14	Yamuna	125	8	13	146
	Total	**348**	**56**	**74**	**478**

http://www.moef.nic.in/sites/default/files/ngrba/Ganga%20Basin.pdf

OPRS- ETP operating satisfactorily
OPRNS- ETP not operating satisfactorily
UCL- Unit closed

CPCB has designated the following 17 categories as grossly polluting Industries:

Table 19.6.2 Categories Designated as Grossly Polluting Industries

1	Aluminium Smelter	10	Pesticides
2	Caustic Soda	11	Petrochemicals
3	Cement	12	Drugs & Pharmaceuticals
4	Copper Smelter	13	Pulp & Paper
5	Distilleries	14	Oil Refineries
6	Dyes & Dye Intermediates	15	Sugar
7	Fertiliser	16	Thermal Power Plants
8	Integrated Iron & Steel	17	Zinc Smelter
9	Tanneries		

The information on grossly polluting industries is collected through a questionnaire. The format of the questionnaire is duly filled by the regional offices of the concerned state Boards. The filled questionnaire after judicious scrutiny by in-house experts has been summarized below**.** It is pertinent to mention that this database is primarily on the information of grossly polluting industries. Grossly Polluting Industries (GPI) are defined as the industry which is discharging wastewater more than 100KLD and/or hazardous chemicals used by the industry as specified under the Schedule-I, Part-II of "The Manufacture, Storage and Import of Hazardous Chemical Rules of 1989" under "Environment (Protection) Act, 1986".

Industrial units are classified in following sectors.

- Chemicals: which mainly include fertilizer, petro-chemical, pesticides and pharmaceuticals.
- Distillery
- Dairy, Food & Beverage
- Pulp and Paper
- Sugar
- Tannery
- Textile, Bleaching & Dyeing
- Other (Cement, Slaughter house, Ordinance, Packaging & printing, Paint, Electronics& Electrical, Thermal, Kattha –kachh, Electroplating, Metallurgical, automobile etc.

Table 19.6.3 State-wise Status

S. No.	Action/State	Uttar Pradesh	Uttar-akhand	Bihar	West Bengal	Total
1	Direction under section 5 of Environment (Protection) Act, 1986	142	3	0	1	**146**
2	Direction under section 18(1)(b) of Water Act, 1974	12	0	0	1	**13**
3	Letter issued for ensuring compliance	25	2	1	6	**34**
4	No action required	23	0	0	0	**23**
5	Found closed	11	1	0	0	**12**
6	Action under process	158	4	0	15	**177**
7	Inspection report under preparation	33	2	0	1	**36**
	TOTAL	**404**	**12**	**1**	**24**	**441**

Source: CPCB, "Pollution Assessment: River Ganga", July 2013

Table 19.6.4 Industrial Sector-wise Status

S. No.	Action/ State	Distillery & Fermentation	Sugar	Pulp & Paper	Tannery	Chemical	Food, Dairy & Beverage	Dyeing & Textile	Other	Total
1	Direction under section 5 of Environment (Protection) Act, 1986	23	3	10	106	1	1	2	0	**146**
2	Direction under section 18(1)(b) of Water Act,1974	0	1	0	11	0	0	0	1	**13**
3	Letter issued for ensuring compliance	3	10	5	3	2	0	3	8	**34**
4	No action required	1	0	1	20	1	0	0	0	**23**
5	Found closed	1	1	3	6	0	0	1	0	**12**
6	Action under progress	14	3	7	110	10	11	10	12	**177**
7	Inspection report under preparation	1	0	6	3	9	4	3	10	**36**
	TOTAL	**43**	**18**	**32**	**259**	**23**	**16**	**19**	**31**	**441**

Source: CPCB, "Pollution Assessment: River Ganga", July 2013

19.6.2 Problem Areas Identified by CPCB

CPCB has identified 24 problem areas in the country where industrial and anthropogenic activities are concentrating and cause rigorous environmental degradation. These problem areas are presented in **Table 19.6.5**. In the Ganga Basin, Singrauli in Uttar Pradesh and Durgapur and Howrah (or Haora) in West Bengal are designated as the problem area.

Table 19.6.5 Problem Areas Identified by CPCB

Sl. No.	Problem Area Identified by CPCB	State
1.	**Durgapur**	**West Bengal**
2.	**Howrah**	**West Bengal**
3.	Dhanbad	Jharkhand
4.	Angul Talcher	Orissa
5.	**Singrauli**	**Uttar Pradesh (U.P.)**
6.	Vishakapatnam	Andhra Pradesh (A.P.)
7.	Bolaram-Patancheru	Andhra Pradesh (A.P.)
8.	Bhadravathi	Karnataka
9.	Greater Cochin	Kerala
10.	Manali	Tamilnadu (T.N.)
11.	North Arcot	Tamilnadu (T.N.)
12.	Ankleshwar	Gujarat
13.	Vapi	Gujarat
14.	Chembur	Maharashtra
15.	Tarapur	Maharashtra
16.	Digboi	Assam
17.	Parwanoo	Himachal Pradesh (H.P.)
18.	Kala-Amb	Himachal Pradesh (H.P.)
19.	Mandi Gobindgarh	Punjab
20.	Nagda-Ratlam	Madhya Pradesh (M.P.)
21.	Korba	Chattisgarh
22.	Chembur	Maharashtra
23.	Pali-Jodhpur	Rajasthan
24.	Drain Basin Area, Najafgarh	Delhi

19.6.3 Notice to Industries

CPCB declared the following Notice to Highly Polluting Industries issued on February 11, 2016.

The Central Pollution Control Board had issued "show cause notice" (dated: July 2015 and August 2015) under the provision of section 5 of Environment (Protection) Act, 1986 to 3387 highly polluting Industries of 17 categories. The following 815 industrial units have not responded to the show cause notice issued to them wherein 256 directions were returned undelivered and 559 have

not responded. This has been viewed seriously on the part of the industry for noncompliance of directions.

Notice is hereby, issued to the listed industries that should respond immediately but not later than within a weeks' time from the publication of this notice failing which the industry shall be liable for closure for noncompliance for the direction under section 5 of Environment (Protection) Act, 1986.

As an Example, the Notice to one sugar industry was as follows:

WHEREAS, the Unit was inspected under National Ganga River Basin Authority (NGRBA) programme by the officials of Central Pollution Control Board (CPCB} on 29.12.2015, and observed the following:

1. ETP outlet effluent sample analysis showed BOD 130 mg/l and COD 257 mg/l as against the prescribed limits of BOD 100 mg/l and COD 250 mg/l.

It is evident from the above observations that the Unit is violating the notified general effluent standards under the Environment (Protection) Act, 1986 and the Unit without complying with the prescribed effluent discharge standards is discharging its partially treated effluent for irrigation purpose or in drain thereby posing serious threat to the surface and groundwater quality.,

NOW, THEREFORE, in view of the above observations and the exercise of powers delegated to the Chairman, Central Water Pollution Board under Section 5 of the Environment (Protection) Act, 1986, notice is hereby served to the Unit to Show Cause why the Unit should not be closed down for not complying with the prescribed effluent discharge standards notified under the Environment (Protection) Rules, 1986 and amendment thereof.

The reply to the Show Cause Notice shall be submitted to this office within 20 days from the date of receipt of this notice.

While, for another sugar industry

WHEREAS, the Unit was inspected under National Ganga River Basin Authority (NGRBA) programme by the officials if Central Pollution Control Board (CPCB) 0n 02.01.2016, and observed the following:

1. *ETP outlet effluent sample analysis showed BOD 808 mg/l and COD 1234 mg/l as against the prescribed limits of BOD 100 mg/l and COD 250 mg/l.*

2. *During inspection, ETP was found not operational.*
3. *Unit has not constructed separate lagoon for storage of treated effluent and was found discharging partially treated effluent via tankers to local drain/fields.*

For the factory not complied with the effluent standards, CPCB has responded strictly regardless of their extents exceeding the standards

19.6.4 Pollution Load on the River Ganga Discharged through Drains

Drains are the channels which are either man made or available in the system naturally to carry storm water to its disposal point which can be either a river or a lake/pond or sea. However, in absence of sewerage systems, drains are turned into open sewers to carry storm water and sewage.

CPCB has identified 138 drains and discharging 6087 MLD of wastewater. In Uttrakhand 14 nos. of drains are discharging 440 MLD of industrial and domestic wastewater directly/indirectly to river Ganga. Uttar Pradesh discharges 3,289 MLD of industrial and domestic wastewater through 45 drains. 25 no. of drains identified in state of Bihar discharging 579 MLD of wastewater to river Ganga. 1,779 MLD of wastewater discharges to river Ganga through 54 drains in West Bengal. Details are mentioned below:

The BOD load discharged from the drains into the Ganga is biggest as 558 t/day (or 55.9% of the total) in the Kanpur Region followed by 77 t/day (7.7%) in the Jajmau Region.. These adjoining two regions discharge almost two-third BOD load of the total into the Ganga.

Table 19.6.6 State-wise Flow and BOD Load Discharged into Drains/Nallas

State	No. Of Drains	Flow (MLD)	BOD Load (Tonnes / Day)
Uttarakhand	14	440	42
Uttar Pradesh	45	3,289	761
Bihar	25	579	99
West Bengal	54	1,779	97
Total	138	6,087	999

Source: CPCB, "Pollution Assessment: River Ganga", July 203

The BOD load of each drain/*nalla* is attributed to a variety of wastewater such as domestic/ commercial wastewater not connected to a public sewer system, effluent discharged from septic tanks, washed-out human and livestock excreta on the ground, industrial wastewater with/without treatment, agricultural drain and so on collected in respective basins. Accordingly, although those are tentatively allocated to the towns immediately upstream of a confluence with drain/*nalla*, such BOD load does not mean the load that was generated within the said town.

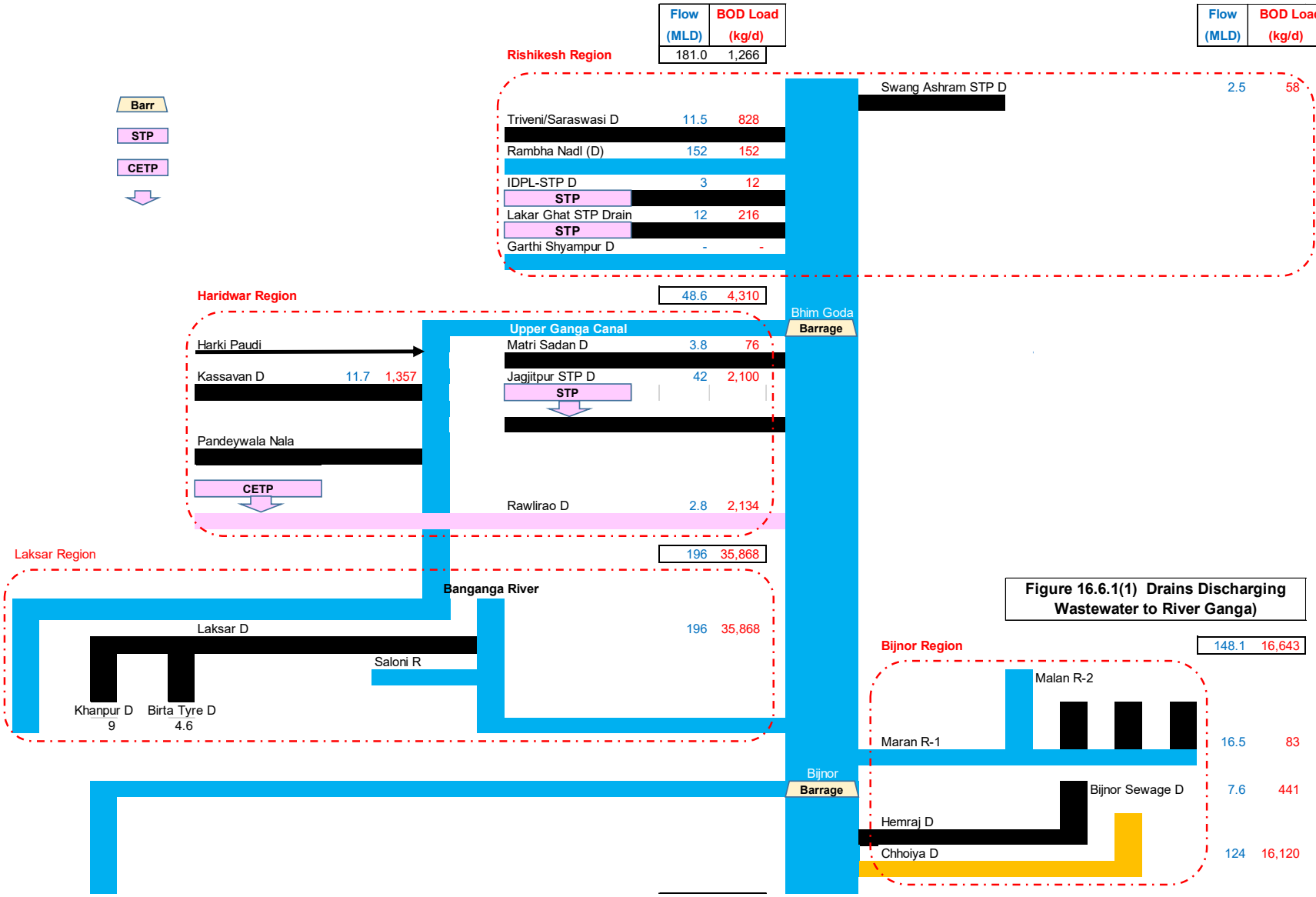


Figure 16.6.1(1) Drains Discharging Wastewater to River Ganga)

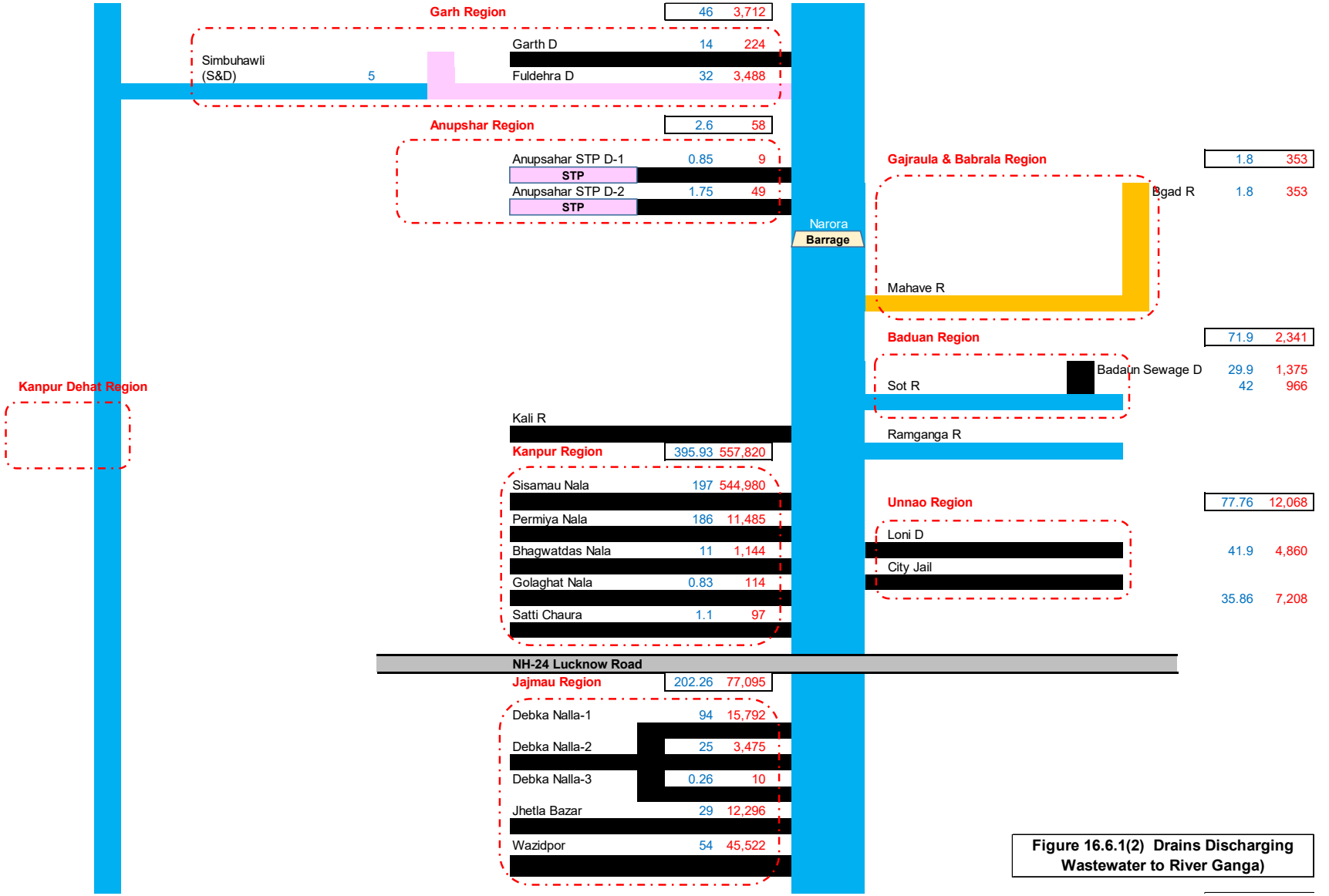


Figure 16.6.1(2) Drains Discharging Wastewater to River Ganga)

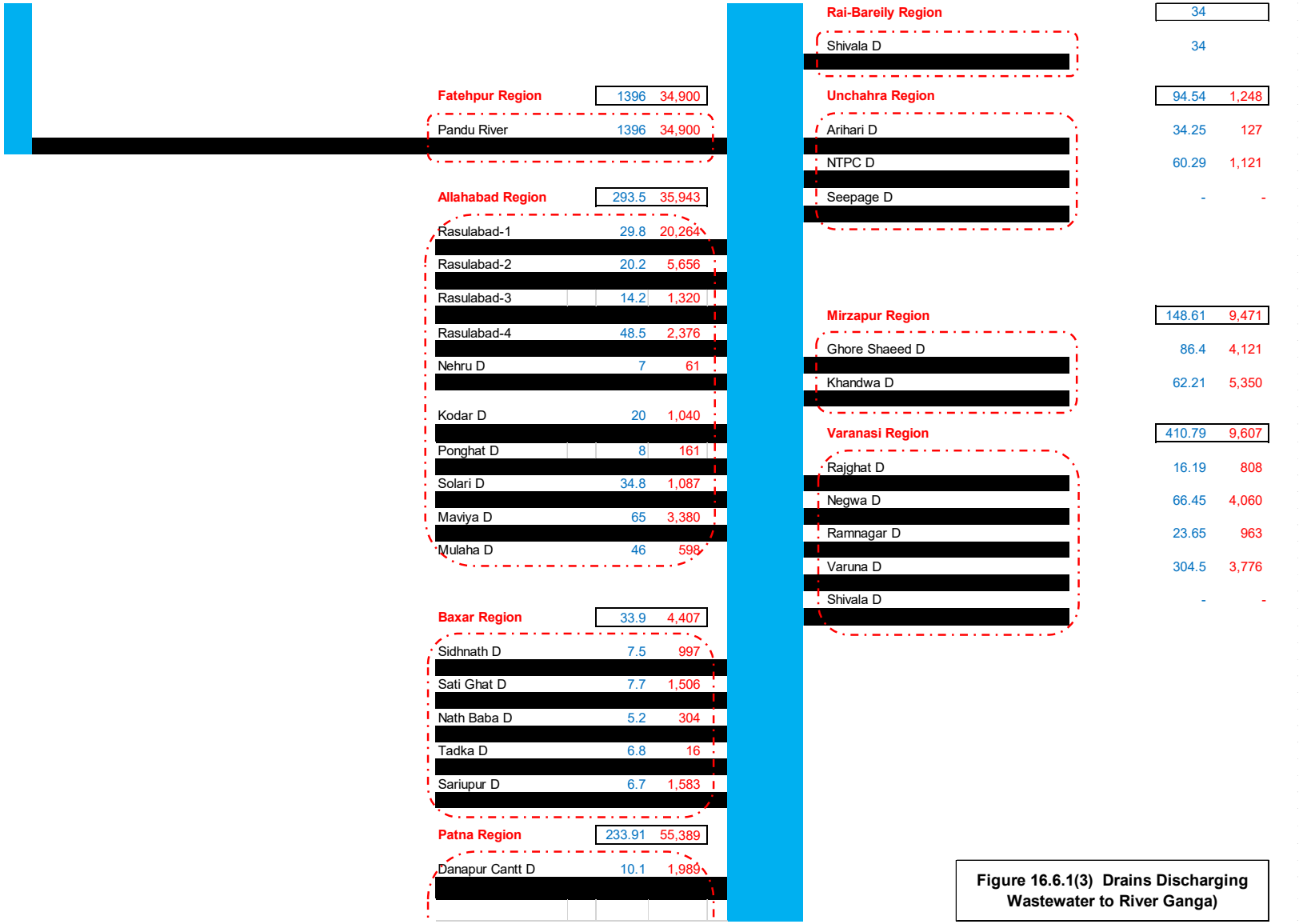


Figure 16.6.1(3) Drains Discharging Wastewater to River Ganga)

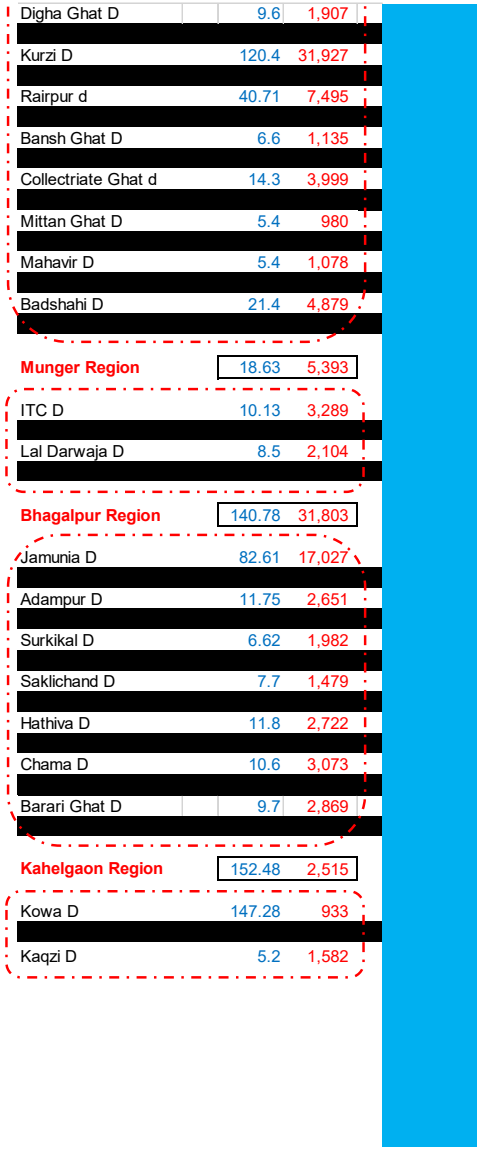
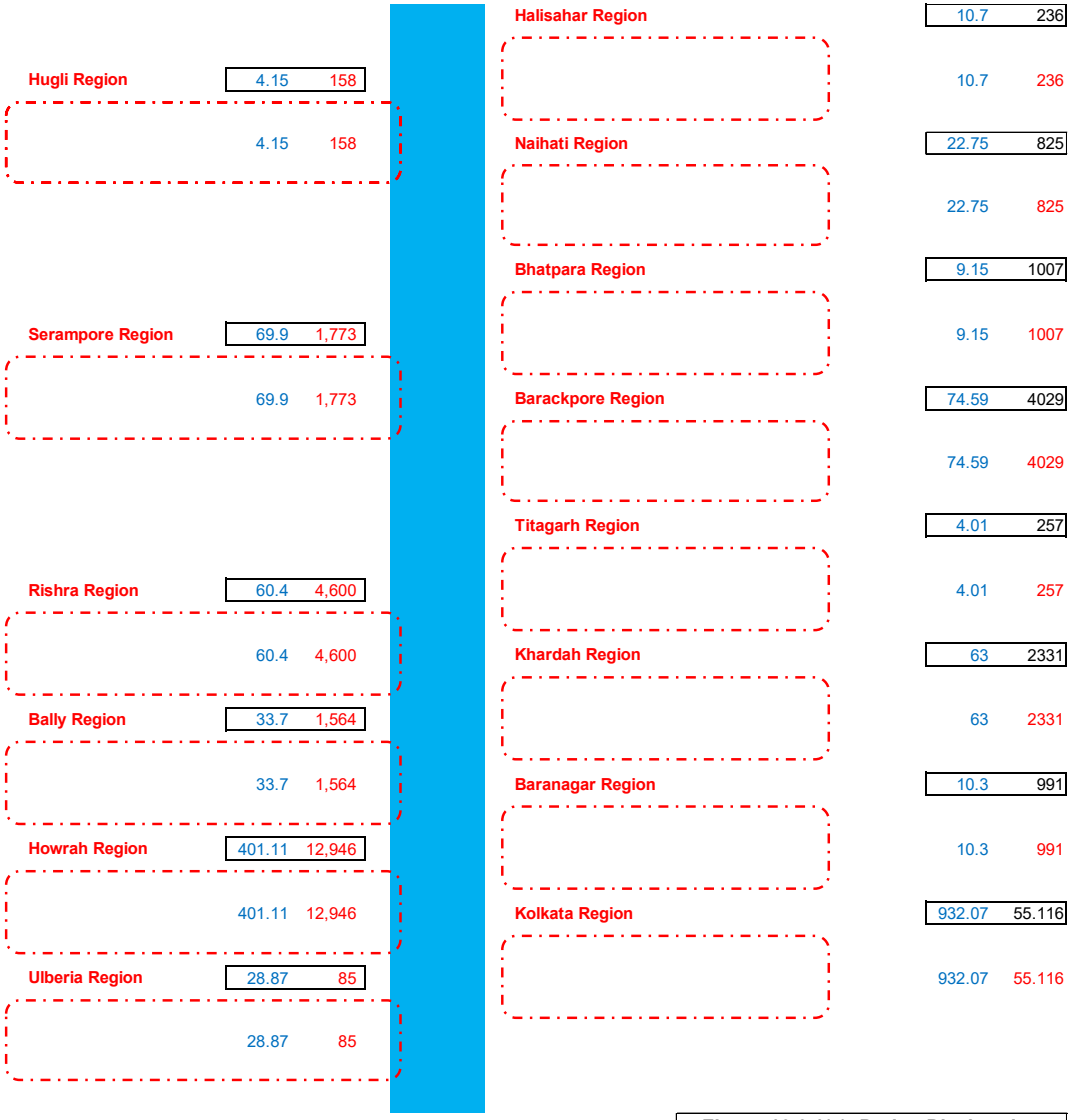


Figure 16.6.1(4) Drains Discharging Wastewater to River Ganga)



Source: *Central Pollution Control Board, "Pollution Assessment : River Ganga", July 2013*

Note: Prepared by JICA Survey Team referring the above reference with corrections of discreancies in figures between Table and Figure therein.

Figure 16.6.1(5) Drains Discharging Wastewater to River Ganga)

19.7 Situation of Solid Waste Management

According to the Progress Report (October 2015) for "**Data Collection and Clarification Study on Improvement of Environment in Varanasi City**" prepared by Kokusai Kogyo Co., Ltd. under the assistance of JICA, the situation of solid waste management in Varanasi is described as follows:

"As of August 2015, the Varanasi Municipal Corporation (VMC) directly provides waste collection and disposal services to its citizens. Until 15th May, 2014, all waste management had been outsourced to a private company called A2Z Infrastructure Private Limited, based on the concession agreement. However, due to financial disagreements between the VMC and A2Z, A2Z withdrew from the entire business of solid waste management in Varanasi city.

In the VMC area, in general, the general public and business entities discharge their waste onto the road side nearby, and 2,600 municipal sanitary workers manually collect these heaps of waste on the roads and bring them to the municipal storage depots by tricycle. Then the bulk of waste is loaded onto the dumper trucks and tractors at the municipal storage depots, and then transferred to the final disposal site."

The Ministry of Urban Development (MoUD), India has prescribed the benchmarks of administrative services such as water supply, sewerage, solid waste management and storm water drain, monitored their town-wise achievements and declared as"Benchmarking Urban Services in India - Targeting Improved Performance – Status Report 2011-12" on the website. For solid waste management, the following benchmarks are given.

Table 19.7.1 Benchmarks of Solid Waste Management in India

	Indicator	Benchmark
1	Household level coverage of solid waste management services	100%
2	Efficiency of collection of municipal solid waste	100%
3	Extent of segregation of municipal solid waste	100%
4	Extent of municipal solid waste recovered	80%
5	Extent of scientific disposal of municipal solid waste	100%
6	Efficiency in redressal of customer complaints	80%
7	Extent of cost recovery in SWM services	100%
8	Efficiency in collection of SWM charges	90%

Source: Ministry of Urban Development, "Handbook of Service Level Benchmarking"

Each indicator is defined as shown in **Table 19.7.2**.

Table 19.7.2 Definition of Indicators for Solid Waste Management

S. No.	Indicator	Unit	Definition
1	Household level coverage of solid waste management services	%	Percentage of households and establishments that are covered by a daily doorstep collection system.
2	Efficiency of collection of municipal solid waste	%	The total waste collected by the ULB and authorized service providers versus the total waste generated within the ULB, excluding recycling or processing at the generation point. (Typically, some amount of waste generated is either recycled or reused by the citizens themselves. This quantity is excluded from the total quantity generated, as reliable estimates will not be available for these.)
3	Extent of segregation of municipal solid waste	%	Percentage of waste from households and establishments that is segregated. Segregation should at least be at the level of separation of wet and dry waste at the source, that is, at the household or establishment level. Ideally, the separation should be in the following categories: bio-degradable waste, waste that is non-biodegradable, and hazardous domestic waste such as batteries, etc. In line with this description, the ULB may further refine the criteria for classifying waste as being 'segregated'. It is important that waste segregated at the source is not again mixed, but transported through the entire chain in a segregated manner. It is therefore important that this indicator is based on measurement of waste arriving in a segregated manner at the treatment/disposal site, rather than being measured at the collection point.
4	Extent of municipal solid waste recovered	%	This is an indication of the quantum of waste collected, which is either recycled or processed. This is expressed in terms of percentage of waste collected.
5	Extent of scientific disposal of municipal solid waste	%	The amount of waste that is disposed in landfills that have been designed, built, operated and maintained as per standards laid down by Central agencies. This extent of compliance should be expressed as a percentage of the total quantum of waste disposed at landfill sites, including open dump sites.
6	Efficiency in redressal of customer complaints	%	The total number of SWM-related complaints redressed within 24 hours of receipt of the complaint, as a percentage of the total number of SWM-related complaints received in the given time period.
7	Extent of cost recovery in SWM services	%	This indicator denotes the extent to which the ULB is able to recover all operating expenses relating to SWM services from operating revenues of sources related exclusively to SWM. This indicator is defined as the total annual operating revenues from SWM as a percentage of the total annual operating expenses on SWM.
8	Efficiency in collection of SWM charges	%	Efficiency in collection is defined as current year revenues collected, expressed as a percentage of the total operating revenues, for the corresponding time period.

Source: Ministry of Urban Development, "Handbook of Service Level Benchmarking"

According to ”Benchmarking Urban Services in India - Targeting Improved Performance – Status Report 2011-12”, which is the latest version of this survey, The report covers the towns in 13 states out of thirty (32) states/UTs of India such as Andhra Pradesh, **Bihar**, Chhattisgarh, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tripura and **Uttar Pradesh**. There is no change in the number of states from 2010-11 version.

Table 19.7.3 Service Coverage by Solid Waste Management

Uttar Pradesh

NMCG: Important 118 River Front Towns Identified						Solid waste Management															
S. No.	Class of Town	District	Town	Type	Census 2011 Population	Household Level Coverage		Efficiency of Collection of MSW		Extent of Segregation		Extent of MSW recovered		Extent of scientific disposal		Efficiency in redressal of customer complaints		Cost recovery		Efficiency in collection of charges	
						100%		100%		100%		80%		100%		80%		100%		90%	
						Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12
16		Farrukhabad	Farrukkabad	NPP	276,581		0.0	89.0	98.0		0.0		0.0		0.0		0.0		0.0		0.0
17		Allahabad	Allahabad	M Corp. + OG + CB	1,195,329	20.0	30.0	71.0	81.0	0.0	5.0		5.0	0.0	0.0	73.0	80.0	0.0	5.0		5.0
18		Ghazipur	Ghazipur	NPP + OG	121,020			100.0	100.0		0.0		0.0		0.0		0.0		0.0		0.0
19		Kanpur Nagar	Kanpur	M Corp. + OG + CB	2,876,591	40.0	50.0	72.0	80.0	43.0	48.0		80.0	0.0	50.0	85.0	85.0	0.0	10.0		5.0
20	I	Mirzapur	Mirzapur	NPP	234,871			95.0	105.0		0.0		0.0		0.0		0.0		0.0		0.0
21		Varanasi	Varanasi	M Corp.	1,198,491	27.3	37.3	85.8	100.0	0.0	5.0		0.0	0.0	0.0	66.0	76.0	0.3	5.0		45.0
22		Chandauli	Mughal Sarai	NPP	109,650			100.0	100.0		0.0		0.0		0.0		0.0		0.0		0.0
23		Moradabad	Moradabad (Ramganga)	M Corp	887,871	35.4	40.4	63.7	68.7	46.0	51.0		8.3	0.0	0.0	83.3	83.3	0.0	5.0		5.0
24		Ballia	Ballia	NPP	104,424			100.0	100.0		0.0		0.0		0.0		0.0		0.0		0.0
25		Unnao	Unnao	NPP	177,658			80.0	88.0		0.0		0.0		0.0		0.0		0.0		0.0
26		Fatehpur	Fatehpur	NPP	193,193			94.0	103.0												
27	II	Bijnor	Bijnor	NPP	93,297			100.0	100.0												
28		Kannauj	Kannauj	NPP	84,862			100.0	100.0												
29		Unnao	Gangaghat	NPP	84,072																
30		Bijnor	Najibabad	NPP	88,535			100.0	100.0												
31		Jyotiba Phule Nagar	Gajraula	NP	55,048																
32		Bijnor	Nagina	NPP	95,246			100.0	100.0												
33		Bijnor	Chandpur	NPP	83,441			100.0	100.0												
34		Bijnor	Dhampur	NPP	50,997			100.0	100.0												
35		Bulandshahar	Jahangirabad	NPP	59,858			79.0	87.0												
36		Sant Ravidas Nagar	Bhadohi	NPP	94,620			80.0	88.0												
37	III	Bulandshahr	Anupshahar	NPP	29,087																
38		Mirzapur	Chunar	NPP	37,185			56.0	62.0												
39		Ghazipur	Saidpur	NP	24,338																
40		Ghaziabad	Garhmukhteshwar	NPP	46,077			100.0	100.0												
41		Varanasi	Ramnagar	NPP	49,132			100.0	100.0												
42		Bulandshahar	Narora	NP	22,775																
43		Kanshiram Nagar	Soron	NPP	27,468			100.0	100.0												
44		Meerut	Hastinapur	NP	26,452		10.0	100.0	100.0		5.0		5.0			93.3	93.3		5.0		5.0
45	IV	Kanpur Nagar	Bithoor	NP	11,300																
46		Budaun	Babrala	NP	18,108																
					8,457,577																

Table19.7.3 Service Coverage by Solid Waste Management (Cont'd)

Bihar

NMCG: Important 118 River Front Towns Identified						Solid waste Management															
S. No.	Class of Town	District	Town	Type	Census 2011 Population	Household Level Coverage		Efficiency of Collection of MSW		Extent of Segregation		Extent of MSW recovered		Extent of scientific disposal		Efficiency in redressal of customer complaints		Cost recovery		Efficiency in collection of charges	
						100%		100%		100%		80%		100%		80%		100%		90%	
						Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12	Status 2010-11	Target 2011-12
47		Bhojpur	Arrah	M Corp.	261,430		20.0	50.0	65.0		20.0					50.0	65.0		25.0		30.0
48		Bhagalpur	Bhagalpur	M Corp.	252,008	30.0	50.0	80.0	90.0	20.0	35.0					90.0	95.0		40.0	10.0	50.0
49		Buxar	Buxar	NP	102,861		20.0	50.0	65.0		20.0					50.0	65.0		35.0		35.0
50		Saran	Chapra	NP	202,352		20.0	50.0	60.0		20.0					50.0	65.0		30.0		35.0
51		Vaishali	Hajipur	NP	147,688		20.0	50.0	65.0		20.0					50.0	65.0		30.0		35.0
52		Munger	Munger	M Corp.	213,303		25.0	50.0	65.0		25.0					50.0	65.0		40.0		40.0
53	I	Patna	Patna	M Corp. + OG	1,684,297	20.0	40.0	80.0	90.0	30.0	40.0					70.0	85.0		30.0	20.0	40.0
54		Patna	Danapur (Dinapur Nizamat)	NP + CB	211,152		20.0	50.0	65.0		15.0					50.0	65.0		30.0		30.0
55		Begusarai	Begusarai	M Corp	252,008		25.0	40.0	60.0		25.0					50.0	65.0		30.0		30.0
56		Katihar	Katihar	M. Corp + OG	240,838		25.0	50.0	65.0		20.0					50.0	65.0		35.0		35.0
57		Munger	Jamalpur	NP	105,434		20.0	50.0	65.0		20.0					50.0	65.0		35.0		35.0
58		Nalanda	Bihar Sharif	M. Corp	297,268		25.0	50.0	65.0		20.0					50.0	65.0		35.0		40.0
59		Patna	Mokameh	NP	60,678		20.0	40.0	60.0		15.0					50.0	65.0		30.0		35.0
60		Patna	Fatuah	NP	50,961																
61		Patna	Barh	NP	61,470		20.0	40.0	55.0		20.0					50.0	65.0		25.0		30.0
62		Begusarai	Barauni	NP	71,660																
63	II	Bhagalpur	Sultanganj	NP	52,892		20.0	30.0	45.0		15.0					50.0	65.0		30.0		35.0
64		Buxar	Dumraon	NP	53,618		20.0	30.0	45.0		20.0					50.0	65.0		30.0		30.0
65		Kaimur (Bhabua)	Bhabua	NP	50,179		20.0	30.0	45.0		15.0					50.0	65.0		25.0		30.0
66		Lakhisarai	Lakhisarai	NP	99,979		20.0	50.0	65.0		15.0					50.0	65.0		30.0		35.0
67		Patna	Phulwari Sharif	NP	81,740		20.0	30.0	45.0		15.0					50.0	65.0		30.0		35.0
68		Lakhisarai	Barahiya	NP	43,032																
69		Bhagalpur	Kahelgaon (Colgong)	NP + CT	33,700																
70	III	Patna	Bakhtiyarpur	NP	47,897																
71		Bhagalpur	Naugachhia	NP	49,069																
72		Saran	Sonepur	NP	37,776																
					4,765,290																

19.8 Status of Assistance by Other Donors

The external assistance to India by various donors are summarized in **Table 19.13.1** with their focusing field.

Table 19.8.1 External Assistance to India

Country	Focusing Field	Project	2014-15	
			Loan (crore)	Grant (crore)
Bilateral				
France (AFD)	• Sustainable management of global public goods • Preservation of bio-diversity		214	
Germany (KfW, GIZ)	• Energy • Environmental policy • Protection and sustainable use of natural resources • Sustainable economic development	(See **Sub-Section 16.15.3**)	378	12
Japan (JICA)		(See **Sub-Section 16.15.2**)	4774	
Russian Federation	• Nuclear Power Plant	• Kudankulam Nucleat Power Project•		
Unted Kingdom (IK)	• Millenium Development Goal (MDG) in the area of health, education, slum development, etc.		557	
USA (USAID)	• To strengthen health systems • To develop replicable models to extend food security • To accelerate transition to a low emmissions and energy secure economy • To reduce greenhouse gas emmissions through carbon sequestration by forests • To assist individuals and communities to adapt to climate change, and • To improve the quality of basic education through teachers training and development			
Multi Lateral				
ADB	• Many assistance to water supply and sewerage through a sector loan especially for Karnataka, Rajasthan and Madhya Pradesh	• North Karnataka Urban Sector Investment Program • Rajasthan Urban Sector Development Investment Program • Kolkata Environmental Improvement Investment Plan • Uttarakhand Urban Sector Development Investment Program • Urban Water Supply and Environmental in Madhya Pradesh	5537	0.62
European Union (EU)	• Environment, public health and education	• Sarva Shiksha Abhiyan (SSA) • National Rural Health Mission (NRHM) • Reproductive Child Health (RCH) • Sector Policy Support Programme for Elementary and Secondary Education		
Global Fund Organization	• To prevent and treat HIV and AIDS, tuberculosis and malaria		331	
IBRD	• To reduce poverty in middle-income countries and creditworthy poorer countries • Infrastructure projects (Power Sector and Roads)	(See **Sub-Section 16.15.1**)	2907	69
IDA	• Poverty reduction		6239	6
IFAD	• Agriculture, rural development, tribal development, womenn's empowerment, natural resources management and rural fnance sector		168	
UNDP	• Capacity developmentb in sustainable human development (SHD)			

Source: "Receipt Budget, 2015-2016, External Assistance"

19.8.1 World Bank

The World Bank has committed US$ 1 billion assistance to the Government of India for the Ganga Rejuvenation Project on November 2011 and conducted the survey for the following towns up to now. Some of them have already entered into the project implementation stage.

Table 19.8.2 Towns Studied by the World Bank for National Ganga River Basin Project

State	Towns Studied
Uttarakhand	Muni Ki Reti-Dhalwala
Uttar Pradesh	Allahabad (District "A", "B", "C" & "E"), Anupsahar, Narora, Kanpur, Bithoor
Bihar	Begusarai, Buxar, Munger, Patna (Saidpur, Beur & Karmalichak)
Jharkhand	Sahibganj
West Bengal	Halisahar, Barackpore, Budge Budge

The World Bank has released nineteen (19) environment assessment reports, two (2) resettlement plans and three (3) indigenous people plans for the project implementation in 14 towns from July 2014 to February 2016 and clarified the problems and solutions therein.

19.8.2 ADB

Original Loan:	US$162.71 million	16 April 2002 – 20 November 2012
Supplemental Loan:	US$ 79.06 million	01 June 2007 – 13 November 2013

Table 19.8.3 ADB-assisted Project

City	Output
Kolkata	Kolkata Environmental Improvement Project Sewerage and Drainage Assessment of targets versus project achieved under S&D reveals the following: (a) 378 km of S&D network was constructed covering the entire project area (100% of the revised target set in 2008); (b) 218 km of existing S&D conduits were renovated and desilted as per the actual requirement, against the estimated target of 364 km; (c) the target of augmentation of 3 existing sewage treatment facilities was fully achieved; (d) 20 new pumping stations were constructed and 22 existing pumping stations rehabilitated with increased efficiencies and capacities (100% achievement of the revised target set in 2008); (e) 14 water bodies were rehabilitated; and (f) 46,145 sewerage connections were provided, achieving full coverage in project areas. (ii) Canal improvement

Source: ADB, "India: Kolkata Environmental Improvement Project – Completion Report", September 2015

19.8.3 JICA

The assistance by JICA for sewerage and sanitation sectors are summarized in **Table 19.13.4** for technical assistance and **Table 19.13.5** for loan

The assistance of JICA to the National Ganga Rejuvenation Project has been focused on Varanasi only so far including non-sewerage component such as the construction of public toilets in the ghat area.

Table 19.8.4 JICA's Technical Assistance for Sewerage and Sanitation Sector

Project Name	Survey Area	Prepared in
Data collection survey on improvement of environment in Varanasi city	Varanasi	2016.2
Data collection and clarification study on sanitation facilities (latrines) in India	States of Rajasthan, Uttar Pradesh and Tamil Nadu	2015.3
Study for formulation and revision of manuals on sewerage and sewage treatment phase-2	-	2013.3
Study for formulation and revision of manuals on sewerage and sewage treatment phase-1	-	2011.3
Study on augmentation of water supply and sanitation for the Goa State	Goa State	2006.11

Source: JICA, "Data Collection Survey on Improvement of Environment in Varanasi City", February 2016

Table 19.8.5 JICA's Assistance for Sewerage Sector (Loan)

Project Name	L/A	Loan Amount (JY million)
Project for Pollution Abatement of River Mula-Mutha in Pune	2016/1/13	19,064
Guwahati Sewerage Project	2015/2/27	15,620
Yamuna Action Plan Project (III)	2011/2/17	32,571
Tamil Nadu Urban Infrastructure Project	2008/3/10	8,551
Goa Water Supply and Sewerage Project	2007/9/14	22,806
Amritsar Sewerage Project	2007/3/30	6,961
Orissa Integrated Sanitation Improvement Project	2007/3/30	19,061
Bangalore Water Supply and Sewerage Project (II-2)	2006/3/31	28,358
Hussain Sagar Lake and Catchment Area Improvement Project	2006/3/31	7,729
Ganga Action Plan Project (Varanasi)	2005/3/31	11,184
Bangalore Water Supply and Sewerage Project (II-1)	2005/3/31	41,997
Yamuna Action Plan Project (II)	2003/3/31	13,333

Source: JICA

19.8.4 GIZ

So far, GIZ or the German Technical Cooperation has no direct assistance for the National Ganga River Basin Project but focus on the area of energy, sustainable economic development, environmental policy, conservation and sustainable use of natural resources. There are many supports in the field of renewable energy such as solar power generation and climate change. GIZ has been involved in the preparation of several state action plans on climate change, including Uttar Pradesh and West Bengal. Besides the above, GIZ has supported to the preparation of City Sanitation Plans (CSPs) as shown in **Table 19.13.6.**

Table 19.8.6 Assistance by GIZ for the Preparation of CSPs

Project Name	Period	Executing Agency	Target Area	Expected Achievements
Support to National Urban Sanitation Policy (SNUSP) (II)	2014-2017	MoUD	Plural cities will be selected	To enhance the capacities at state and city level towards adopting participatory processes for formulating and implementing city-wide sanitation plans
Support to National Urban Sanitation Policy (SNUSP) (I)	2011-2014	MoUD	Six cities	Support the preparation of City Sanitation Plan (CSP) for six cities

Source: JICA, "Data Collection Survey on Improvement of Environment in Varanasi City", February 201

19.9 Status of DPR Preparation and Structure of Project Implementation

The status of DPR preparation by 118 river front towns are shown in **Table 19.8.1**.

Table 19.9.1 Status of DPR Preparation (As of February 29, 2016)

S. No.	State	Class of Town	District	Town	Type	Status of DFR
1	Uttar-akhand	I	Haridwar	Haridwar	NPP + OG + ITS	
2		II	Dehradun	Rishikesh (including Tapovan)	NPP	
3		III	Chamoli	Gopeshwar	NPP	I&D
4			Tehri Garhwal	Tehri	NPP	
5			Garhwal	Srinagar	NPP	
6		IV	Chamoli	Joshimath	NPP	I&D+STP
7			Uttarkashi	Uttarkashi (Budkot)	NPP	
8			Tehri Garhwal	Muniki Reti - Dhaluwala	NP + CT	
9		V	Chamoli	Gaucher	NP	
10			Chamoli	Karnaprayag	NP	I&D

S. No.	State	Class of Town	District	Town	Type	Status of DFR
11			Rudraprayag	Rudraprayag	NPP	I&D
12		VI	Garhwal	Kirtinagar	NP	
13			Chamoli	Nandprayag	NP	
14			Chamoli	Badrinath(puri)	NP	STP (3 MLD)
15			Tehri Garhwal	Devprayag	NP	STP (1.4 MLD)
16	Uttar Pradesh	I	Farrukhabad	Farrukkabad	NPP	
17			Allahabad	Allahabad	M Corp. + OG + CB	
18			Ghazipur	Ghazipur	NPP + OG	
19			Kanpur Nagar	Kanpur	M Corp. + OG + CB	
20			Mirzapur	Mirzapur	NPP	
21			Varanasi	Varanasi	M Corp.	
22			Chandauli	Mughal Sarai	NPP	
23			Moradabad	Moradabad (Ramganga)	M Corp	
24			Ballia	Ballia	NPP	
25			Unnao	Unnao	NPP	
26			Fatehpur	Fatehpur	NPP	
27		II	Bijnor	Bijnor	NPP	
28			Kannauj	Kannauj	NPP	
29			Unnao	Gangaghat	NPP	
30			Bijnor	Najibabad	NPP	
31			Jyotiba Phule Nagar	Gajraula	NP	
32			Bijnor	Nagina	NPP	
33			Bijnor	Chandpur	NPP	
34			Bijnor	Dhampur	NPP	
35	Uttar Pradesh	II	Bulandshahar	Jahangirabad	NPP	
36			Sant Ravidas Nagar	Bhadohi	NPP	
37		III	Bulandshahr	Anupshahar	NPP	
38			Mirzapur	Chunar	NPP	
39			Ghazipur	Saidpur	NP	
40			Ghaziabad	Garhmukhteshwar	NPP	
41			Varanasi	Ramnagar	NPP	
42			Bulandshahar	Narora	NP	
43			Kanshiram Nagar	Soron	NPP	
44			Meerut	Hastinapur	NP	
45		IV	Kanpur Nagar	Bithoor	NP	
46			Budaun	Babrala	NP	
47	Bihar	I	Bhojpur	Arrah	M Corp.	
48			Bhagalpur	Bhagalpur	M Corp.	
49			Buxar	Buxar	NP	SN & STP (16 MLD)
50			Saran	Chapra	NP	
51			Vaishali	Hajipur	NP	SN & STP (22 MLD)
52			Munger	Munger	M Corp.	SN & STP (27 MLD)
53			Patna	Patna	M Corp. + OG	
54			Patna	Danapur (Dinapur Nizamat)	NP + CB	

S. No.	State	Class of Town	District	Town	Type	Status of DFR
55			Begusarai	Begusarai	M Corp	SN & STP (17 MLD)
56			Katihar	Katihar	M. Corp + OG	
57			Munger	Jamalpur	NP	
58			Nalanda	Bihar Sharif	M. Corp	
59		II	Patna	Mokameh	NP	
60			Patna	Fatuah	NP	
61			Patna	Barh	NP	
62			Begusarai	Barauni	NP	
63			Bhagalpur	Sultanganj	NP	
64			Buxar	Dumraon	NP	
65			Kaimur (Bhabua)	Bhabua	NP	
66			Lakhisarai	Lakhisarai	NP	
67			Patna	Phulwari Sharif	NP	
68		III	Lakhisarai	Barahiya	NP	
69			Bhagalpur	Kahelgaon (Colgong)	NP + CT	
70			Patna	Bakhtiyarpur	NP	
71			Bhagalpur	Naugachhia	NP	
72			Saran	Sonepur	NP	
73	Jhakhand	II	Sahebganj	Sahebganj	NP	
74		III	Sahebganj	Rajmahal	NP	
75	West Bengal	I	Kolkata	Kolkata	M Corp.	I&D*
76			Maldah	English Bazaar	M	
77			Murshidabad	Bahrampur	M	
78			Nadia	Santipur	M	
79			Purba Medinipur	Haldia	M	
80	West Bengal	I	Uttar Dinajpur	Raiganj	M	
81			Nadia	Krishnanagar	M	
82			Nadia	Nabadwip	M	
83			North 24 Parganas	Barrackpore	M	
84			Hugli	Uttarpara Kotrung	M	
85			Hugli	Rishra	M	RFD
86			Hugli	Baidyabati	M	RFD
87			Hugli	Champdani	M	
88			Hugli	Bhadreshwar	M	
89			North 24 Parganas	Kamarhati	M	RFD (13 Ghats)
90			North 24 Parganas	Baranagar	M	
91			North 24 Parganas	Naihati	M	RFD
92			North 24 Parganas	Kanchrapara	M + OG	RFD (16 Ghats)
93			Hugli	Serampore	M	RFD
94			Hugli	Hugli-Chinsurah	M + OG	RFD
95			South 24 Parganas	Maheshtala	M	RFD
96			North 24 Parganas	Panihati	M	RFD (16 Ghats)

S. No.	State	Class of Town	District	Town	Type	Status of DFR
97			Haora	Bally	M	RFD (7 Ghats)
98			Haora	Ulluberia	M + OG	
99			Haora	Howrah	M Corp	RFD & EC
100			North 24 Parganas	Khardah	M	RFD
101			Hugli	Bansberia	M	RFD (? Ghats)
102			Hugli	Chandannagar	M Corp	RFD
103			North 24 Parganas	Titagarh	M	RFD (4 Ghats)
104			North 24 Parganas	Halishahar	M	
105			Nadia	Kalyani	M	
106		II	North 24 Parganas	Bhatpara	M + OG	
107			Murshidabad	Dhulian	M	
108			Murshidabad	Jangipur	M	
109			Nadia	Ranaghat	M	
110			Murshidabad	Jiaganj-Azimganj	M	
111			Barddhaman	Katwa	M	
112			Nadia	Chakdah	M	
113			Hugli	Konnagar	M	
114			South 24 Parganas	BudgeBudge	M	RFD
115			Nadia	Gayespur	M	
116			North 24 Parganas	Garulia	M	
117	West Bengal	III	Murshidabad	Murshidabad	M	
118			South 24 Parganas	Diamond Harbour	M	

Source: http://www.moef.nic.in/sites/default/files/ngrba/index.html
Kolkata: (1) ID & Afforestation, (2) Resuscitation of Chelta Boat Canal Jointing Ganga
Note: Uttar Pradesh & Jhakhand: No Response on the Website
RFD: River Front Development, I&D: Interception & Diversion, SN: Sewer Network, EC: Electric Cramatoria

As shown in **Table 19.9.1**, most DPRs especially of West Bengal are focused on the RFD (RFD) which are composed of the following items in case of the Patna RFD as an example;

- Development of ghats (change room, life guard etc.) on 20 Ghats
- Promenades – 2.3 km
- Community Cum Cultural Centres – 4 Nos
- Landscape Works on 21 Ghats
- City Level Parks – 2 Nos
- Improvement of approach roads
- Crematorium (Gulvi Ghat) – **1** No
- Interceptor Drain
- Sulabh Toilet Complex – 3 Nos

In relation to a sewerage sub-sector, the interceptor drain and the sulabh toilet complex is important.

19.10 Situation of Flow and Water Quality of the Ganga and its Tributaries

19.10.1 River Flow

The data pertaining to dependable flow of the River Ganga at Kanpur (1959–2008), Allahabad (1970–2008) and Varanasi (1959–2008), is depicted in **Figure 19.9.1**. The data indicates that the average flow is below 1,000 m^3/s in Kanpur and Allahabad and 1,200 m3/s in Varanasi, respectively, and during lean period of November to May and 10%, 50%, 90%, and average dependable flow tends to be the same. However, during July to October, a higher value due to monsoon discharge is observed, along with a sharp variation on 10%, 50%, 90%, and average dependable value. This also indicates a higher degree of flow during certain periods of monsoon, while the flow during rest of the times is very small.

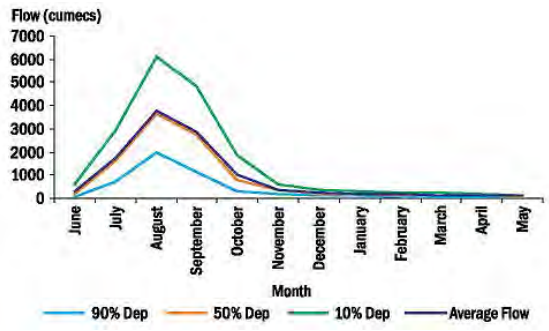
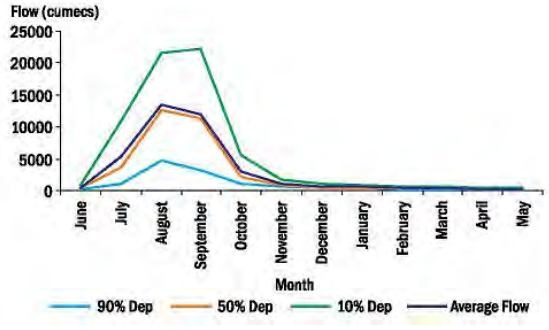
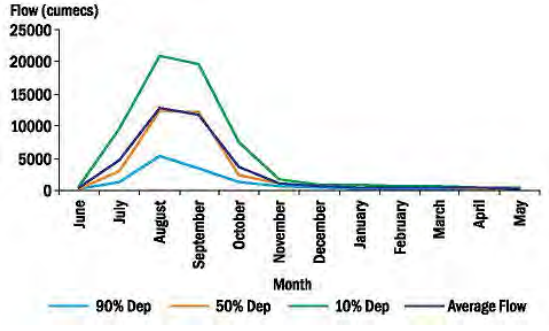
(1) Kanpur During lean period of November to May: 90–386 m^3/s	
(2) Allahabad During lean period of November to May: 279-997 m^3/s	
(3) Varanasi During lean period of November to May: 278-1,160 m^3/s	

Figure 19.10.1 Dependable Flow of the River Ganga

A comparison of the flow data in Kanpur, Allahabad, and Varanasi reveals a similar trend in the flow. However, the flow in Kanpur during the lean period is almost half of that in Allahabad andVaranasi, thus conferring a critical status on Kanpur with respect to water quality management.[8]

Table 19.9.1 shows the Seasonal Variation of the River Ganga Flow.

Table 19.10.1 Seasonal Variation of the River Ganga Flow

Station	Distance from Source (km)	Elevation above Sea Level (m)	Mean Seasonal Flow					Mean Annual Flow
			Monsoon (Jun-Sep)	Post-Monsoon (Oct-Nov)	Winter (Dec-Feb) Dry Season		Summer (Mar-May)	
			(mil.m^3)	(mil.m^3)	(mil.m^3)	(m^3/sec)	(mil.m^3)	(m^3/sec)
Rishikesh	250	350	21,531	1,912	1,305	41	2,150	856
Balawali	330	280	13,306	947	167	5	760	481
Garhmukresar	440	200	18,392	1,756	908	29	982	699
Fatehgarh	670	145	17,300	1,266	264	8	281	606
Kanpur	800	138	30,763	4,139	1,518	48	910	1,184
Allahabad	1,050	95	112,278	10,703	4,148	132	2,987	4,126
Mirzapar	1,170	90	97,142	9,362	4,529	144	3,362	3,627
Varanasi	1,295	80	112,206	11,244	4,213	134	2,793	4,105
Buxar	1,430	60	113,247	17,741	5,463	173	3,438	4,436
Patna	1,600	50	192,625	28,488	11,044	350	8,341	7,626
Azamabad	2,000	35	235,357	54,494	18,055	573	12,474	10,159

Source: Central Water Commission
JICA, "Integrated Pollution Abatement and River Basin Management Project for Ganga Basin – Preparatory and Pre-Feasibility Study Report", November 2002

At the upstream of Kannauj and Kanpur, the significant quantity of water is abstracted through three barrages, namely Bheem Gaura Barrage at Haridwar, Ch. Chransingh Barrage at Bijnor and Narora Barrage at Narora, which is equivalent to about 80% of average flow of the River Ganga at Haridwar as shown in **Figure 19.10.2**. In addition, Madhya Ganga Canal (Phase-II) is under construction to abstract further water from Ch. Chransingh Barrage. That is to say, it is required to reduce the pollutant loads certainly at Kannauj and Kanpur for water quality improvement in the River Ganga.

[8] NRCD. "Status Paper on River Ganga – State of Environment and Water Quality", August 2009

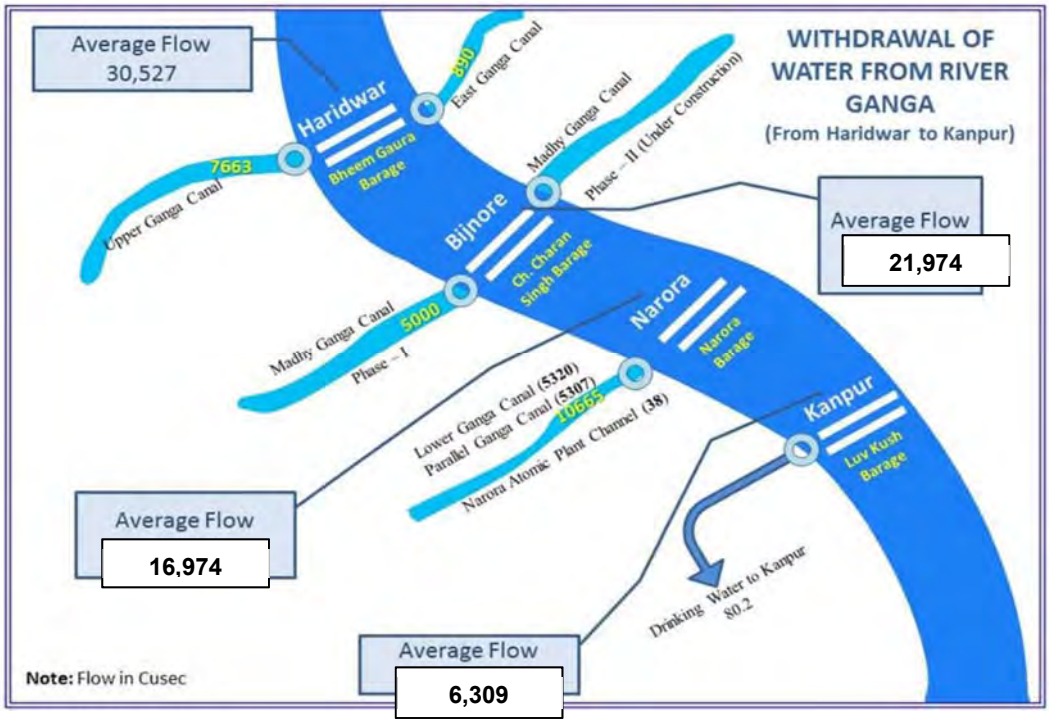


Figure 19.10.2 Withdrawal of Water from the River Ganga between Haridwar and Kanpur

Source: CPCB, "A Plan on Conservation of Water Quality of River Ganga", December 2015
Note: Figures in "Average flow" are corrected by the JICA Survey Team.

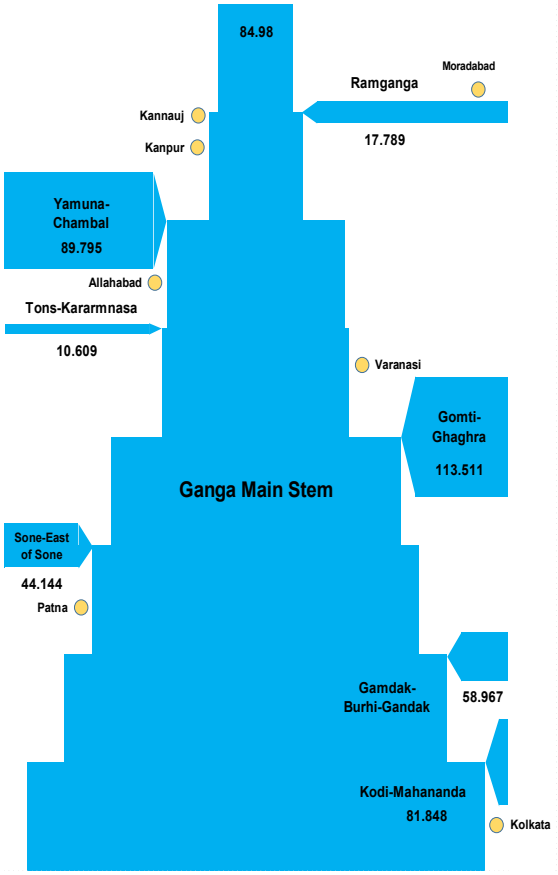


Figure 19.10.3 shows the scale of the annual average river discharge of the River Ganga System and the location of major cities in the basin.

Figure 19.10.3
Annual Average Discharge of the River Ganga and Location of Major Cities

19.10.2 Water Quality Standards

Table 19.10.2 Primarily Water Criteria Based on the Designated Best Use

Designated-Best-Use	Class of Water	Criteria
Drinking water source without conventional treatment but after dsinfection	A	1. Total Coliforms Organism MPN/100ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6 mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 2 mg/l or less
Outdoor bathing* (organised)	B	1. Total Coliforms Organism MPN/100ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5 mg/l or more 5. Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less
Drinking water source after conventional treatment and disinfection	C	1. Total Coliforms Organism MPN/100ml shall be 5000 or less 2. pH between 6 to 9 3. Dissolved Oxygen 4 mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less
Propagation of wild life and Fisheries	D	1. pH between 6.5 to 8.5 2. Dissolved Oxygen 4 mg/l or more 3. Free Ammonia (as N) 1.2 mg/l or less
Irrigation, industrial cooling, controlled waste disposal	E	1. pH between 6.0 to 8.5 2. Electrical Conductivity at 25°C µmhos/cm Max.2250 3. Sodium absorption Ratio Max. 26 4. Boron Max. 2 mg/l

* The draft notification of new Primary Water Quality for Bathing Water was gazetted on November 30, 2015.

Table 19.10.3 Primary Water Quality Criteria for Bathing Reaches in Rivers by MoEFCC

Criteria		Rationale
1. Faecal Coliform	500 (Desirable) MPN/100ml 2500 (Maximum Permissible)	To ensure low sewage contamination. Faecal coliform and faecal streptococci are considered as they reflect the bacterial pathogenicity.
2. Faecal Streptococci	100 (Desirable) MPN/100ml 500 (Maximum Permissible)	The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal changes, changes in flow conditions etc.
3. pH	Between 6.5-8.5	The range provides protection of the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing.
4. Dissolved Oxygen	5 mg/l or more	The minimum dissolved oxygen concentration of 5 mg/l ensures reasonable freedom from oxygen consuming organic pollution immediately U/S which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediments
5. Biochemical Oxygen Demand, 3 day, 27°C	3 mg/l or less	The Biochemical Oxygen Demand of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases.

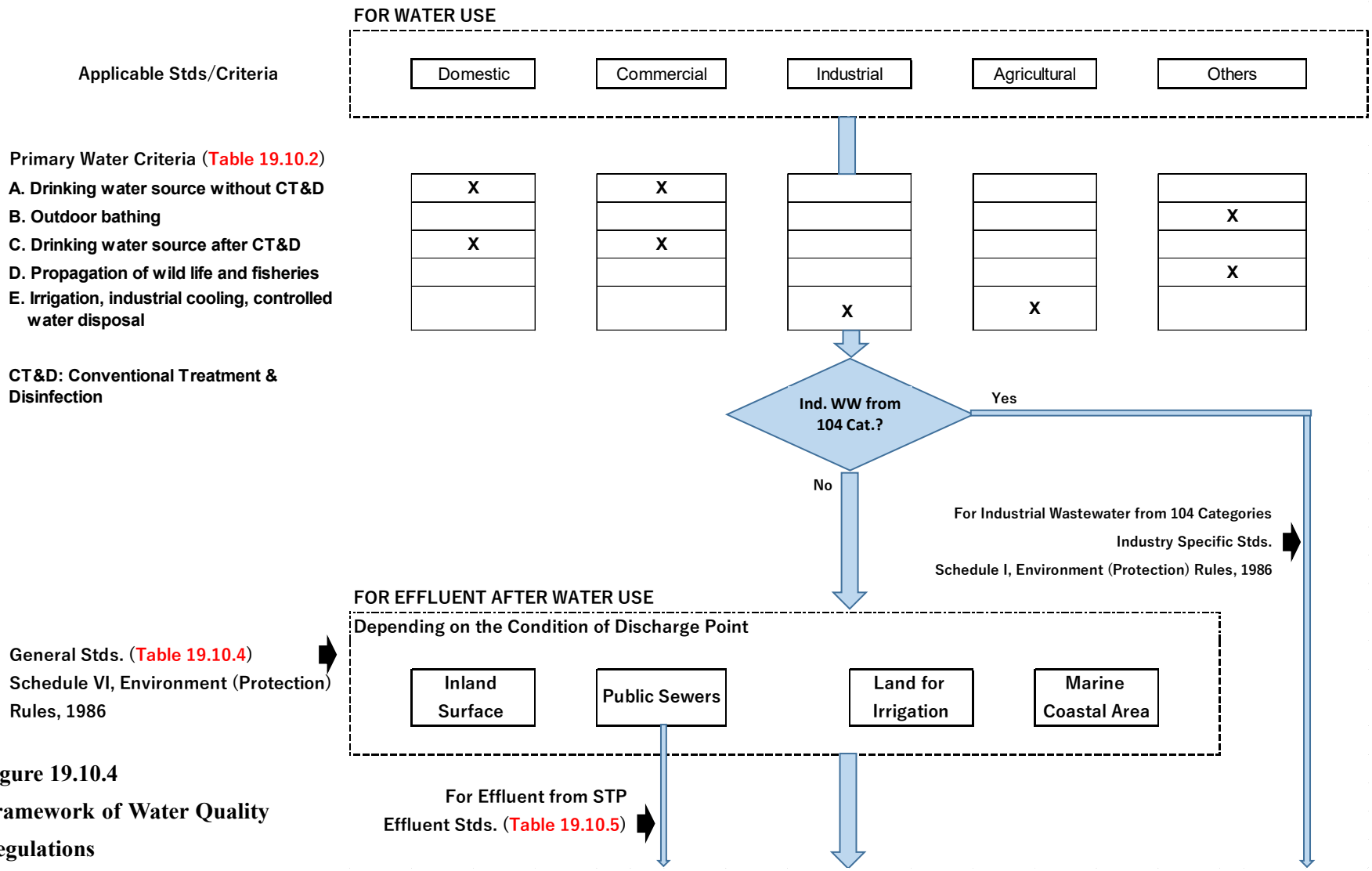


Figure 19.10.4
Framework of Water Quality Regulations

19.10.3 Effluent Standards

In India, the effluent quality is regulated by the General Standards in Schedule VI (see **Table 19.9.4**) of "Rule 3. Standards for Emission or Discharge of Environmental Pollutions" of the Environment (Protection) Rules, 1986 in accordance with the condition of discharge points**.**

Table 19.10.4 General Standards for Discharge of Environmental Pollutants

S. No.	Parameters	Standards			
		Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
1.	Colour and odour	See 6 of Annexure-I	--	See 6 of Annexure-I	See 6 of Annexure-I
2.	Suspended solids mg/l, Max.	100	600	200	(a) For process waste water-100
					(b) For cooling water effluent 10 percent above total suspended matter of influent.
3.	Particulate size of suspended solids	Shall pass 850 micron IS Sieve	--	--	(a) Floatable solids, max. 3 mm.
					(b) Settleable solids, max. 850 microns.
[2]4	***	*	--	***	--
5.	pH Value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6.	Temperature	shall not exceed 5oC above the receiving water temperature	--	--	shall not exceed 5oC above the receiving water temperature
7.	Oil and grease mg/l, Max.	10	20	10	20
8.	Total residual chlorin mg/l, Max.	1.0	--	--	1.0
9.	Ammonical nitrogen (as N) mg/l, Max.	50	50	--	50
10.	Total Kjeldahl Nitrogen (as NH3) mg/l, Max.	100	--	--	100
11.	Free ammonia (as NH3) mg/l, Max	5.0	--	--	5.0
12.	Biochemical Oxygen demand [3][3 days at 27ºC] mg/l, Max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/l,	250	--	--	250

S. No.	Parameters	Standards			
		Inland surface water	**Public sewers**	**Land for irrigation**	**Marine coastal areas**
1	**2**	**3**			
		(a)	(b)	(c)	(d)
	Max.				
14.	Arsenic (as As), mg/l, Max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg), mg/l, Max.	0.01	0.01	--	0.01
16.	Lead (as Pb) mg/l, Max.	0.1	1.0	--	2.0
17.	Cadmium (as Cd) mg/l, Max.	2.0	1.0	--	2.0
18.	Hexavalent Chromium (as Cr+6), mg/l max.	0.1	2.0	--	1.0
19.	Total chromium (as Cr) mg/l, Max.		2.0	--	2.0
20.	Copper (as Cu) mg/l, Max.	3.0	3.0	--	3.0
21.	Zinc (As Zn) mg/l, Max.	5.0	15	--	15
22.	Selenium (as Se) mg/l, Max.	0.05	0.05	--	0.05
23.	Nickel (as Ni) mg/l, Max.	3.0	3.0	--	5.0
[4]24.	* * *	*	*	*	*
[4]25.	* * *	*	*	*	*
[4]26.	* * *	*	*	*	*
27.	Cyanide (as CN) mg/l, Max.	0.2	2.0	0.2	0.2
128.	* * *	*	*	*	*
29.	Fluoride (as F) mg/l, Max.	2.0	15	--	15
30.	Dissolved Phosphates (as P) mg/l, Max.	5.0	--	--	--
231.	* * *	*	*	*	*
32.	Sulphide (as S) mg/l, Max.	2.0	--	--	5.0
33.	Phenoile compounds (as C_6H_5OH) mg/l, Max.	1.0	5.0	--	5.0
34	Radioactive Materials:				
	(a) Alpha emitter, micro curie/ml.	10^{-7}	10^{-7}	10^{-8}	10^{-7}
	(b) Beta emitter, micro curie/ml.	10^{-6}	10^{-6}	10^{-7}	10^{-6}

S. No.	Parameters	Standards			
		Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
35.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
36.	Manganese (as Mn)	2 mg/l	2 mg/l	--	2 mg/l
37.	Iron (as Fe)	3 mg/l	3 mg/l	--	3 mg/l
38.	Vanadium (as V)	0.2 mg/l	0.2 mg/l	--	0.2 mg/l
39.	Nitrate Nitrogen	10 mg/l	--	--	20 mg/l
[4]40.	* * *	*	*	*	*

1 Schedule VI inserted by Rule 2(d) of the Environment (Protection) Second Amendment Rules, 1993 notified vide G.S.R. 422(E) dated 19.05.1993, published in the Gazette No. 174 dated 19.05.1993

2 Omitted by Rule 2(d)(i) of the Environment (Protection) Third Amendment Rules, 1993 vide Notification No.G.S.R.801(E), dated 31.12.1993.

3 Substituted by Rule2 of the Environment (Protection) Amendment Rules, 1996 notified by G.S.R.176, dated 2.4.1996 may be read as BOD (3 days at 27ºC) wherever BOD 5 days 20ºC occurred.

4 Omitted by Rule 2(d)(i) of the Environment (Protection) Third Amendment Rules, 1993 vide Notification No.G.S.R.801(E), dated 31.12.1993.

For industrial wastewater, the Industry Specific Standards in Schedule I of "Rule 3. Standards for Emission or Discharge of Environmental Pollutions" of the Environment (Protection) Rules, 1986 are applied to wastewater discharged from 104 categories: while the General Standards in Schedule VI (see **Table 19.9.4**) are applied to wastewater from other industries than 104 categories.

For effluent from a sewage treatment plant, **Table 19.9.5** is applied to.

Table 19.10.5 Effluent Standards for Sewage Treatment Plant

Parameter	Existing Standards	Proposed Standards (Draft Notification 24/11/2015)
pH	6.0-9.0	6.5-9.0
BOD	30 mg/l	10 mg/l
COD	50 mg/l	50 mg/l
TSS	20 mg/l	20 mg/l
NH_4-N	-	5 mg/l
N-total	-	10 mg/l
Fecal Coliform	-	<100 MPN/100ml

(i) All values in mg/l except for pH and Coliform.

(ii) These standards will be applicable for discharge in water resources s well as for land disposal. The standards for Fecal Coliform may not be applied for use. of treated sewage in industrial purposes.

* Achievements of Standards for existing STPs within 05 years from date of notification.

19.10.4 BOD5 Variation along the River Ganga

(1) Water Quality Monitoring Station

To assess the water quality of the River Ganga, the Central Pollution Control Board (CPCB） has set fifty-seven (57) water quality monitoring stations in the main stem of the River Ganga in cooperation with the State Pollution Control Board (SPCB) of five states concerned. These monitoring stations are listed in **Table 19.9.6** with the location map in **Figure 19.11.1**.

Table 19.10.6 State-wise Water Quality Monitoring Stations on Main Stem of River Ganga

State	No. of Monitoring Locations	Frequency	Monitoring Agency
Uttarakhand	11	Yearly/Monthly	UEPPCB/CPCB
Uttar Pradesh	20	Monthly	UPPCB
Bihar	15	Monthly	BPCB
Jharkhand	1	Monthly	JPCB
West Bengal	10	Monthly	WBPCB

(2) Water Quality Assessment of River Ganga

The monitoring results obtained during 2011 under National Water Quality Monitoring Programme reflect that organic matter and bacterial population of faecal origin continue to dominate the pollution problem in River Ganga. The major water quality concerns as revealed from the monitoring results are pathogenic pollution as reflected through indicators i.e. Total Coliforms (TC) & Faecal Coliform (FC), organic matter as reflected through Biochemical Oxygen Demand (BOD) and salinity as reflected through conductivity.

(3) River Water Quality

Figure 19.10.5 shows the BOD_5 yearly variation along the River Ganga based on the yearly average data at each monitoring station. Haridwar, Kaunanj, Kanpur, Allahabad and Varanasi are clearly identified as five big polluting points. The monitoring station-wise BOD_5 yearly variation is presented in **Figure 19.10.6** for selected monitoring stations. Most stations show the slight ascending trend, except for Varanasi which shows the big improvement in BOD_5 concentrations.

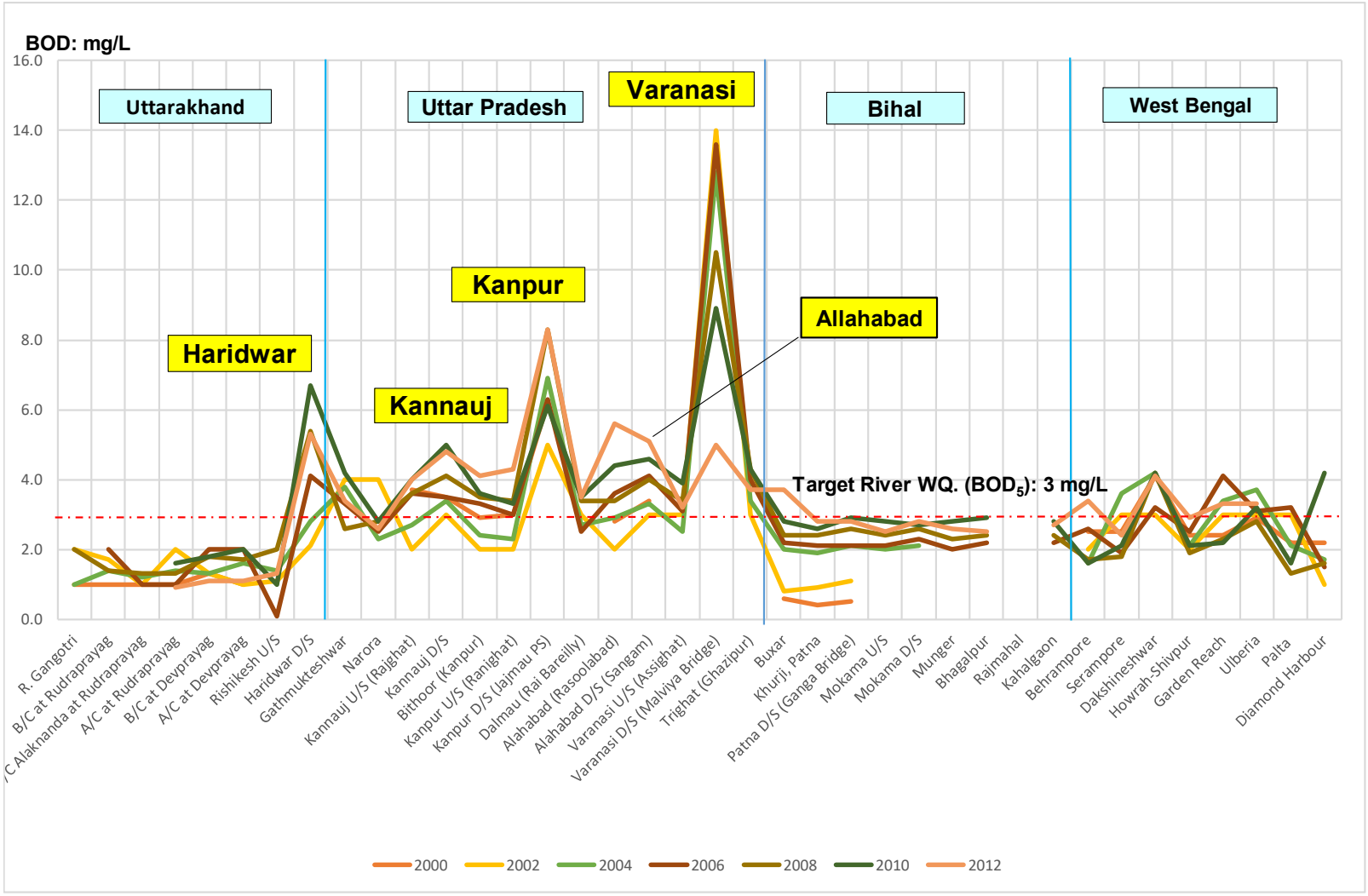


Figure 19.10.5 BOD_5 Yearly Variation along the River Ganga (2000-2012)

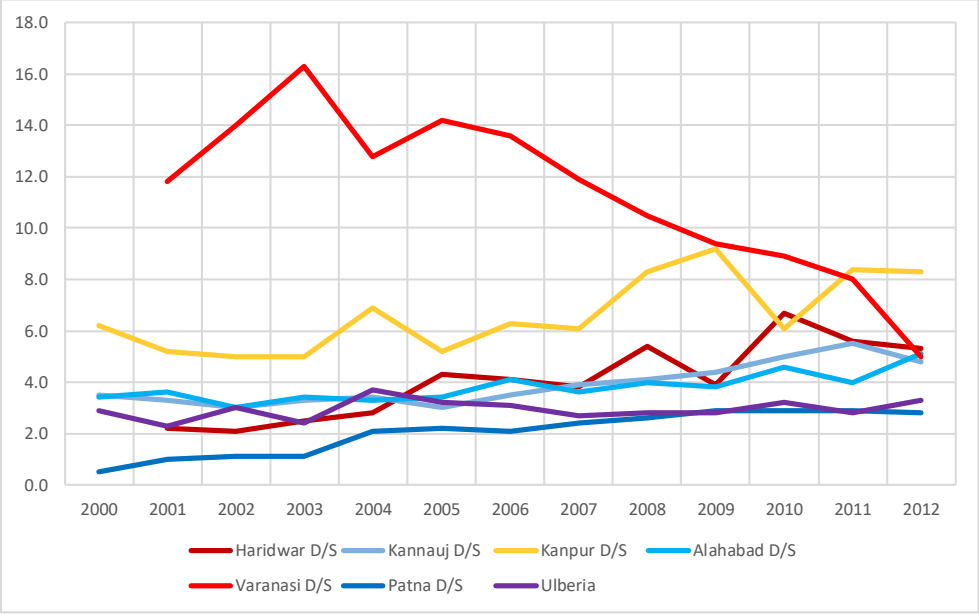


Figure 19.10.6 BOD_5 Yearly Variation at Major Monitoring Stations Based on Yearly Average

While, **Figure 19.10.7** shows the BOD_5 yearly variation along the River Ganga based on the summer average data covering four months of March to June average data at each monitoring station as shown in **Table 19.10.7**. Almost monitoring stations show that BOD_5 concentrations are moving sideways and have not yet been improved.

Table. 19.10.7 Yearly Variation of BOD5 at Major Monitoring Stations along the Ganga

Station Name	1994	1996	1998	1999	2002	2004	2006	2008	2010
Hardwar D/S	2.1	1.1	1.6	1.2	1.7	1.5	1.3	1.4	1.90
Kannauj D/S	3.0	3.2	3.5	4.8	4.2	3.18	4.2	3.1	4.58
Kanpur D/S	8.5	4.1	6.4	6.5	4.8	5.70	6.8	4.1	4.16
Allahabad D/S	3.6	3.3	2.6	3.2	3.8	3.58	3.2	3.2	4.41
Varanasi D/S	2.9	2.3	4.3	3.7	2.5	2.65	2.25	3.0	3.78
Patna D/S	1.6	1.6	1.6	2.4	1.9	1.65	2.3	2.4	2.20
Uluberia	3.2	2.0	2.2	NA	1.9	2.43	2.64	3.6	2.69

Note: The 2000 data is not available

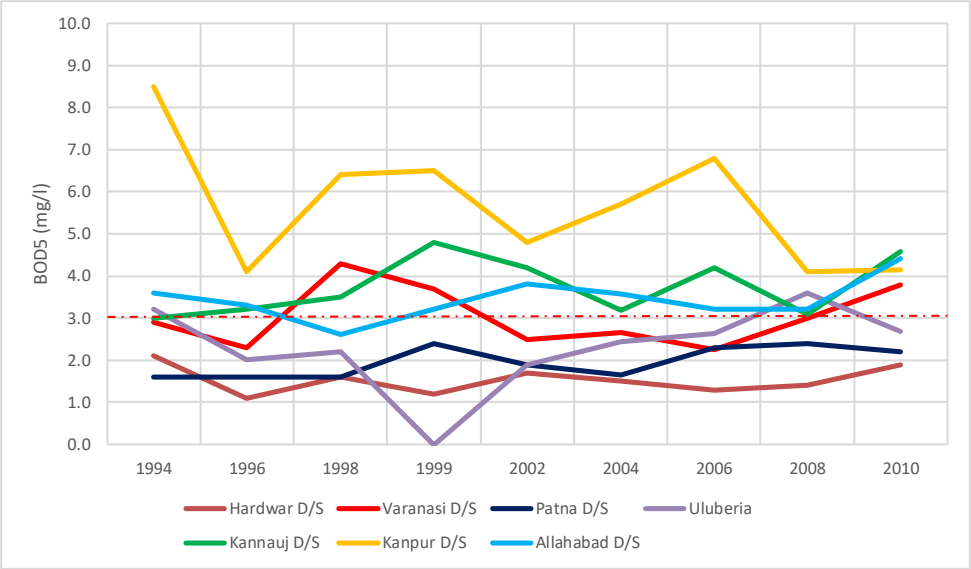


Figure 19.10.7 Yearly Variation of BOD5 at Major Monitoring Stations along the Ganga (Average during Summer of March to June)

Figure 19.10.8 is prepared to check the trends between the yearly average (dot lines) and the summer average (solid lines) for four major polluting points, or Kanauj, Kanpur, Allabad and Varanasi, which shows a big difference in both Kanpur and Varanasi, but a slight difference in both Kannauj and Allahabad. As far as seeing these data, their trends are not even. The water quality is largely variable by the river flows and incoming pollution loads to the River Ganga during the monsoon season, therefore, in the comparison of water quality among monitoring stations, it is better to use the four-month average in the summer when the river flows are low. Watching the 2012 values of four major polluting points, they are gathering at around 4 mg/l in BOD_5. It can be said that there is still no outstanding improvement in water quality of the River Ganga.

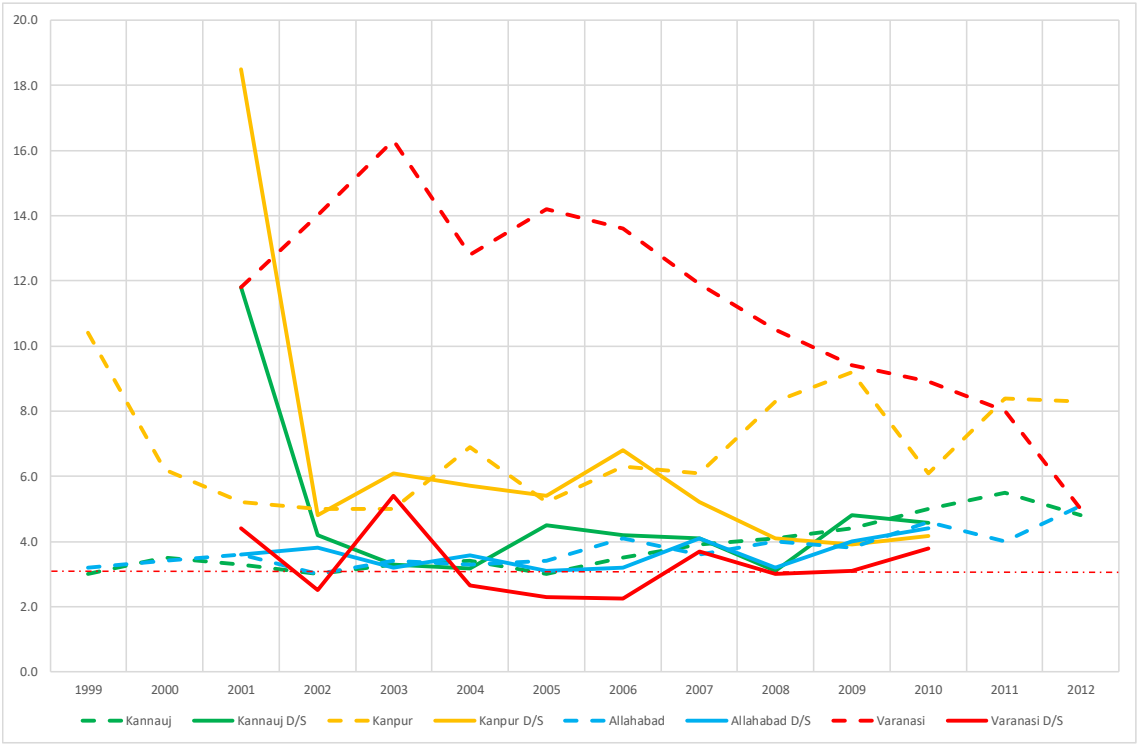


Figure 19.10.8 Comparison of BOD5 between Yearly Average and Summer Average at Four Major Polluting Points, Say, Kannauj, Kanpur, Allahabad and Varanasi

19.11 Water Quality Monitoring on the Ganga and its Tributaries

19.11.1 Outline

The Central Pollution Control Board (CPCB) has established a network of monitoring stations on rivers across the country. The present network is comprising of 870 stations in 26 States and 5 Union Territories spread over the country. The monitoring is done on monthly or quarterly basis in surface waters and on half yearly basis in case of ground water. The monitoring network covers 189 Rivers, 53 Lakes, 4 Tanks, 2 Ponds, 3 Creeks, 3 Canals, 9 Drains and 218 Wells. Among the 870 stations, 567 are on rivers, 55 on lakes, 9 on drains,12 on canals, 4 on tank, 3 on and creeks,2 on pond and 218 are groundwater stations. The monitoring of water quality at 257 stations is being done on monthly basis, 393 stations on quarterly basis, 216 on half yearly basis and 4 stations on yearly basis. Presently the inland water quality-monitoring network is operated under a three-tier programme i.e. GEMS, Monitoring of Indian National Aquatic Resources System and Yamuna Action Plan.

Water samples are being analysed for 28 parameters (see **Table 19.10.1**) consisting of physico-chemical and bacteriological parameters for ambient water samples apart from the field observations. Besides this, 9 trace metals and 15 pesticides (see **Table 19.10.1**) are analysed in selected samples. Biomonitoring is also carried out on specific locations. In view of limited resources, limited numbers of organic pollution related parameters are chosen for frequent monitoring i.e.

monthly or quarterly and major cations, anions, other inorganic ions and micro pollutants (toxic metals & POP's) are analysed once in a year to keep a track of water quality over large period of time. The water quality data are reported in Water Quality Statistics yearbooks.[9]

Generally, SPCBs assist in sampling and analysis of water quality data, while the CPCB undertakes scrutiny, processing, and storage of data, along with the analysis of data for interpretation and preparation of action plans. The monitoring is undertaken either on monthly or yearly basis.[10]

Table 19.11.1 List of Parameters Monitored under National Water Quality Monitoring Programme

Field Observations (7)	Core Parameters (9)	General Parameters (19)	Bio-monitoring (3)	Trace Metals (9)	Pesticides (15)
• Weather • Depth of main stream/depth of water table	• PH • Temperature	• Turbidity, NTU • Phenolphthalein Alkalinity, as $CaCO_3$	• Saprobity Index • Diversity Index	• Arsenic, µg/L • Cadmium, µg/L	• Alpha BHC, µg/L • Beta BHC, µg/L
• Colour and intensity	• Conductivity, µ mhos/cm	• Total Alkalinity, as $CaCO_3$	• P/R Ratio	• Copper, µg/L	• Gama BHC (Lindane) , µg/L
• Odour	• Dissolved Oxygen, mg/L	• Chlorides, mg/L		• Lead, µg/L	• O P DDT, µg/L
• Visible effluent discharge	• BOD, mg/L	• COD, mg/L		• Chromium (Total), µ g/L	• P P DDT, µg/L
• Human activities around station	• Nitrate – N , mg/L	• Total Kjeldahl - N, as N mg/L		• Nickel, µg/L	• Alpha Endosulphan, µ g/L
• Station detail	• Nitrite – N, mg/L	• Ammonia - N, as N mg/L		• Zinc, µg/L	• Beta Endosulphan, µ g/L
	• Faecal Coliform, MPN/100 ml	• Hardness, as $CaCO_3$		• Mercury, µg/L	• Aldrin, µg/L
	• Total Coliform, MPN/100 ml	• Calcium, as $CaCO_3$		• Iron (Total) , µg/L	• Dieldrin, µg/L
		• Sulphate, mg/L			• Carboryl(Carbamate), µg/L
		• Sodium, mg/L			• 2-4 D, µg/L
		• Total Dissolved Solids, mg/L			• Malathian, µg/L
		• Total Fixed Dissolved Solids, mg/L			• Methyl Parathian,
		• Total suspended Solid, mg/L			• Anilophos, µg/L
		• Phosphate, mg/L			• Chloropyriphos, µg/L
		• Boron, mg/L			
		• Magnesium, as $CaCO_3$			
		• Potassium, mg/L			
		• Fluoride, mg/L			

19.11.2 Water Quality Monitoring Network

Central Pollution Control Board started national water quality monitoring in 1978 under Global Environmental Monitoring System (GEMS), Water Programme. Monitoring Programme was started with 24 surface water and 11 groundwater stations. Parallel to GEMS, a National Programme of

[9] *Source: R.M. Bhardwaj, CPCB, "Water Quality Monitoring in India – Achievement and Constraints"*

[10] *Source: CPCB, "Pollution Assessment: River Ganga", July 2013*

Monitoring of Indian National Aquatic Resources (MINARS), was started in 1984, with a total of 113 stations spread over 10 river basins. The present network comprises of 870 stations on rivers, lentic water bodies and subsurface waters is elaborated in **Table 19.10.2**. The number of locations on mainstream of the major river and their tributaries, medium and minor rivers, lakes, ponds, tanks and other water bodies is given in parenthesis.

Table 19.11.2 Monitoring Stations in the Ganga River Basin

River	Distribution of Monitoring Stations	Total Station
Main Stream	Ganga	39
Tributaries	Barakar (1), Betwa (3), Chambal (7), Damodar (5), Gandak (1), Saryu-Ghaghra (3), Gomti (5), Hindon (3), Kali (West) (2), Kali Nadi (2), Khan (1), Kshipra (2), Mandakini (Madhya Pradesh) (1), Parvati (3), Ramganga (1), Rapti (1), Rihand (2), Rupanarayan (1), Sai (1), Sone (5), Tons (Madhya Pradesh) (2), Yamuna (23), Sind (1), Johila (1), Sankh(1), Gohad (1), Kolar (1), Sai(1), Churni (1), Tons (Himachal Pradesh) (1), Sikrana (1), Daha (1), Sirsa (1), Dhous (1), Farmer (1)	88

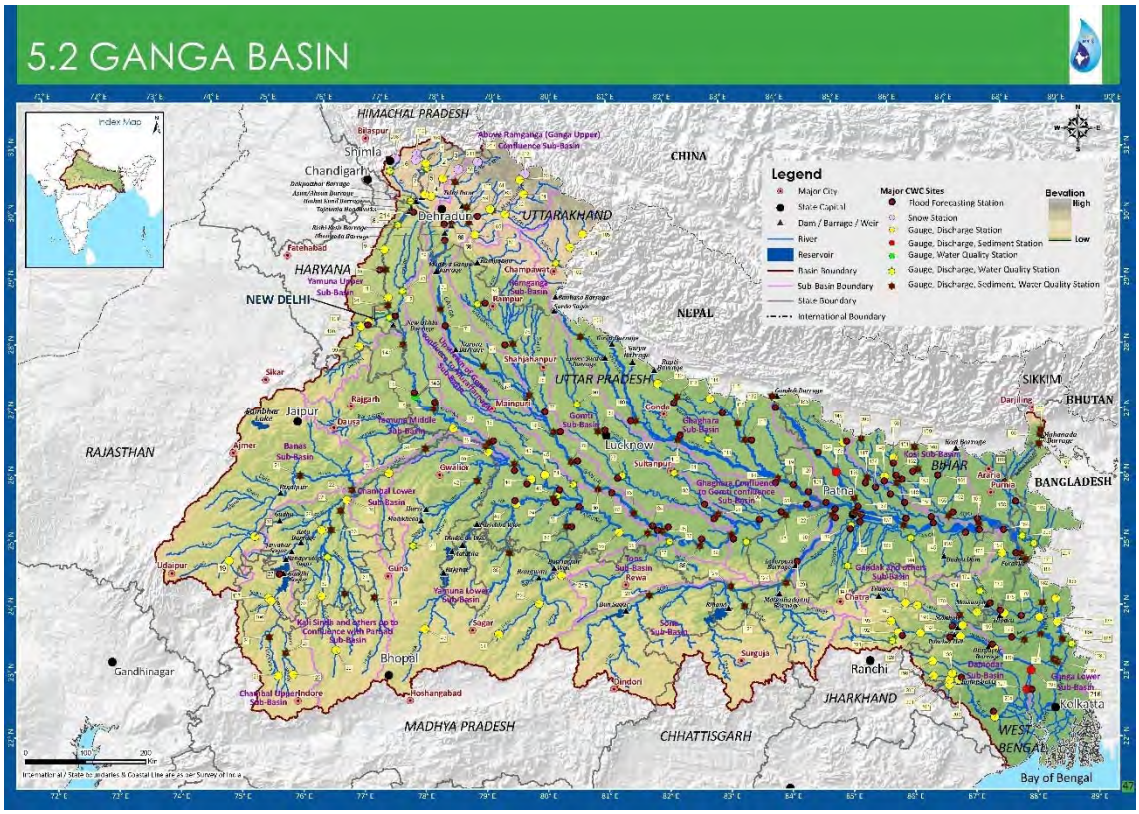


Figure 19.11.1 Location of Water Quality Monitoring Stations on the River Ganga (Shown with Mainly Yellow Marks)

The results of water quality monitoring on the River Ganga are available at the website of ENVIS Centre on Control of Pollution Water, Air and Noise (*see below*) for parameters of temperature, dissolved oxygen, pH, electric conductivity, BOD_5, faecal coliform and total coliform. The data is available by backdating to 2002. For 2012 data, the results of water quality monitoring at 57 stations on the main stem and 57 stations at its tributaries are open

http://cpcbenvis.nic.in/water_quality_data.html

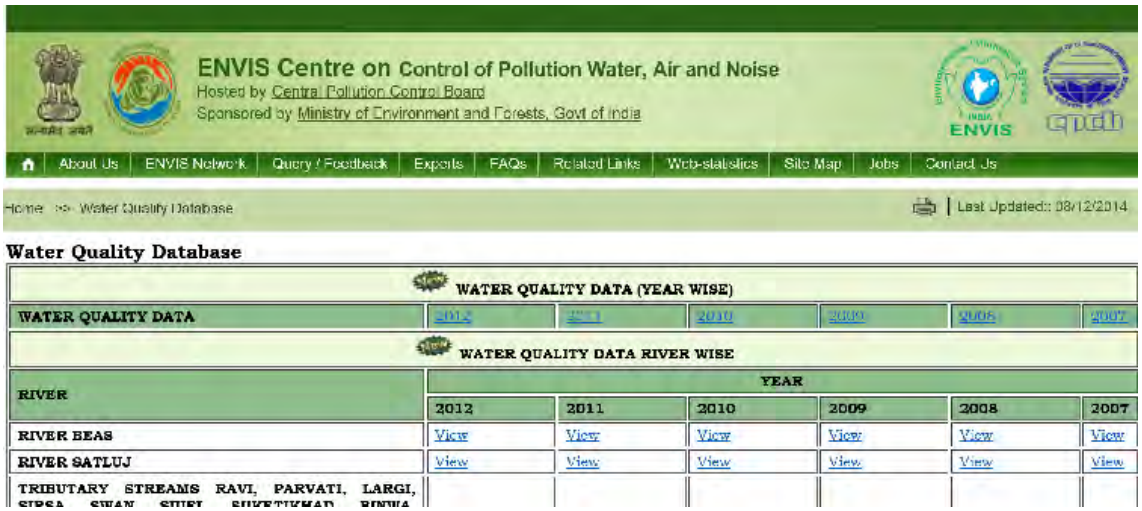


Figure 19.11.2 Website of ENVIS Centre on Control of Pollution Water, Air and Noise

CWC is maintaining a three tier laboratory system for analysis of the parameters. The level-I laboratories are located at 258 field water quality monitoring stations on various rivers of India where physical parameters such as temperature, colour, odour, specific conductivity, total dissolved solids, pH and dissolved oxygen of river water are observed. There are 23 level–II laboratories located at selected division offices to analyze 25 nos. physico-chemical characteristics and bacteriological parameters of river water.4 level-III/II+ laboratories are functioning at Varanasi, Delhi, Hyderabad and Coimbatore where 41 parameters including heavy metals/toxic parameters and pesticides are analysed.

The following procedure is followed in CWC for classification of stations, sampling frequency, identification of parameters and their analysis, which is based on Water Quality Assessment Authority's Gazette Notification dated June 18, 2005.

(A) Classification

Stations are classified as Base, Trend and Flux Stations. CWC has 164 Base stations, 179 Trend stations and 28 Flux stations.

(B) Frequency of Monitoring

- **Base Station**: One sample is collected every two months and totals six samples in a year.
- **Trend Stations**: Sample is collected once in every month.
- **Flux Stations**: Samples are collected thrice in a month, however toxic and trace metal are analyzed once in a month.

19.11.3 Automatic Water Quality Monitoring on the River Ganga[11]

Under the World Bank aided project Automatic Water Quality Monitoring has been setup under the NGRBA Project for the river Ganga at an estimated cost of Rs. 94.45 Cr. approx. The network will consist of 113 stations at critical locations along the main stem of the river. These stations will be located at:

- Upstream and downstream of major urban areas
- On major tributaries upstream of the confluence with the Ganga
- Downstream of Sewerage Treatment Plants (STPs)
- In major *nallahs*
- Downstream of industrial areas
- At intakes of drinking water treatment plants
- At important bathing ghats

This Project focuses on the main stem of the Ganga River in the states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal with the following objectives;

- To assess nature and extent of pollution.
- To understand the environmental fate of different pollutants.
- To evaluate effectiveness of pollution control measures in place.
- To evaluate water quality trend.
- To assess the fitness of water for different uses.

This project is expected to provide a state-of-the-art, real-time picture of water quality of river Ganga through the real time data on predefined 20 parameters and acquire the data from all the 113 stations for the all predefined parameters such as Ammonia, BOD, COD, BTX Chloride, DO, DOC, EC, Fluoride, Nitrate, Hydrogen Sulfide, pH, Potassium, TOC, TSS Turbidity, Colour, Temperature

[11] Source: https://nmcg.nic.in/pdf/NMCGdocketonWQM.pdf

Nitrites and water level. The Executing Agency of this project is the NGRBA Cell of CPCB for implementing the Automatic Water Quality Monitoring System.

Real time data, collected at an interval of fifteen minutes will be transferred to the Central Repository / Data Server / RDBMS though the GSM / GPRS telemetry link. The Data Server will be supported with the mechanism to feed real data and processed data. The filtered and calibrated data will be analyzed and process in the desired form to feed in the NGRBA Ganga Knowledge Centre Portal and also other Websites/Portals/Mobile Applications.

All the data that is delivered will be validated by an audit contractor in order to qualify for purchase. The audit contractor will perform continuous field inspections of the equipment and sensors in each station.

In addition to the automatic 113 station, NGRBP proposes to monitor water quality manually in 134 stations along the main stem of river Ganga. Bio-monitoring to evaluate the impact of pollutants on the wholesomeness of the aquatic ecosystem is also proposed to involve community monitoring and also to identify additional sources of pollution through citizens group, like schools, cultural and religious organizations and NGOs, with an interest in conservation of local water resources.

19.12 Organisation for Water Quality Control of the River Ganga

19.12.1 Central Pollution Control Board (CPCB）

The Central Pollution Control Board (CPCB), a statutory organization, was constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974. Further, CPCB was entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

It serves as a field formation and also provides technical services to the Ministry of Environment, Forests and Climate Change of the provisions of the Environment (Protection) Act, 1986. Principal Functions of the CPCB, as spelt out in the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, (i) to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution, and (ii) to improve the quality of air and to prevent, control or abate air pollution in the country.

Functions of the CPCB at the National Level are given below:

- Advise the Central Government on any matter concerning prevention and control of water and air pollution and improvement of the quality of air.
- Plan and cause to be executed a nation-wide program for the prevention, control or abatement of water and air pollution;
- Co-ordinate the activities of the State Board and resolve disputes among them;

- Provide technical assistance and guidance to the State Boards, carry out and sponsor investigation and research relating to problems of water and air pollution, and for their prevention, control or abatement;
- Plan and organize training of persons engaged in program on the prevention, control or abatement of water and air pollution;
- Organize through mass media, a comprehensive mass awareness program on the prevention, control or abatement of water and air pollution;
- Collect, compile and publish technical and statistical data relating to water and air pollution and the measures devised for their effective prevention, control or abatement;
- Prepare manuals, codes and guidelines relating to treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts;
- Disseminate information in respect of matters relating to water and air pollution and their prevention and control;
- Lay down, modify or annul, in consultation with the State Governments concerned, the standards for stream or well, and lay down standards for the quality of air; and
- Perform such other function as may be prescribed by the Government of India

As per the policy decision of the Government of India, the CPCB has delegated its powers and functions under

- Water (Prevention & Control of Pollution) Cess Act, 1977.
- Air (Prevention & Control of Pollution) Act, 1981
- Environment (Protection) Act, 1986 and Rules made thereunder
- Hazardous Waste (Management & Handling) Rules1989.
- Manufacture, storage and Import of Hazardous Chemicals Rules, 1989
- Bio-medical Waste (Management & Handling) Rules, 1998
- Municipal Solid Waste (Management & Handling) Rules, 2000.
- Plastics wastes Rules, 1999 o Coastal Regulation Zone Rules, 1991
- Public Liability Insurance Act, 1991

CPCB along with its counterparts State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCC) are responsible for implementation of legislations relating to prevention and control of environmental pollution.

19.12.2 Relationship between CPCB and SPCB

The Central Pollution Control Board is fully funded by the Central Ministry of Environment & Forests. The State Pollution Control Boards receive funds from the concerned State Governments and from the Central Ministry of Environment & Forests through reimbursement of Water Cess (upto

80%) collected by the respective State Boards. In addition, the State Boards receive fees for processing for applications from the industries for issuing consent in regard to discharge of effluent and emissions.

SPCBs are getting only marginal/ nominal financial assistance from State Governments. In some of the State Pollution Control Boards, State Governments are not providing budgetary grants. State Pollution Control Boards are dependent on consent and authorization fee and cess reimbursements which they get out of cess collections.

Ministry of Environment, Forests and Climate Change (MoEF&CC) provides financial assistance to State Pollution Control Boards on specific projects relating to prevention and control of pollution. Ministry provides financial assistance on following programmes:

- Specific projects for abatement of pollution
- Hazardous waste management
- Management of municipal solid waste
- Strengthening of Pollution Control Boards (for laboratory upgrdation)

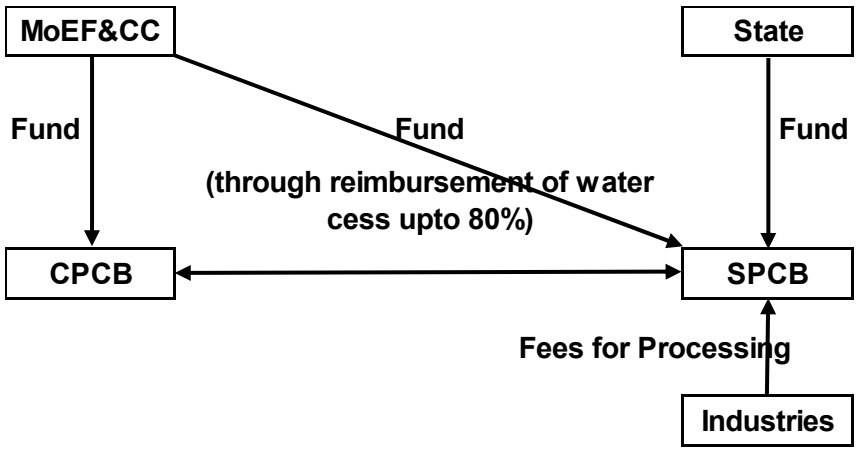


Figure 19.12.1 Fund Flow

The functions of SPCB are as follows:

- Pollution control in 17 categories of highly polluting industries
- Pollution control from industries discharging waste water into rivers and lakes
- Inventorization of pollution industries in the State and ensuring their compliance to the pollution control norms
- Restoration of environmental quality in critically polluted areas

- Monitoring of water and ambient air quality in the States
- Hazardous waste

19.13 Smart Ganga City Programme

On August 13, 2016, the NMCG selected the 10 cities in the first phase for infrastructure development for sewage treatment, on hybrid annuity mode with the following contents:.

- Union Minister for Water Resources, River Development and Ganga Rejuvenation and Union Urban Development Minister launched Smart Ganga City Scheme in ten important cities through video conference.
- These cities are – *Haridwar, Rishikesh, Mathura-Vrindavan, Varanasi, Kanpur, Allahabad, Lucknow, Patna, Sahibgunj and Barrackpore*.
- National Mission for Clean Ganga (NMCG) has chosen these cities in the first phase for infrastructure development for sewage treatment.
- This will be on hybrid annuity mode based on PPP model.

Source: MoWRRD&GR, "NAMAMI Ganga Programme" presented at INDIA@COP22 on November 10, 2016

19.14 Estimation of Sewage Flow for the Year of 2030

(1) Available data source

The additional capacity requirement for STP for the certain year is considered as one of the important indices to select the town(s) for the Phase-II Project out of 118 towns identified by NMCG, which is given by the following equation.

Additional capacity requirement for STP by 2030
= Estimated sewage flow in the year of 2030 – Existing/sanctioned STP capacity

The sanctioned STP capacity doesn't show the present STP capacity but it is committed to enter into operation within about five years, since the STP construction has been sanctioned, and handled equivalent to the existing STP capacity

As the clues to estimate the sewage flow for the year of 2030, the following reports and data are helpful:

1) The design population and sewage flow proposed in the existing DPRs for sewerage facility construction
2) The World Bank has prepared the Environmental and Social Assessment and Management Plan for some towns out of 118 towns identified for the Ganga Action Plan. The report analyzes the impacts of proposed project, and suggests the management plans to handle any negative impacts on the basis of the DPR that has been prepared by U.P. Jal Nigam. Therefore, the

results on the projection of design population and sewage flow are referred in the report without detailed description but they are useful in case of no availability of DPRs.

3) The City Development Plan (CDP） shows the development plans for various urban infrastructures including sewerage facilities with the population projection and required STP capacity
4) Since most towns out of 118 towns have not yet any DPRs and CDPs, it is still necessary for the population projection based on the past census populations and the estimation of sewage flows as per the manual.

Among the reports mentioned above, the first priority to population projection and sewage flow estimation is given to those in DPRs as well as WB reports which are discussing sewerage facility development directly, followed by CDPs. For the towns with no DPR and CDP, the population shall be projected using the past five census populations (1971-2011) and the sewage flow shall be estimated as per the manual.

(2) Problems in DPRs and CDPs

There are the following problems in DPRs and CDPs:

- The target years in the DPR and/or CDP are different depending on the towns
  In the selection of towns for Phase-II Project, it is necessary to calculate the additionally required STP capacities in the certain year for comparison. For this purpose, the target year was set at the year of 2030, and all the figures on projected population and estimated sewage flow available in the existing reports as mentioned-above were converted to those for the year of 2030 using the proportional interpolation method.
- Some DPRs and CDPs do not reflect the 2011 census population (refer to **Appendix 19.14.1**)
- Some reports were prepared before 2010 (refer to **Appendix 19.14.1**)
  The figures on projected population and estimated sewage flow proposed in the existing reports shall be accepted as they are without any review.

(3) Estimation of Sewage Flow Based on Population Projection

In case of using the census population, the sewage flow for the year 2030 shall be estimated applying the figures in **Table 19.14.1**. to the following equation:

Sewage flow = (Projected population) x (Rate of water supply) x (Conversion factor to sewage)
x (1＋Infiltration rate）

Table 19.14.1 Criteria for Estimation of Sewage Flow (2030)

Population size	P≥5 lac	5 lac>P≥1 lac	P<1 lac	Remark
Rate of water supply	150 lpcd	135 lpcd	135 lpcd	
Conversion factor to sewage	80%	80%	80%	
Infiltration rate	20%	10%	10%	

The results of estimated sewage flow for the year of 2030 is summarized in **Table 19.14.2** for 118 river front tows based on DPRs, WB reports, CDRs or census populations and the additional STP capacity requirements are shown in **Figure 19.14.1**

The additional STP capacity requirement is biggest as 413.6 MLD in Kolkata, followed by Kanpur (203.5 MLD), Patna (135.4 MLD), Howrah (133.3 MLD) and Moradabad (83.0 MLD), respectively.

Table 19.14.2 Estimated Sewage Flow for the Year of 2030

S. No.	Year	Census Population						DPR (Detailed Design Report) / WB (World Bank)						CDP				Estimated Sewage Flow (2030) (MLD)				
		1971	1981	1991	2001	2011	2030 (Proj'd)	Projected Population			Estimated Sewage Flow (MLD)			Projected Population		Estimated Sewage Flow (MLD)		JICA Survey Team	NMCG	DPR / WB	CDP	Adopted
1	Haridwar	91,371	75,946	187,392	220,767	278,286	400,565							2,021 516,859		2021 50.3		47.6	135.0		71.2	71.2
2	Rishikesh	17,646	29,145	44,487	66,189	70,499	95,604											11.4	18.0			11.4
3	Gopeshwar	6,354	9,709	15,378	19,833	21,447	27,018	2011 28,000	2026 46,000	2041 74,000	2011 3.0	2026 5.0	2041 6.0					3.2	4.0	5.3		5.3
4	Tehri	5,480	12,249	20,226	25,423	24,014	32,819											3.9	3.4			3.9
5	Srinagar	5,566	9,171	18,791	19,658	20,115	24,135											2.9	6.4			2.9
6	Joshimath	5,852	8,610	11,488	13,204	16,709	22,552	2011 36,130	2026 46,730	2041 64,430	2011 3.8	2026 5	2041 7					2.7	6.8	5.5		5.5
7	Uttarkashi	6,020	10,043	13,919	16,218	17,475	20,376											2.4	3.1			2.4
8	Muni ki Reti - Dhaluwala *1	1,126	2,264	4,519	19,636	28,636	48,925	2013 38,553		2045 70,672	2013 3.8		2045 7.0					5.8	7.3	5.5		5.5
9	Gaucher		3,284	4,422	7,303	8,864	13,793											1.6	1.4			1.6
10	Kanaprayag		3,772	5,169	6,977	8,297	11,894	2011 11,384	2026 18,056	2041 28,638	2011 1.23	2026 1.95	2041 3.09					1.4	1.4	2.3		2.3
11	Rudraprayag		1,331	1,542	2,250	9,313	20,415	2011 18,433	2026 28,452	2041 43,922	2011 1.99	2026 3.07	2041 4.74					2.4	3.1	3.5		3.5
12	Kirtinagar	--	736	1,058	1,040	1,517	1,783											0.2	0.3			0.2
13	Nandprayag		1,103	1,262	1,704	1,641	1,645											0.2	0.3			0.2
14	Badrinath		2,576	978	1,682	2,438	2,801	2011 18,370	2026 27,480	2041 36,640	2011 1.98	2026 2.97	2041 3.96					0.3	2.8	3.2		3.2
15	Devprayag	1,527	1,701	2,164	2,769	2,152	2,448	2011 12,146	2026 12,886	2041 13,771	2011 1.31	2026 1.39	2041 1.49					0.3	1.4	1.4		1.4
16	Allahabad *1	513,036	650,070	844,546	1,042,229	1,195,329	1,534,171	2010 1,496,955	2026 1,908,697	2040 2,549,444	2010 197.8	2026 251.95	2040 336.63					220.9	296.0	276.1		276.1
17	Farukhabad	102,768	145,793	194,567	228,333	276,581	363,938							N/A				43.2	40.2			43.2
18	Ghazipur	45,635	60,725	76,547	103,298	121,020	159,244	2015 130,000	2030 165,000	2045 205,000	2015 15.4	2030 19.6	2045 24.4					18.9	17.6	19.6		19.6
19	Kanpur	1,158,321	1,576,833	1,974,441	2,656,607	2,876,591	4,235,871	2020 3,668,232	2035 5,295,697	2050 7,645,209	2020 528.2	2035 762.6	2050 1,100.9	2,025 5,599,999	2,040 8,632,000	2025 673	2040 1035	610.0	673.0	684.5	793.7	684.5
20	Mirzapur	105,939	127,787	169,336	205,053	234,871	303,434	2030 322,533	2035 346,686	2050 423,624	2030 38	2035* 41	2050 50	N/A				36.0	34.1	38.0		38.0

Table 19.14.2 Estimated Sewage Flow for the Year of 2030 (Cont'd)

S. No.	Year	Census Population						DPR (Detailed Design Report) / WB (World Bank)						CDP				Estimated Sewage Flow (2030) (MLD)				
		1971	1981	1991	2001	2011	2030 (Proj'd)	Projected Population			Estimated Sewage Flow (MLD)			Projected Population		Estimated Sewage Flow (MLD)		JICA Survey Team	NMCG	DPR / WB	CDP	Adopted
21	Varanasi	588,608	735,175	947,481	1,091,918	1,198,491	1,451,459	2020 1,831,523	2035 2,654,338	2050 3,800,478	2020 302	2035 425	2050 540					209.0	348.0	384.0		384.0
22	Mugalsarai	13,583	48,063	66,529	88,387	109,650	245,138											29.1	15.9			29.1
23	Moradabad *4	258,590	330,051	429,214	641,583	887,871	1,347,329	2020 989,390	2030 1,305,892	2050 2,216,400	2020 106.9	2030 141.0	2050 239.4					194.0	143.4	141.0		141.0
24	Ballia	47,101	61,704	84,063	101,465	104,424	138,692											16.5	17.0			16.5
25	Unnao	38,195	75,983	107,425	144,662	177,658	347,832											41.3	25.8			41.3
26	Fatehpur	54,665	84,831	117,675	152,078	193,193	269,050											32.0	28.1			32.0
27	Bijor	43,290	56,713	66,486	79,346	93,297	122,609											14.6	24.0			14.6
28	Kannauj	28,187	41,016	58,932	71,727	84,862	111,783											13.3	12.3			13.3
29	Gangaghat	--	26,050	50,260	70,803	84,072	105,742											12.6	13.4			12.6
30	Najibabad	42,586	55,109	66,860	79,025	88,535	113,873											13.5	12.9			13.5
31	Gairaula	--	--	21,096	39,790	55,048	87,302											10.4	8.0			10.4
32	Nagina	37,066	50,405	58,513	71,350	95,246	132,576											15.8	13.8			15.8
33	Chandpur	28,179	41,552	55,825	68,287	83,441	111,328											13.2	12.1			13.2
34	Dhampur	22,639	29,070	39,179	46,869	50,997	62,352											7.4	7.4			7.4
35	Jahangirabad	21,578	29,301	37,981	51,394	59,858	78,721											9.4	8.7			9.4
36	Bhadohi	23,250	32,192	64,010	74,522	94,620	138,768											16.5	13.8			16.5
37	Anupshahar *1	12,253	15,193	19,684	23,795	29,087	39,244	2028 45,887	2033 49,878	2048 63,635	2028 4.94	2033 5.39	2048 6.9					4.7	5.0			4.7
38	Chunar	10,240	21,307	27,778	33,933	37,185	42,807	2030 55,000	2035 63,000	2050 80,000	2030 6.5	2035* 7.5	2050 9.5					5.1	5.4	6.5		6.5
39	Saidpur	10,045	12,937	18,217	21,568	24,338	31,127											3.7	3.5			3.7
40	Garhmukteshwa	10,937	17,914	25,241	33,847	46,077	67,593											8.0	9.0			8.0

Table 19.14.2 Estimated Sewage Flow for the Year of 2030 (Cont'd)

S. No.	Year	Census Population						DPR (Detailed Design Report) / WB (World Bank)						CDP				Estimated Sewage Flow (2030) (MLD)				
		1971	1981	1991	2001	2011	2030 (Proj'd)	Projected Population			Estimated Sewage Flow (MLD)			Projected Population		Estimated Sewage Flow (MLD)		JICA Survey Team	NMCG	DPR / WB	CDP	Adopted
41	Ramnagar	17,241	23,297	30,116	40,619	49,132	66,537		2035 87,122	2050 118,503		2035 10.36	2050 14.06					7.9	7.1	9.1		9.1
42	Naraura *1	--	9,573	15,652	20,407	22,775	26,024	2018 31,400	2033 40,060	2048 49,620			2048 4					3.1	4.0	3.1		3.1
43	Soron	17,153	19,443	21,966	26,678	27,468	32,368											3.8	4.0			3.8
44	Hastinapur	8,889	11,637	15,081	21,249	26,452	37,048											4.4	3.8			4.4
45	Bithoor *1	--	5,318	7,444	9,652	11,300	15,797	2020 17,900	2035 24,000	2050 32,300	2020 2	2035 2.6	2050 3.6					1.9	2.1	2.4		2.4
46	Babrala	--	6,151	9,786	14,451	18,108	28,799											3.4	2.6			3.4
47	Arrah	92,919	125,111	157,082	203,380	261,430	365,219							2,035 490,828		2030 70		43.4	42.0		70.0	70.0
48	Bhagalpur	172,202	225,062	253,225	340,767	400,146	535,316							2,030 536,000		2030 63		77.1	65.0		63.0	63.0
49	Buxar	31,691	42,952	55,753	83,168	102,861	177,670	2011 106,759	2026 153,995	2041 *2 218,514		2026 17.28	2041 24.25					21.1	17.0	19.1		19.1
50	Chapra	83,101	111,564	136,877	179,190	202,352	258,997							2,035 384,739		2030 46.6		30.8	32.0		46.6	46.6
51	Hajipur	41,890	62,520	87,687	119,412	147,688	204,965	2011 152,979	2026 217,992	2041 305,494		2026 23.54	2041 32.99	2,035 357,581		2030 45		24.3	23.4	26.1	45.0	26.1
52	Munger *1	102,474	129,260	150,112	188,050	213,303	264,538			2041 370,439		2026 30		2,030 310,000		Not incl'd		31.4	33.7	35.0		35.0
53	Patna *1	517,994	872,647	1,041,033	1,591,619	1,895,449	2,549,741	2028 2,770,400	2032 3,085,217	2047 4,568,410	2028 332.5	2032 370.2	2047 548.2					367.2	340.3	351.4		351.4
54	Danapur	59,993	82,228	108,107	159,410	211,152	310,051							2,030 348,185		2030 37.5		36.8	33.4		37.5	37.5
55	Begusarai	35,736	56,633	71,424	93,741	252,008	480,889	2011 117,516	2026 162,410	2041 *2 221,740		2026 18.26	2041 24.66	2,035 250,000		2030 35		57.1	39.9	20.0	35.0	20.0
56	Katihar	80,121	122,005	154,367	190,873	240,838	346,917							2,030 405,698		2030 43.81		41.2	38.1		43.8	43.8
57	Jamalpur	61,731	78,356	86,112	96,983	105,434	133,150							2,030 152,000		2030 18		15.8	16.7		18.0	18.0
58	Bihar Sharif	100,046	151,343	201,323	232,071	297,268	403,713							2,035 485,873		2030 59		48.0	47.0		59.0	59.0
59	Mokameh	38,164	51,047	59,528	56,615	60,678	67,323											8.0	10.0			8.0
60	Fatuah	15,309	21,252	30,668	38,672	50,961	73,723											8.8	8.1			8.8

Table 19.14.2 Estimated Sewage Flow for the Year of 2030 (Cont'd)

S. No.	Year	Census Population						DPR (Detailed Design Report) / WB (World Bank)						CDP				Estimated Sewage Flow (2030) (MLD)				
		1971	1981	1991	2001	2011	2030 (Proj'd)	Projected Population			Estimated Sewage Flow (MLD)			Projected Population		Estimated Sewage Flow (MLD)		JICA Survey Team	NMCG	DPR / WB	CDP	Adopted
61	Barh	23,599	31,869	45,285	48,442	61,470	83,829											10.0	10.0			10.0
62	Barauni	8,348	11,672	12,594	13,882	71,660	126,139											15.0	11.3			15.0
63	Sultanganj	14,654	22,578	34,181	41,958	52,892	73,819											8.8	9.0			8.8
64	Dumraon	22,969	29,560	35,068	45,806	53,618	69,297											8.2	8.5			8.2
65	Bhabua	13,420	19,896	27,041	41,775	50,179	69,411											8.2	7.9			8.2
66	Lakhisarai	26,782	39,818	53,360	77,875	99,979	143,075											17.0	15.8			17.0
67	Phulwari Sharif	15,917	22,712	35,123	53,451	81,740	132,746											15.8	12.9			15.8
68	Barahiya	24,665	27,180	31,980	39,865	43,032	53,011											6.3	7.0			6.3
69	Kahelgaon	10,543	14,030	17,899	22,049	33,700	57,539											6.8	5.3			6.8
70	Bakhtiyarpur	5,764	11,358	26,867	32,293	47,897	77,103											9.2	8.0			9.2
71	Naugachhia	9,544	23,235	31,250	38,287	49,069	67,843											8.1	8.0			8.1
72	Sonepur	--	20,363	27,124	33,490	37,776	49,638											5.9	6.0			5.9
73	Sahibganj *1	35,640	45,154	49,257	80,154	88,214	124,358	2025	2027	2042	2025	2027	2042					14.8	12.0	18.2		18.2
								103,796	105,988	124,908	11.2	17.6	20.7									
74	Rajmahal	8,189	12,426	13,958	17,977	22,514	31,290											3.7	3.4			3.7
75	Kolkata *3	3,716,377	4,126,846	4,399,819	4,572,876	4,496,694	4,643,890	2032	2037	2042	2032	2037	2042					668.7	744.5	567.6		567.6
								4,812,815	5,019,525	5,292,815	577.53	602.34	635.14									
76	English Bazaar	61,335	84,665	139,204	161,456	205,521	293,053											34.8	27.8			34.8
77	Baharampur	72,605	94,896	117,647	160,143	195,223	265,212											31.5	26.5			31.5
78	Santipur	61,166	82,980	109,956	138,235	151,777	187,222											22.2	20.6			22.2
79	Haldia	9,968	21,122	100,347	170,673	200,827	308,933											36.7	27.2			36.7
80	Raiganj	43,191	60,343	151,045	165,212	183,612	293,887											34.9	24.9			34.9

Table 19.14.2 Estimated Sewage Flow for the Year of 2030 (Cont'd)

S. No.	Year	Census Population						DPR (Detailed Design Report) / WB (World Bank)						CDP				Estimated Sewage Flow (2030) (MLD)				
		1971	1981	1991	2001	2011	2030 (Proj'd)	Projected Population			Estimated Sewage Flow (MLD)			Projected Population		Estimated Sewage Flow (MLD)		JICA Survey Team	NMCG	DPR / WB	CDP	Adopted
81	Krishnanagar	85,923	98,141	121,110	139,110	153,062	186,546											22.2	20.7			22.2
82	Nabadwip	94,204	109,108	125,037	115,016	125,543	138,420											16.4	17.0			16.4
83	Barrackpore *1	96,889	115,516	142,557	144,391	152,783	175,691	2024 189,602	2029 199,688	2044 215,535			2044 24.0					20.9	21.1	21.3		21.3
84	Uttarpara Kotlun	67,568	79,598	101,268	150,363	159,147	199,667											23.7	21.6			23.7
85	Rishra	63,486	81,001	102,815	113,305	124,577	147,863											17.6	16.9			17.6
86	Baidyabati	54,130	70,573	90,081	108,229	121,110	152,926											18.2	16.4			18.2
87	Champdani	58,596	76,138	101,067	103,246	111,251	133,433											15.9	15.1			15.9
88	Bhadreshwar	45,586	58,858	72,474	106,071	101,477	119,823											14.2	13.8			14.2
89	Kamarhati	169,404	234,951	266,889	314,507	330,211	360,823											42.9	44.7			42.9
90	Baranagar	136,842	170,343	224,821	250,768	245,213	278,756											33.1	86.6			33.1
91	Naihati	82,080	114,607	132,701	215,303	217,900	254,928											30.3	29.5			30.3
92	Kanchrapara	78,768	98,816	111,602	135,198	129,576	141,923											16.9	17.6			16.9
93	Serampore	102,023	127,304	137,028	197,857	181,842	200,796											23.9	24.6			23.9
94	Hugli Chinsurah	105,241	128,918	160,976	184,173	179,931	202,591											24.1	24.4			24.1
95	Maheshtala				385,266	448,317	578,165											83.3	60.7			83.3
96	Panihati	148,046	205,718	275,990	348,438	377,347	486,265											57.8	51.1			57.8
97	Bally		147,735	184,474	260,906	293,373	379,797											45.1	39.7			45.1
98	Ulluberia	62,573	81,352	155,172	204,771	235,345	328,244											39.0	31.9			39.0
99	Khardah	36,679	50,202	88,358	122,133	108,496	130,139											15.5	14.7			15.5
100	Howrah	737,877	744,429	950,435	1,007,532	1,077,075	1,238,195											178.3	162.1			178.3

Table 19.14.2 Estimated Sewage Flow for the Year of 2030 (Cont'd)

S. No.	Year	Census Population						DPR (Detailed Design Report) / WB (World Bank)						CDP				Estimated Sewage Flow (2030) (MLD)				
		1971	1981	1991	2001	2011	2030 (Proj'd)	Projected Population			Estimated Sewage Flow (MLD)			Projected Population		Estimated Sewage Flow (MLD)		JICA Survey Team	NMCG	DPR / WB	CDP	Adopted
101	Bansberia	61,748	77,967	94,698	107,081	103,920	115,053											13.7	11.2			13.7
102	Chandannagar	75,238	101,923	120,378	162,187	166,867	210,759											25.0	18.0			25.0
103	Titagarh	88,218	104,534	114,085	124,213	116,541	129,995											15.4	12.6			15.4
104	Halisahar *1	68,906	99,366	117,539	130,621	124,939	134,960		2025			2025						16.0	14.6	14.0		14.0
									147,000			12.5										
105	Kalyani	18,310	39,257	57,648	85,503	100,575	206,935											24.6	16.0			24.6
106	Bhatpara	204,750	265,419	315,976	444,655	386,019	472,121											56.1	56.3			56.1
107	Dhulian	22,068	25,466	33,191	72,850	95,706	130,685											15.5	19.3			15.5
108	Jangipur	29,872	43,795	55,981	74,458	88,165	115,854											13.8	9.5			13.8
109	Ranaghat	47,815	64,722	71,929	85,321	75,365	76,118											9.0	8.1			9.0
110	Jiaganj-Azimganj	26,535	32,725	42,104	47,212	51,790	63,787											7.6	5.6			7.6
111	Katwa	28,832	44,430	55,541	71,589	81,615	101,571											12.1	8.8			12.1
112	Chakdah	46,345	59,308	74,769	86,999	95,203	114,042											13.5	10.3			13.5
113	Konnagar	34,424	51,211	62,200	72,177	76,172	84,255											10.0	38.9			10.0
114	Budge Budge *1	51,039	70,404	77,575	81,554	76,837	78,035	2014	2029	2044	2014	2029	2044					9.3	10.0	11.6		11.6
								91,000	97,500	110,000	9.3	11.5	12.5									
115	Gayespur	21,291	41,667	52,158	55,048	58,998	72,997											8.7	7.4			8.7
116	Gaulia	44,271	57,061	80,918	79,926	85,336	101,453											12.1	9.2			12.1
117	Murushidabad	17,110	21,341	30,327	36,947	44,019	59,409											7.1	4.8			7.1
118	Diamond Harbou	13,072	20,259	30,266	37,234	41,802	53,045											6.3	5.7			6.3
																		4,502.6	4,746.3			4,692.7

*1 *Figures in DPR/WB coloums are based on WB reports*

*2 *Projected population is also confirmed in WB report*

*3 *ADB, "Technical Assistance Consultant's Report - India: Preparing for Kolkata Environmental Improvement Project Phase II", March 2012*

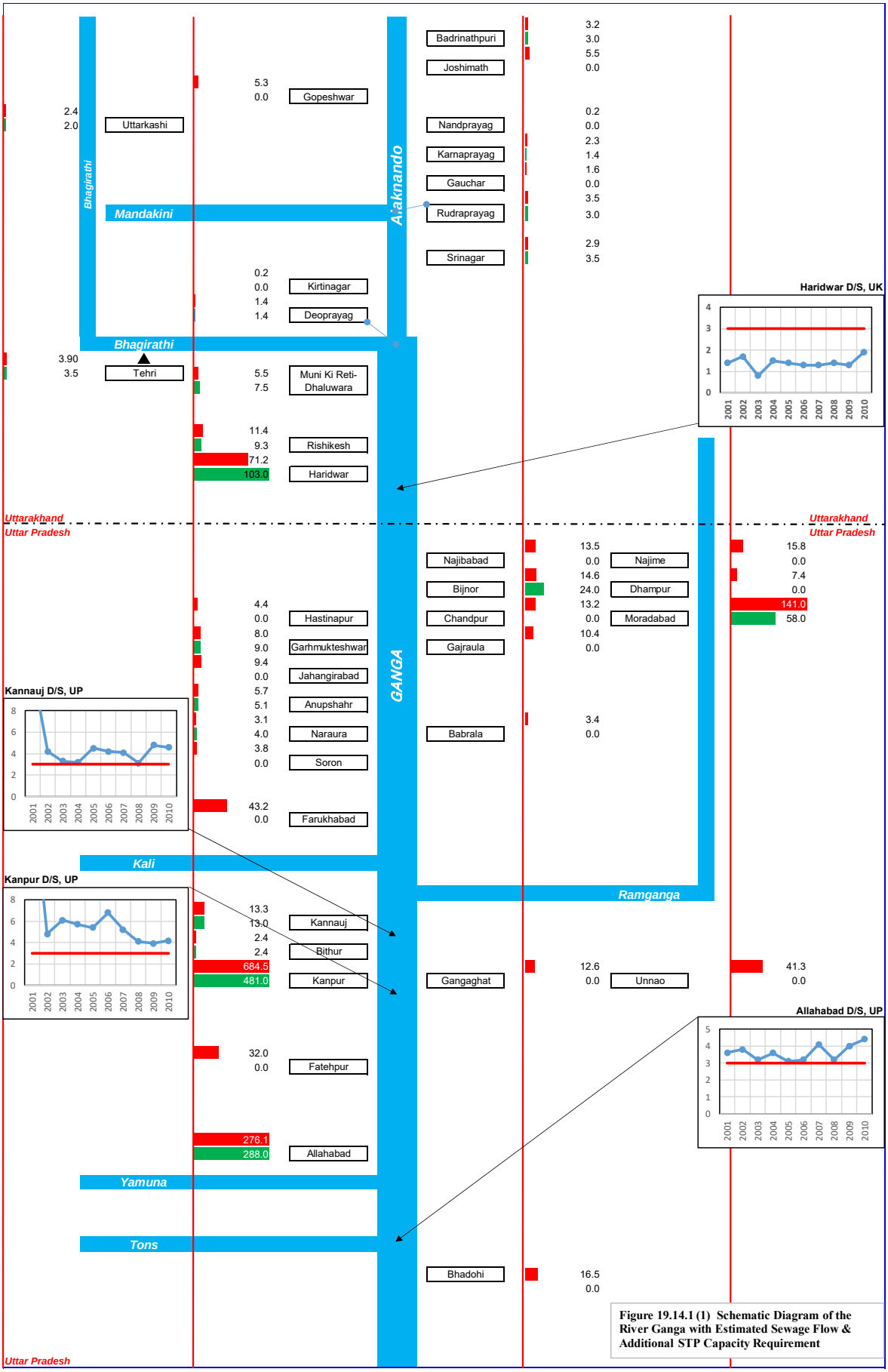


Figure 19.14.1 (1) Schematic Diagram of the River Ganga with Estimated Sewage Flow & Additional STP Capacity Requirement

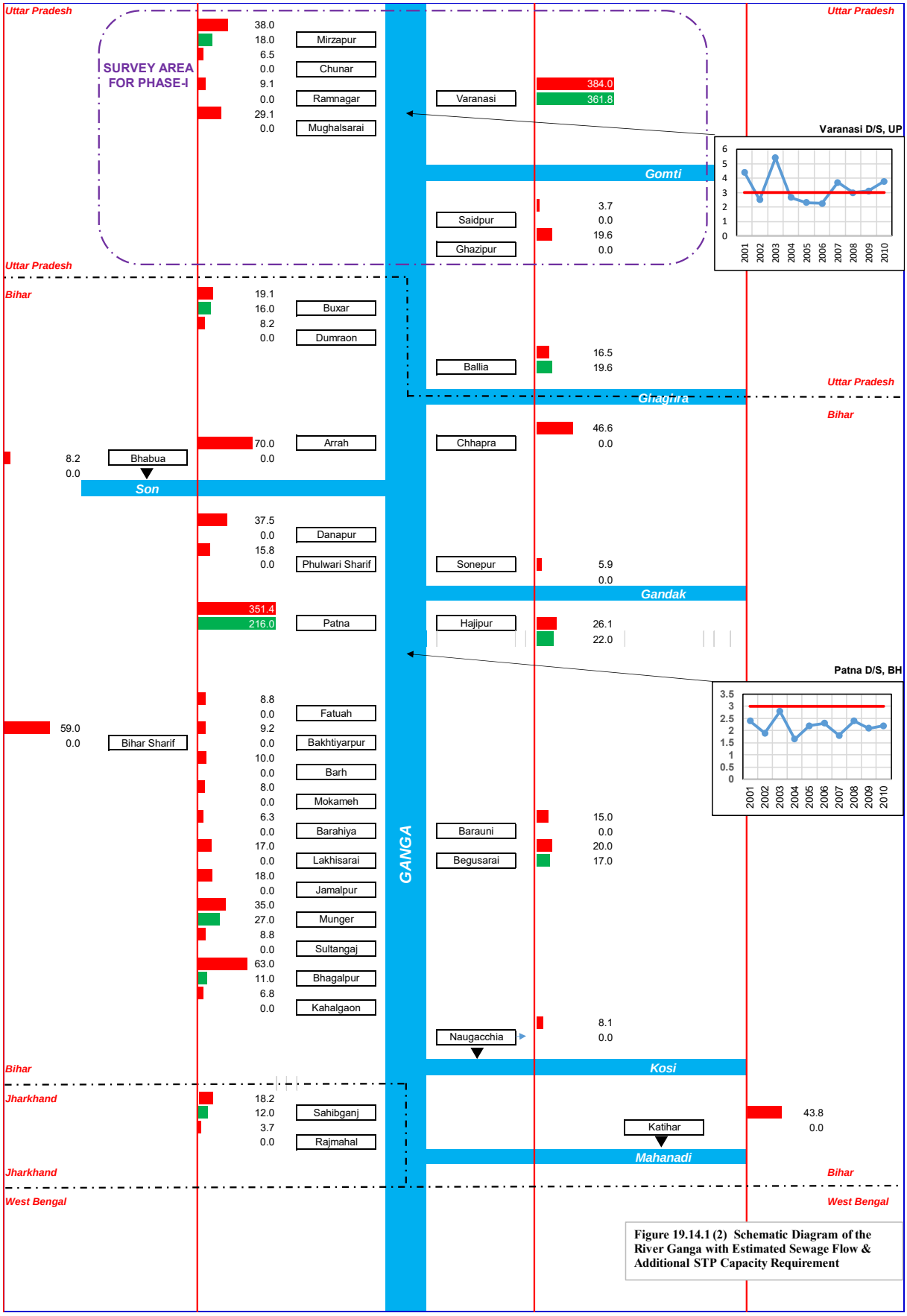
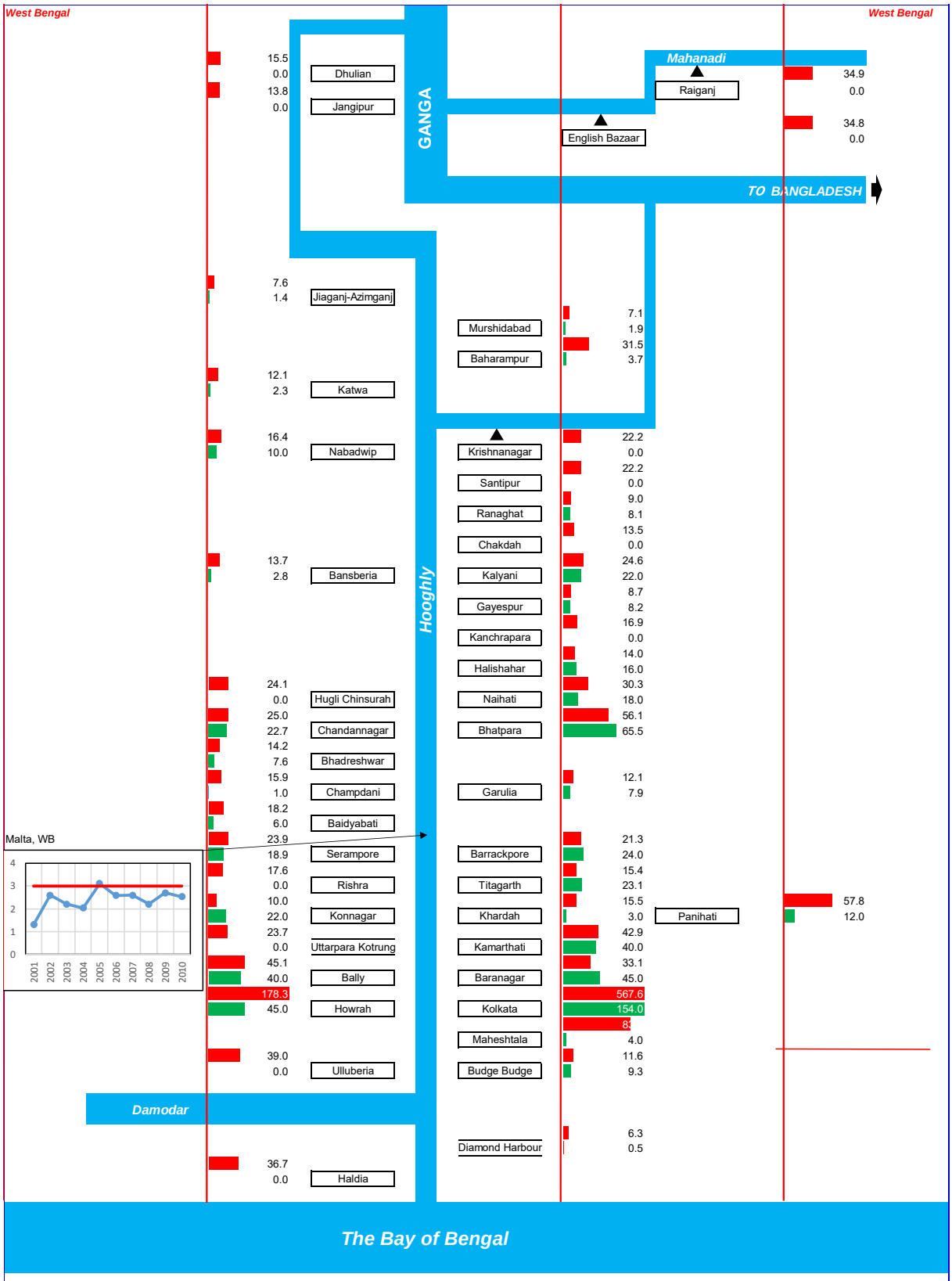


Figure 19.14.1 (2) Schematic Diagram of the River Ganga with Estimated Sewage Flow & Additional STP Capacity Requirement



Note: Since the bar char of the above is set so as to have the maximum of 100 MLD, the bar chart with a capacity of more than 100 MLD doesn't follow the scale.

Figure 19.14.1 (3) Schematic Diagram of the River Ganga with Estimated Sewage Flow & Additional STP Capacity Requirement

PART-II: SELECTION OF TARGET AREA FOR PHASE-II PROJECT

19.15 Composition of Database

19.15.1 Composition of Database

The composition of database is shown in **Table 19.15.1** with data source and availability (for more details, refer to **Appendix 19.15.1**).

Table 19.15.1 Composition of Database

Database-1

Source	NMCG	Census			MoUD: Service Level Benchmark			
Contents	118 RFTs	Census 2001	Census 2011	Census 2011 (Slum)	Water Supply	Sewerage	Solid Waste Management	Storm Water Drain
Colum Range	A~K	L~AC	AD~DS	DT~GZ	HA~HT	HU~IL	IM~JB	JC~JF
Uttarakhand	√	√	√	√	N/A	N/A	N/A	N/A
Uttar Pradesh	√	√	√	√	√	√	√	√
Bihal	√	√	√	√	√	√	√	√
Jharkhand	√	√	√	√	N/A	N/A	N/A	N/A
West Bengal	√	√	√	√	N/A	N/A	N/A	N/A

Database-2

Source	NMCG	State	DADF	Wikipedia	Census		NGRBA	
Contents	118 RFTs	Rainfall	Livestock Census 2012	Location (Coordinates)	Latrine Availability	Bathing Facility Availability	Status of DFR	
Colum Range	A~K	L~AL	AM~AW	AX~BJ	BK~CD	CE~CR	CS	
Uttarakhand	√	N/A	*1	√	√	√	√	
Uttar Pradesh	√	N/A	*1	√	√	√	√	
Bihal	√	√	√	√	√	√	√	
Jharkhand	√	N/A	√	√	√	√	√	
West Bengal	√	N/A	*1	√	√	√	√	

Database-3

Source	NMCG	Housinh Census 2011*2						
Contents	118 RFTs	Total	Within the Premises	Near the Premises	Away			
Colum Range	A~K	L~BH	BI~CV	CW~EJ	EK~FX			
Uttarakhand	√	√	√	√	√			
Uttar Pradesh	√	√	√	√	√			
Bihal	√	√	√	√	√			
Jharkhand	√	√	√	√	√			
West Bengal	√	*3	*3	*3	*3			

Collected

Website file (19th Livestock Census District Wise Report 2012 Volume III) is broken

Location, source of drinking water, electricity availability and latrine availability wise

Website file is broken

19.15.2 Limits of Database

There are some problems to prepare the database as described below, therefore it is necessary to check the data carefully one by one so as to minimize their effects.

- Even in census data, the town/village code is different between Census 2001 and Census 2011.
- One town data out of 118 towns may be sometime given dividing into a few areas in other data source.
- The extent of an urban area used in the various data sources may not be necessarily same.
- The data is arranged in accordance with the town name and the urban/rural division neglecting the separation/integration of towns, if any

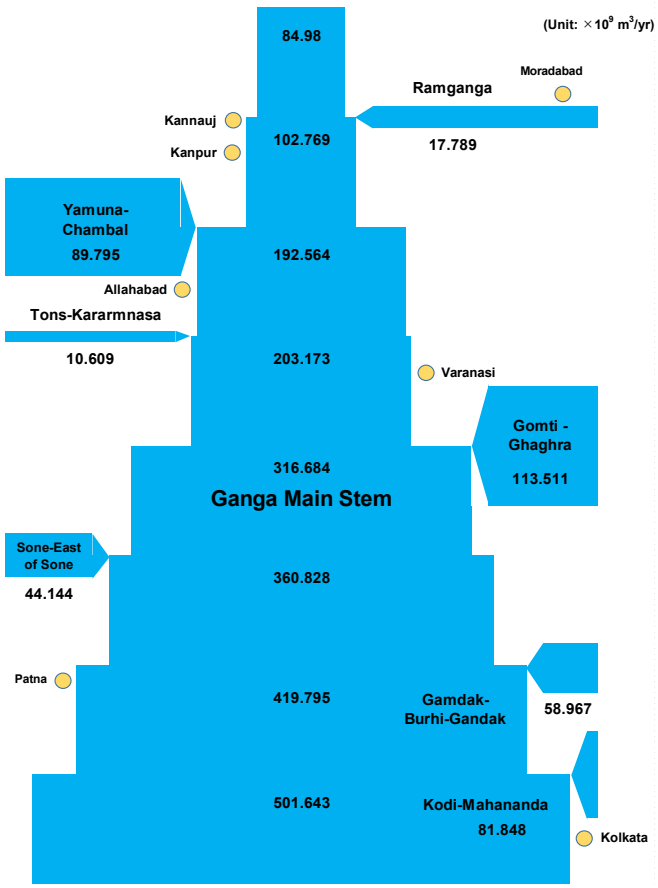
19.16 Selection of Target Area for Phase-II Project

The contents as described in **Sections 19.2** to **19.14** are summarized in **Table 19.16.1**.

Table 19.16.1 Summary of Present Situation of 118 Towns

Item	Situation
(1) Natural conditions	● The temperature is about 5°C lower in Dehradun (UK) and Ranchi (JK) among five state capitals in the River Ganga basin, but their annual fluctuation patters are almost same. ● The precipitation is biggest as 2,209 mm in Dehradun (UK) at the uppermost stream of the Ganga, but, entering into the plain, almost halves to 990 mm in Lucknow (UP), and then increase to 1,019 mm in Patna (BH), 1,398 mm in Ranchi (JK) and 1,800 mm in Kolkata (WB) westwards or toward the downstream of the Ganga. ● The River Ganga basin covers 26.2% of the country land, out of which the UP State shares 34.2% followed by BH (16.7%) and WB (8.3%). ● The States of UP, BH and WB located in the Indo-Gangetic Plain are blessed with affluent groundwater
(2) Socio-economic conditions	● The total population of five states (UK, UP, BH, JK and WB) in the Ganga Basin is 260 billion accounting for 26.3% of the total population in India ● The total population of 118 towns identified by NMCG as the river-front towns is 26.3 million, in which UP accounts for 32.3% followed by 18.8% by BH and 46.5% by WB. ● The state-wise percentages in the total Indian GDP are 8.2% in UP (2nd ranked in India), 3.3% in BH (13th) and 6.6% in WB (6th). ● The percentages holding a latrine within a premise to the total state households is 87.7% in UP and 71.6% in BH (WB: N/A).

(3) Irrigation, water Supply and water re-use	● The irrigation area in the Ganga Basin is biggest as 41.3% in UP followed by 11.7% by BH and 7.6% by WB. ● The UP State accounts for 38.0% of the total irrigation area by canals and 45.8% by groundwater ● The breakdown of water source for water supply is 53.2% in UP, 26.1% in BH and 63.2% in WB by treated tap water and 29.5% in UP, 45.3% in BH and 22.4% in WB by hand pumps (groundwater)
(4) Existing/on-going sewerage projects	● The sewerage projects have been implemented in 53 towns out of 118 towns with a total existing/sanctioned treatment capacity of 2317.4 MLD.
(5) Status of industrial wastewater	● The Grossly Polluting Industries (GPI) identified in the Ganga Basin amounts to 155 industries which is classified into ETP operating satisfactorily (95 industries), ETP not operating satisfactorily (22) and unit closed (38). ● According to CPCB, the 6,087 MLD wastewater is discharged into the Ganga with a BOD load of 999 t/day) through 138 drains, out of which 3,289 MLD (761 t/day) is derived from UP, 1,779 MLD (97 t/day) from WB and 579 MLD (99 t/day) from BH, respectively. The UP State accounts for 54.0% of wastewater and 76.2% of BOD load. ● The region-wise BOD load discharged from the drains into the Ganga is biggest as 558 t/day (or 55.9% of the total) in the Kanpur Region followed by 77 t/day (7.7%) in the Jajmau Region.. These adjoining two regions discharge almost two-third BOD load of the total into the Ganga.
(6) Status of solid waste management	● The Service Level Benchmarking (SLB) Survey for 2010-11by MoUD shows that the solid waste collection rates from individual households are 20.0% in Allahabad. 40.0% in Kanpur, 27.3% in Varanasi, and 35.4% in Moradabad in the UP State and 30.0% in Bhagalpur and 20.0% in Patna in the BH State (WB* N/A).
(7) Movement of other donors for 118 towns	● The World Bank has extensively provided the assistance to 15 towns in five states. For major cities, it concentrates the assistance to Allahabad (UP) and Patna (BH). ● ADB has provided the assistance to Kolkata (BWB) and JICA to Varanasi, while GIZ has no performance
(8) Status of DPR preparation	● *MoWRRD&GR reported the all the DPRs for 118 towns would be completed by December 2015 in "Ganga Rejuvenation Committee of Estimate (2016-17)" on 11/05/2016*

(9) River discharge and water quality	 ● The river discharge balance of the Ganga is shown in the above figure based on the annual river discharge. ● At the upstream of the confluence with the Ramganga River, or one of tributaries of the Ganga, the 80% of an annual river discharge of the Ganga is taken through tour irrigation canals. In addition, one more canal is under construction. ● According to the past water quality variation along the Ganga, Do has achieved the target quality of more than 5 mg/l at all monitoring stations except for Kanpur, while BOD has achieved the target water quality of less than 3 mg/l at all monitoring stations except for the stretch of the UP State. ● For BOD, there are obviously four pollution points, say, Kannauj, Kanpur, Allahabad and Varanas in the stretch of the UP Statei. ● The pollution at kannauj is not caused by Kannauj itself but the tributary of the Ganga, that is to say, the Ramganga River in which Moradabad is located in its upstream.
(10) Status of water quality surveillance	● The water quality in the Ganga is monitored at the network consisting of 39 stations in the Ganga main stem and 88 stations in its tributaries for 20 parameters. The results are open at the website of ENVIS Centre. ● Under the assistance of the World Bank, the formation of an automatic water

	quality monitoring system is in progress on a state-of-art, real time basis at 113 monitoring stations for 20 parameters.
(11) Organizational structures for water quality management	● CPCB (Central Pollution Control Board) is responsible for the enforcement of laws concerning the environmental protection and pollution control in collaboration with SPCB (State Pollution Control Board).
(12) Smart Ganga City	● NMCG has selected the following ten cities under the Smart Ganga Cities Programme for Phase-1 on 13 August, 2016. Haridwar, Rishkesh, Mathura-Vrindavan, Varanasi, Kanpur, Allahabad, Lucknow, Patna, Sahibganj and Barrackpore ● These sewerage projects will be implemented under the HAM-PPP Model
(13) Additional STP capacity requirement	● The additional STP capacity is biggest as 413.6 MLD in Kolkata, followed by Kanpur (203.5 MLD), Patna (135.4MLD), Howrah (133.3 MLD) and Moradabad (83.0 MLD).

Source: JICA Survey Team

The conditions of 118 Towns are as follows:

- The precipitation is biggest as 2,209 mm in Dehradun (UK) at the uppermost stream of the Ganga, almost double in the plain represented by Lucknow (UP) as 990 mm, however the river discharge of the Ganga is cut to 80% at Haridwarto use for irrigational purpose up to before the confluence with the Ramganga River.
- The state-wise percentages in the total Indian GDP is 8.2% in the UP State which is ranked at the 2nd showing the active economic activities in the area.
- The sewerage projects have been implemented in 53 towns out of 118 towns with a total existing/sanctioned treatment capacity of 2317.4 MLD.
- So far Allahabad has been mainly assisted by the World Bank, as well as Varanasi by JICA. When the currently proposed project for Varanasi will be implemented in addition to the existing/sanctioned project, the sewerage system will almost cover the service area with sewage treatment plants. The similar situation to Varanasi is expected in Allahabad, although the sewer network and sewage treatment plant plan has not yet been fixed in some service areas.
- According to CPCB, the 6,087 MLD wastewater is discharged into the Ganga with a BOD load of 999 t/day) through 138 drains. The UP State accounts for 54.0% of wastewater and 76.2% of BOD load.
- The region-wise BOD load discharged from the drains into the Ganga is biggest as 558 tonnes/day (or 55.9% of the total) in the Kanpur Region followed by 77 tonnes/day (7.7%) in the Jajmau Region.. These adjoining two regions discharge almost two-third BOD load of the total into the Ganga.

- According to the "Service Level Benchmarks (SLB) Survey for 2011-12", the collection rate of solid waste from households is still in the low level of 20 to 40% even in the major cities.
- The World Bank has extensively provided the assistance to 15 towns in five states. For major cities, it concentrates the assistance to Allahabad (UP) and Patna (BH) as well as ADB to Kolkata (BWB) and JICA to Varanasi. GIZ has no performance in the field of sewerage facility construction
- The DO variation along the Ganga main stem is shown in Table 19.14.4 as summer average (March – June) for the period of 2001-2010. The DO requirement for outdoor bathing was achieved at all monitoring stations except for Kanpur downstream (D/S) which showed a DO concentration of less than 5 mg/L in some years

Table 19.16.2 DO Variation along the Ganga Main Stem (2001-2010, Summer Average)

Monitoring Sta.	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Haridwar	8.8	7.8	9.0	8.1	8.1	8.1	8.1	7.9	7.8	7.38
Kannauj D/S	6.8	6.5	6.2	7.85	7.6	6.45	6.4	6.2	7.6	7.03
Kanpur D/S	4.8	7.2	4.4	5.28	4.7	3.9	4.6	6.0	7.5	6.18
Allahabad D/S	7.2	8.2	7.3	6.58	8.4	8.5	8.8	7.7	8.1	7.98
Varanasi D/S	7.2	7.5	8.1	5.55	8.3	8.65	8.4	7.3	7.7	7.85
Patna D/S	7.7	7.1	7.8	6.73	8.0	8.1	6.9	5.9	6.8	6.10
Palta	6.8	7.2	7.2	7.55	7.0	6.96	6.9	6.9	7.2	7.61

- For the BOD variation along the River Ganga, the requirement of less than 3 mg/l in BOD is almost achieved in the stretch of Uttarakhand, Bihar, Jhakhand and West Bengal, but not achieved in the almost stretch of Uttar Pradesh as shown in **Figure 19.16.1**.

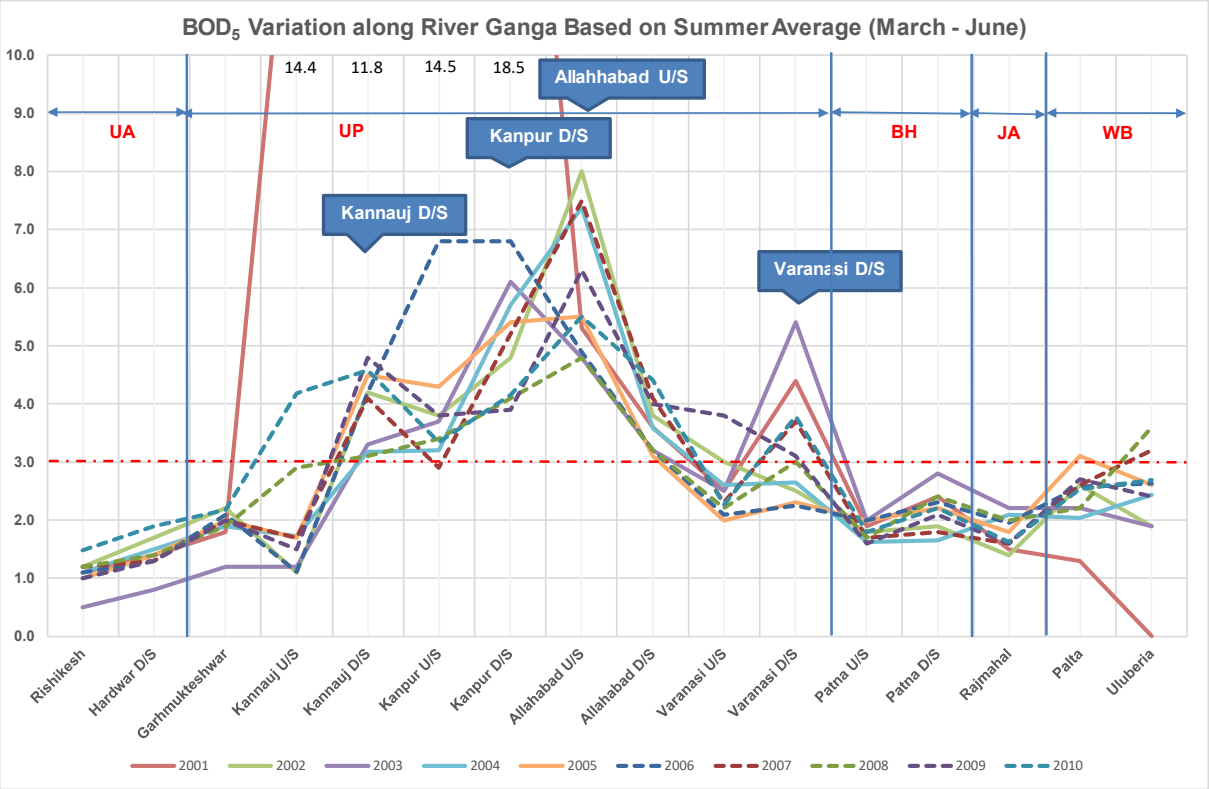


Figure19.16.1 BOD Variation along the River Ganga (Summer Average: March-June)

- In the stretch of Uttar Pradesh, there are obviously four major pollution sources, that is to say, Kannauj, Kanpur, Allahabad and Varanasi.
- Kannauj is not a so big town with an estimated population of about 139,000 persons for the year of 2030 in the Ganga basin as shown in Table 19.14.2 (S. No. 28). The pollution is caused by the Ganga tributary, or the River Ramganga. When ascending the River Ramganga, it reaches to Moradabad.
- **Figures 19.16.2** and **19.16.3** show the DO and BOD variations in the stretch of Uttar Pradesh for a period of October 2015 to July 2016, respectively. The DO concentrations are below 5 mg/l in only May and June, 2016, at Kanpur D/S, while the BOD concentrations are above 5 mg/l in almost months at almost monitoring stations. Especially in the summer season covering March to June, the BOD concentrations (dot line) is higher than those in non-summer season.

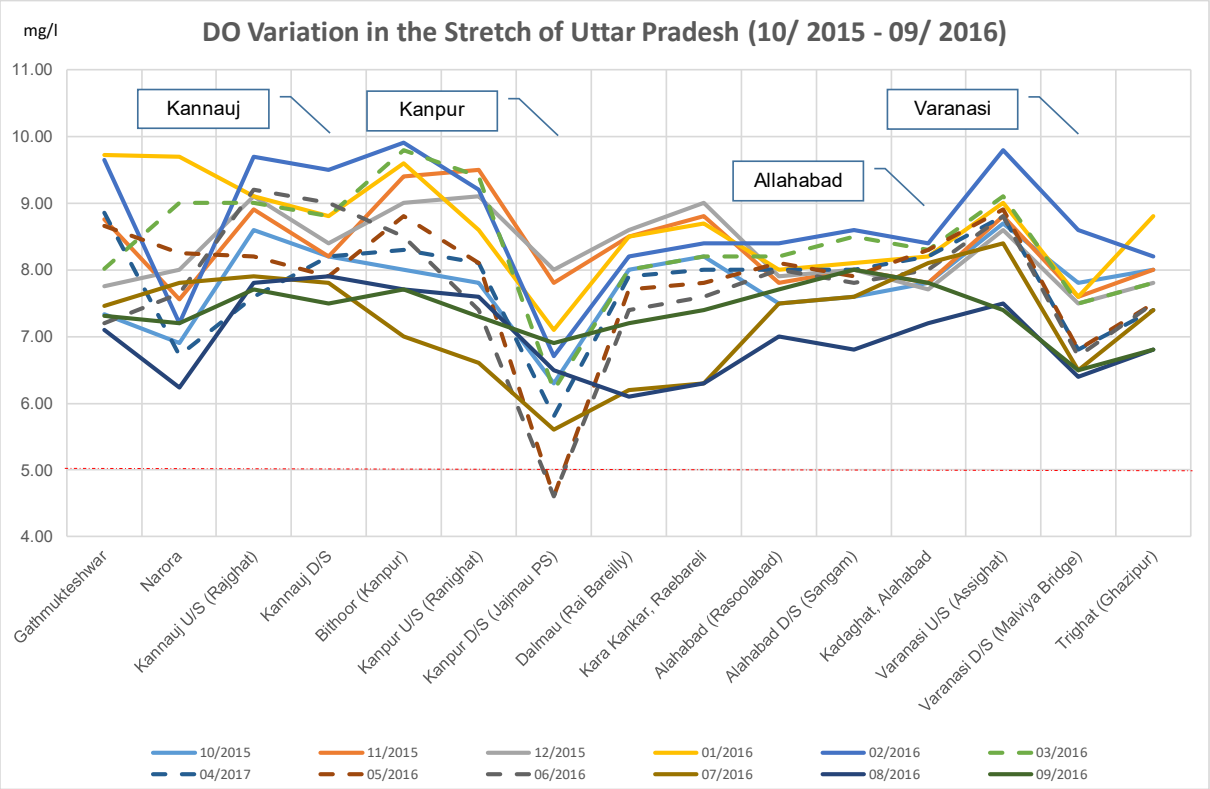


Figure 19.16.2 DO Variation along the Stretch of Uttar Pradesh (10/2015-09/2016)

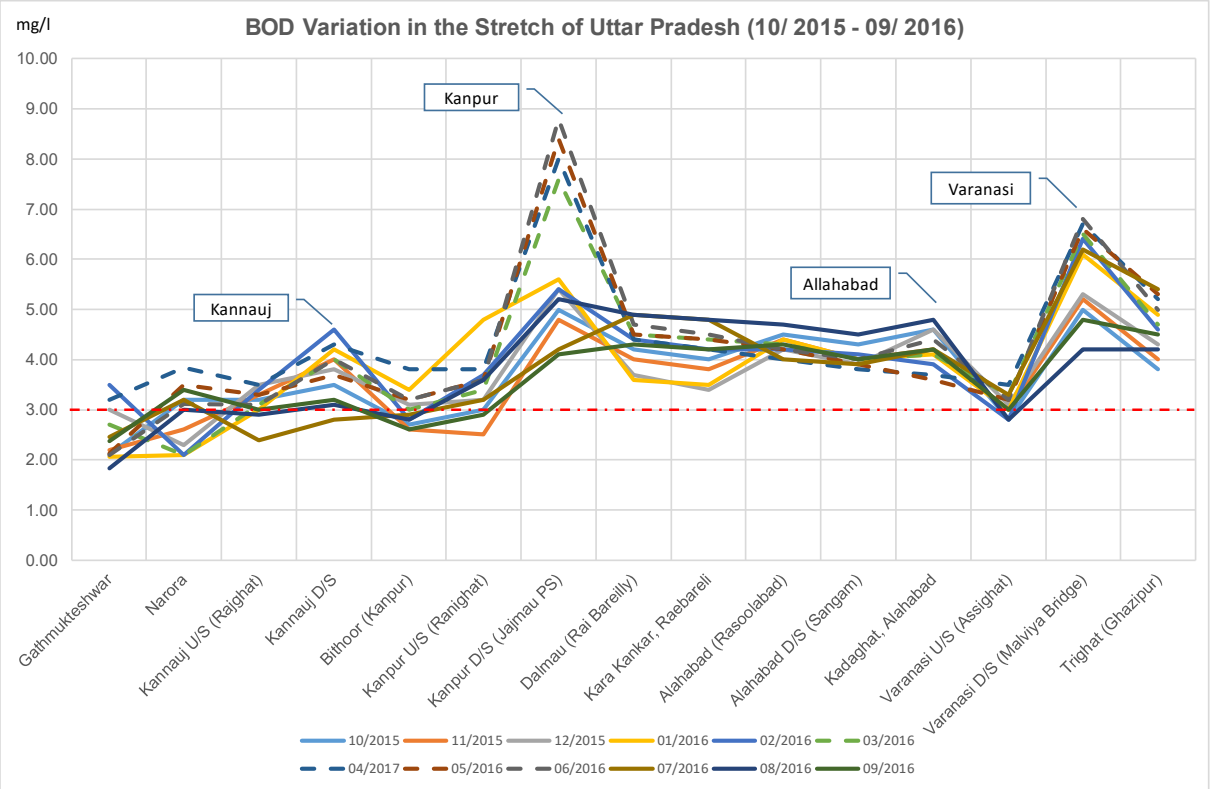


Figure 19.16.3 BOD Variation along the Stretch of Uttar Pradesh (10/2015-09/2016)

Table 19.16.2 shows the comparison of 14 towns ranked within the 14th regarding the addition STP capacity requirement and 6 towns except for Mathura-Vindavan and Lucknow in the different river basin from the Ganga and Kanpur and Patna already in cluded in the above 14 towns

From the situation mentioned below, Kanpur is recommended as the target area for the Phase-II Project together with Unnao (additional STP capacity requirement: 50.1 MLD) and Gangaghat (16.2 MLD). which are located on the opposite side of the River Ganga from Kanpur.

- The Ganga Action Plan aims to achieve a BOD concentration of less than 3 mg/l for bathing purpose in the holly Ganga in the earliest time. Therefore, the priority should be given to the compliance status of primary water quality criteria set for the Ganga in selecting the target area for the Phase-II Project.
  - ✓ Total Coliforms Organism: 500 MPN/100 ml or less
  - ✓ pH : 6.5 – 8.5
  - ✓ DO : 5 mg/l or more
  - ✓ BOD_5 at $20^{O}C$: 3 mg/l or less
- The primary water quality criteria of both DO and BOD is not achieved in Kanpur where the biggest BOD load is discharged into the Ganga through drains from the adjoining two regions, say Kanpur and Jajmau.
- The additional STP capacity requirement is in proportion to the untreated pollution load and the value dividing the additional STP capacity requirement by the annual average river discharge shows the magnitude of impact on water quality, that is to say, sewage treatment effect. The impact on water quality is biggest in Kanpur, followed by Kolkata, Moradabad, Farrukhabad and Unnao.
- Kanpur is selected as one of the Phase-I Smart Ganga Cities under the HAM-PPP Model, for infrastructure development of sewage treatment by NMCG on 13 August 2016
- There is no competition with other donor agencies/countries (The World Bank has provided the assistance to Kanpur 36 years ago in 1981.)
- Unnao is ranked as the 5th position regarding the impact on water quality as mentioned above.

Moradabad is secondly proposed as the target area for Phase-II Project. Since Modarabad is ranked at the 3rd position and the synergy effect is expected on Kannauj and Kanpur n the ganga main stem.

Table 19.16.3 Comparison of Major Towns with Big Additional STP Capacity Requirements and Smart Ganga Cities

	Item	(2)		(4)	(13)	(1), (9)		(12)	(7)	(5)
Add. STP Cap. Rank	City/Town	Census 2011 Population	2030 Estimated Sewage (MLD)	Existing /Sanctioned STP Capacity (MLD)	Additional STP Capacity Requirement (MLD)	River Discharge (10^6 m^3/yr)	Sewage Flow / River Discharge	Smart Ganga City Programme	Externally Assisted Project	BOD Load from Drains (kg/day)
1	Kolkata	4,496,694	567.60	154.00	**413.60**	501,643	**0.0301**		ADB	55,116
2	Kanpur	2,876,591	684.50	481.00	**203.50**	102,769	**0.0723**	×	World Bank*1	634,915*1
3	Patna	1,684,297	351.40	216.00	**135.40**	419,795	0.0118	×	World Bank	55,389
4	Howrah	1,077,075	178.30	45.00	**133.30**	501,643	0.0097			12,946
5	Moradabad	887,871	141.00	58.00	**83.00**	102,769	**0.0295**			
6	Maheshtala	448,317	83.30	4.00	79.30	501,643	0.0058			
7	Arrah	261,430	70.00	0.00	70.00	360,828	0.0071			
8	Bihar Sharif	297,268	59.00	0.00	59.00	419,795	0.0051			
9	Bhagalpur	252,008	63.00	11.00	52.00	419,795	0.0045			31,803
10	Chapra	202,352	46.60	0.00	46.60	360,828	0.0047			
11	Panihati	377,347	57.80	12.00	45.80	501,643	0.0033			
12	Katihar	240,838	43.80	0.00	43.80	360,828	0.0044			
13	Farrukkabad	276,581	43.20	0.00	43.20	84,980	**0.0186**			
14	Unnao	177,658	41.30	0.00	41.30	102,769	**0.0147**			12,068
	Rishkesh	73,726	11.40	9.30	2.10	84,980		×		1,266
	Haridwar	278,286	71.20	103.00	-31.80	84,980		×		4,310
	Varanasi	1,198,491	384.00	361.80	22.20	203,173		×	JICA	9,607
	Allahabad	1,195,329	276.10	288.00	-11.90	192,564		×	World Bank	35,943
	Sahibganj	88,214	18.20	12.00	6.20	419,795		×	World Bank	
	Barracjpore	152,783	21.30	24.00	-2.70	501,843		×	World Bank	4,029

*1 ADB assistance to Kanpur is 36 years ago (1981).. *2 The figure is the summation o adjoining two regions or Kanpur and Jajmau.

19.17 Situation of Sewerage Works in Kanpur and Moradabad

(1) Kanpur

Kanpur City with a population of 2,942,910 in Census 2011 is situated on the most important national highways no. 2 and 25 and state highway, and on the main Delhi-Howrah railway trunk line. It is situated on bank of holy River Ganga and is about 126 meters above the sea level.

1) Population

According to the DPR for Sewerage Works for Zone 1, district-III, Kanpur", the district-wise population is projected as shown in **Table 19.17.1**.

Table 19.17.1 District-wise Population Projection of Kanpur

	Census Population	Projected Population		
	2011	2020	2035	2050
District-I	795,444	914,761	1,272,710	1551,116
Kanpur Cantonment	108,035	113,428	122,512	130,313
Total District-I	903,479	1,028,189	1,395,222	1,681,429
District-II	1,418,727	1,773,409	2,482,772	3,546,818
District-III	424,875	573,581	849,750	1,397,839
District-IV	135,456	230,275	501,187	948,192
Total of all District	**2,882,537**	**3,605,454**	**5,228,932**	**7,574,277**
Northern Railway colony	29,708	31,203	33,645	36,109
Chakeri (Air Force)	9,868	10,164	10,628	11,206
Armapur Estate (Arms Factory Residential Area)	20,797	21,421	22,492	23,617
Total Population of Other Areas	**60,373**	**62,778**	**66,765**	**70,932**
TOTAL	**2,942,910**	**3,668,232**	**5,295,697**	**7,645,209**

2) Water Supply

Table 19.17.2 Present Status of Water Supply in Kanpur

Areas	Production Capacity	Water Supplied
WTP at Bhenajbhar	280 MLD	230 MLD
WTP at Gujaini	28.5 MLD	15 MLD
WTP at Barraj	200 MLD	35 MLD
Tube wells	169 nos. 133 MLD	133 MLD
Private wells and Hand Pumps	14342 Hps-192.75 MLD	166 MLD
Total	**834.25 MLD**	**579 MLD**

3) Sewerage

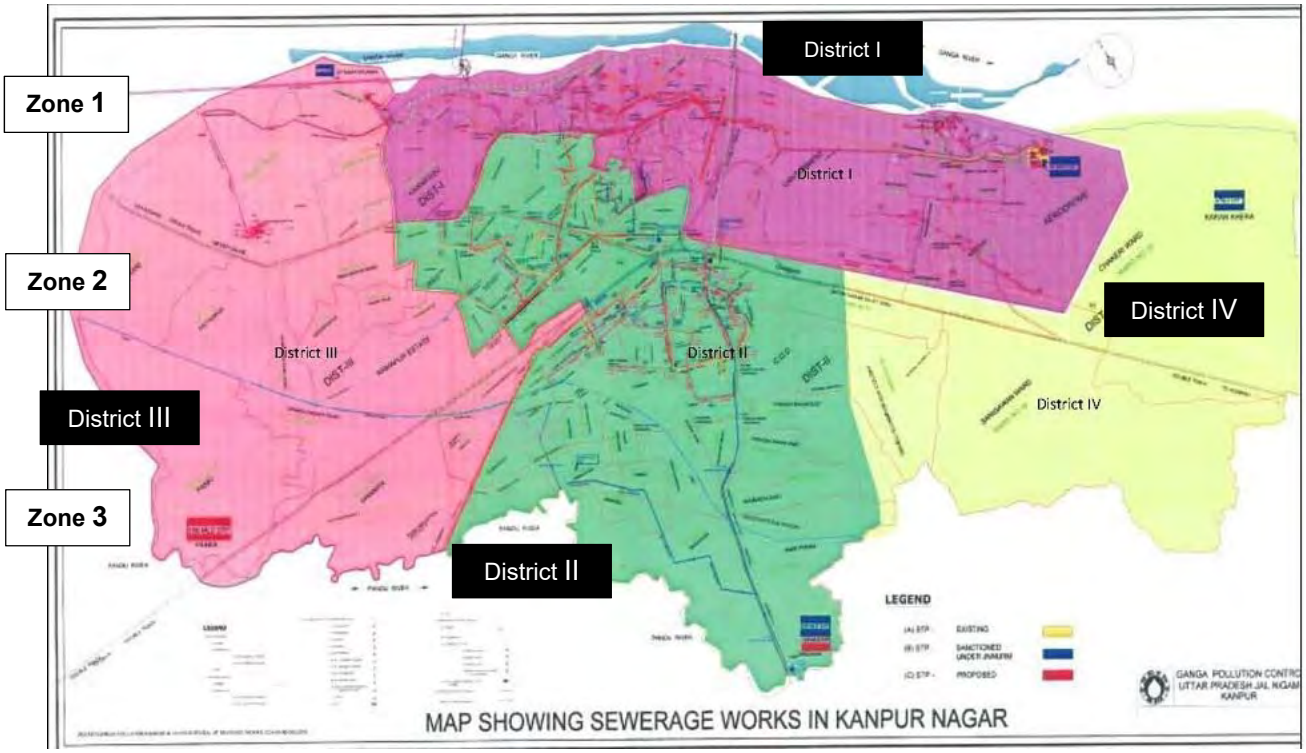


Figure 19.17.1 Sewerage Plan for Kanpur

The present status of sewerage works is summaraised as shown in **Table 19.17.3.**

Table 19.17.3 Present Status of Sewerage Works in Kanpur

Sewerage District	Sub-district	STP	Capacity (MLD)	Treatment Process	Fund	Status
District I		Jajmau	5	UASB	GAP-I	Existing (1989)
			36	CETP* UASB+ASP	GAP-1	Existing (1994)
			130	ASP	GAP-1	Existing (1999)
			43	ASP	JNNURM (P-I)	Under execution
District II		Bingawan	210	??	JNNURM (P-II)	Under execution
			105	??		Under preparation
District III	Zone-1	Baniyapura	15	??	JNNURM (P-I)	Under execution
	Zone-2		109	??		Under preparation
	Zone-3					
District-IV		Sajari	42	??	JNNURM (P-III)	Under execution

CESP: Common Effluent Treatment Plant for Industrial Wastewater

Source: Prepared by the JICA Survey Team based on the description in "Environmental and Social Assessment with Management Plan for Laying of Branch Sewers and Allied Works in Sewerage District-I of Kanpur City, Uttar Pradesh", 2014, et al.

"The Detailed Design Report for Sewerage Works Zone I, District-III, Kanpur" was prepared with an estimated cost of Rs.147.00 Crores in July 2016.

(2) Modarabad

Moradabad with a population of 894,337 in Census 2011 is situated 167 km from Delhi, connected to it by the National Highway 24. And on the main railway line between Howrah and Amritsar. Ramganga river flows in the north east and Gagan river in south west of the city.

1) Population

City Area: 85 km^2
DPR Area: 50 m^2

Table 19.17.4 Year-wise Population Projection of Moradabad

Sl. No.	Zone	2011	2020	2030	2035	2050
1	Zone-I	506,184	519,168	555,613	577,935	660,321
2	Zone-II	107,044	126,436	189,450	227,354	370,486
3	Zone-III	119,302	158,170	292,668	373,749	680,299
4	Zone-IV	161,807	185,616	268,161	317,500	505,294
Total		894,337	989,390	1,305,892	1,496,538	2,216,400

2) Water Supply

Rate of water Supply: 135 lpcd

Table 19.17.5 Present Water Supply of Moradabad

Sr. No.	Description	Water Production, MLD
1	Surface Water	0
2	Ground Water (92 Tube wells & hand pumps)	166
Total, mld		166

3) Sewerage

Interception Factor: 0.8 as per "Manual of Sewerage & Sewage Treatment (Dec. 1993)"

Table 19.17.6 Year-wise Sewage Generation of Moradabad

Sl. No.	Zone	Year-wise Sewage Generation (MLD)				
		2011	2020	2030	2035	2050
1	Zone-I	54.67	56.07	60.01	62.42	71.32
2	Zone-II	11.56	13.66	20.46	24.55	40.01
3	Zone-III	12.88	17.08	31.61	40.36	73.47
4	Zone-IV	17.48	20.05	28.96	34.29	54.57
Total		96.59	106.85	141.04	161.63	239.37

Zone-1 comprises of the old city area from Katghar to PAC Tiraha. Sewerage and sewage treatment work, entitled "Prevention of Pollution of River Ram Ganga at Moradabad (Phase-I)" for Zone-1 of Moradabad have been sanctioned from NGRBA, on 24/02/2011, under Non-EAP Project for Rs. 279.91 Crores. Works proposed under this estimate are under implementation, these works are tentatively scheduled for completion by the year 2015-16. In this project sewer network of length 264 Km, 11 numbers of sewage pumping stations and one sewage treatment plant of capacity 58 MLD based on SBR technology have been proposed.

The Detailed Design Report of Sewerage Works in Moderabad City for Abatement of Pollution of River Ramganga, Phase-II (Zone-II – Sewerage Network) has been recently prepared with an estimated cost of Rs.232.34 Crores for the developed area of Zone-II, leaving undeveloped area between Moradabad-Bijnaur and Moradabad-Delhi railway line for which a separate project will be framed after development of this area. Total length of proposed sewer in Zone-II of Moradabad town is 140 km. The diameter of proposed sewer varies between 200 mm and 600mm.

For Zone-III and Zone-IV, the DPR has not yet been prepared

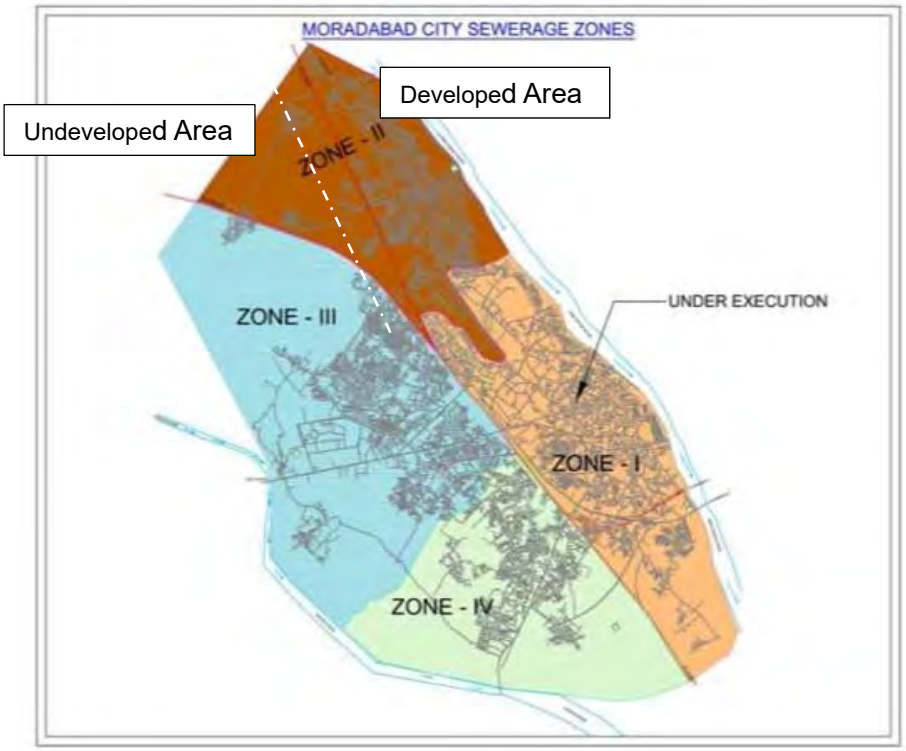


Figure 19.17.2 Moradabad City Sewerage Zones

Source: "Detailed Project Report for Sewerage Works in Moradabad for Abatement of Pollution on River Ramganga Phase-II (Zone-II - Sewerage Network)", UP Jal Nigam

Sewage Treatment for the developed area of Zone-II is not included in the proposed project. However, the treated sewage is set as shown in **Table 19.17.7** according to the General Standards for Discharge of Environment Pollutants notified by Ministry of Environment & Forest (MoEF), GoI in April 2015.

Table 19.17.7 General Standards for Discharge from Sewage Treatment Plant

S. No.	Parameters	Raw Sewage	Treated Sewage	
			For discharge on land	For discharge into water
1	Total BOD_5 at 20oC	250 mg/l	<10 mg/l	<10 mf/l
2	COD	600 mg/l		
3	Total Suspended Solids	450 mg/l	<20 mg/l	<10 mg/l
4	pH	7.2-8.5		
5	Fecal Coliform	10^6 MPN/100 ml	<100 MPN/100 ml	<100 MPN/100 ml

4) Storm Water Drainage

Present Situation: Moradabad city has very limited and inefficient Drainage system, due to which, open drains also carry the sewage which ultimately discharge into the river Ram Ganga and Ganga.

Chapter 20 Risk Control

<Objective of the Study>

Following five project risks were evaluated for project implementation:

1) Increase of STP effluent discharge not conforming to the new effluent standard, 2) Timing gap of construction completion under the different project implementation structure for sewer network and SPS/STP, 3) Ramana STP contract negotiation may affect on subsequent HAM-PPP projects, 4) Land acquisition for the Ramnagar STP and 5) Sewerage development by the comprehensive or ID&T system

<Result of Study>

Probability, Impact, Mitigation Measure, Action and Contingency plan was studied. Land acquisition was raised to have large impact on the project risk. The role of UPJN who will be involved in both EPC and HAM-PPP projects is very important to adjust two project implementation schedule for sewer networks and STP/SPS. UPJN is also concerned with land acquisition and the decision on sewerage development method for the comprehensive or ID&T system.

The following five project risks is supposed to be involved during the project implementation

1) Increase of STP effluent discharge not conforming to the new effluent standard
2) Timing gap of construction completion under the different project implementation structure for sewer network and SPS/STP
3) Whether tendering for Ramana STP is completed successfully or not may affect on subsequent HAM-PPP projects
4) Land acquisition for the Ramnagar STP
5) Sewerage development by the comprehensive or ID&T system

These risks are evaluated from the viewpoint of probability, impact, analysis of probability and impact, mitigation measures, action during the implementation and contingency plan, if applicable,

Table 20.1 Possible Risks Involved in the Project Implementation.

Potential Project Risks	Assessment
Project Risk	
Increase of STP effluent discharge not conforming to the new effluent standards The wastewater generated in District-I and District-II of Varanasi will flow into the existing 80 MLD Dinapur STP and the 140 MLD Dinapur STP under construction, respectively. A part of wastewater generated in District-I is diverted to District-II. The DPR for upgrading and rehabilitation of the Dinapur and Bhagwanpur STPs was once revised so as to meet the new	**Probability: High** **Impact: Small** **Analysis of Probability and Impact:** Since the continuation of present operation at Dinapur and Bhagwpur STPs is the matter decided by NMCG/UPJN who is the implementation/execution agency, it is unavoidable to discharge the treated sewage not conforming to the new effluent standards. The continuation period is unknown at this moment

effluent standards in accordance with the instruction of NMCG, but NMCG/UPJN has decided to maintain the operation of the 80 MLD Dinapur STP as it is with no modification. Therefore, the development of District-I sewer network will increase the discharge of STP effluent in no conformity with the new effluent standards. When the existing 80 MLD Dinapur STP will be reconstructed to meet the new effluent standards is unknown at this moment. While the 140 MLD Dinapur STP is under construction as JICA-assisted GAP-II Project, which adopts the activated sludge process as the treatment process in conformity with the old effluent standards, or BOD/TSS: 20/30. Accordingly likewise District-1, the development of District-II sewer network will increase the discharge of STP effluent in no conformity with the new effluent standards.	**Mitigation Measures:** Adoption of treatment process proposed by the JICA survey team, if the reason for the continuation of present operation at Dinapur STP is attributed to its high construction cost proposed by UPJN. The continuation of present operation with no modification at Dinapur STP is decided by NMCG/UPJN but its reason is unknown. The revised DPR by UPJN to meet the new effluent standards is based on the idea to demolish the existing STPs fully and re-construct them in the present premises due to the constraint of land availability. If the decision is based on the such construction cost, the proposal of the JICA survey team will be worthy to be considered, Its proposal is based on the idea to make use of existing treatment facilities as long as possible, since they were constructed 23 years ago in 1994 and has not yet reached to their service life and are still usable.
	Action during the Implementation: None
	Contingency Plan (If Applicable): None
Executing Agency Risk	
Timing gap of construction completion under the different project implementation structure for sewer network and SPS/STP The wastewater of District-III will flow into the 50 MLD Ramna STP to be implemented under the HAM-PPP Model but the District-III sewer network development will be done under the conventional EPC model. The construction schedule for the Ramna STP is already open in its bidding documents and, if the schedule will be in progress as expected, the Ramna STP will be completed by June 30, 2019 including 63 days for contractual processing and two-year construction period starting from the bid opening on April 29, 2017. On the other hand, since the schedule of the loan agreement for District-III has been not yet fixed, the Ramna STP will be completed preceding the commissioning of the District-III sewer network, which will lead to the idle time of the Ramna STP.	**Probability: High**
	Impact: Small
	Analysis of Probability and impact
	Mitigation Measures: According to the JICA-assisted Master Plan, when the Ramna STP will be completed, the existing Bhagwanpur STP will be de-commissioned and the wastewater that flows into the Bhagwanpur STP will be led to the Ramna STP. Therefore, if the trunk sewer to convey the wastewater from the Bhagwanpur STP to the Ramna STP will be installed in the early time during the District-III sewer network development work, the idle time of the Ramna STP will be avoided and the period that the Bhagwanpur STP discharge the effluent not conforming to the new effluent standards will be shortened.
	Action during the Implementation: Keep close communication between both EPC and HAM-PPP projects so as to adjust the construction schedules
	Contingency Plan (If Applicable): None
Executing Agency Risk	
Whether tendering for Ramana STP is completed successfully or not may affect on subsequent HAM-PPP	**Probability: Middle**
	Impact: Small

projects The Ramana STP is the first project that the HAM-PPP Model is applied to the Ganga Projects. Whether the procedure up to the contract signing will be in progress as scheduled in the bid documents is unknown and there is even the risk of delay. When the bidder will attend the contract negotiation with any alternatives or requests on the application conditions of the HAM-PPP model shown in the bid documents, since such results will become the previous instance for other projects, NMCG/UPJN will carefully correspond to thrush out the conditions that the concessionaire will be acceptable which will result in taking a time. The sewerage projects in Mirzapur, Chunar and Ghazipur that the HAM-PPP Model will be expectedly applied to will be affected by the movement of contract negotiation on the Ramana STP project.	**Analysis of Probability and impact:** If the Ramana STP project under HAM-PPP will not be successfully negotiated, other projects that HAM-PPP will be applied to subsequently will be affected **Mitigation measures: None** **Action during the Implementation:** Watch the bid for the Ramna STP under the HAM-PPP Model closed on April 29, 2017 and the subsequent contract negotiation **Contingency Plan (If Applicable):** Dialogue to develop the model at policy level.
Executing Agency Risk	
Land acquisition for the Ramnagar STP According to the letter (draft) from Executive Office, Municipal Council Office, Ramnagar addressed to General Manager, Ganga Pollution Prevention Unit, UPJN, the landowner for the Ramnagar STP site mentioned The JICA survey team also submitted the letter to the State Government of Uttar Pradesh to get the budgetary allocation and proceed the land acquisition of the particular site as early as possible but could not get the information that the land acquisition had been completed during the field survey in Varanasi. Therefore, it is necessary to confirm the situation of STP site land acquisition in the course of project formation。	**Probability: Low** **Impact: Big** **Analysis of Probability and impact:** On the delay in land acquisition, "Ganga Rejuvenation Committee of Estimate (2016-17)" on May 11, 2016" under MoWRRD&GR describes below. "In written reply to a query as to why only 25 out of 80 projects and 600 kms out of 3315 Kms network of sewer lines were built, the M/oWR,RD&GR stated that "The delay in the construction of STPs is mainly due to delay in land Acquisition and dispute over land. Laying of sewer network in densely populated towns is delayed, mainly due to narrow streets and issues in road cutting. Despite such constraints, 25 out of 80 projects and 600 kms out of 3315 Kms network of sewer lines were built". Therefore, the land acquisition issue is common in India. If the land acquisition for the STP site will not be completed by the conclusion of L/A, the impact will be big. **Mitigation measures: None** **Action during the Implementation:** Monitor the status of land acquisition for the Ramnagar STP site **Contingency Plan (If Applicable): None**

	Confirm the completion of land acquisition for the Ramnagar STP site before the agreement on the scope (design site) for the project. .
Stakeholder Risk	
Sewerage development by the comprehensive or ID&T system MoUD promotes the comprehensive (or comprehensive) sewerage system for the cities with a population of more than 100,000 (1 lark), while NMCG adopts the Interception, Diversion and Treatment sewerage system (ID&T system) with the priority to solve the water pollution issues. Mirzapur has submitted both DPRs for the comprehensive and ID&T systems, but Ghazipur has submitted only the DPR for the comprehensive system and not submitted the DPR for the ID&T system in spite of the request of the JICA survey team during the field survey. Both cities have once shown the movement to submit the application to AMRUT which provides the fund for the development of a comprehensive system. This issue will smolder in the future and may cause the delay of project implementation. In case that the project will be implemented under the HAM-PPP model, since the sewer cost is very small in the ID&T system, it will be included in the HAM-PPP cost, but it will be too big in the comprehensive system resulting in an increase of the concessionaire's burden. For example, in Mirzapur, the net construction cost is sewer : SPS/STP=21,455:5,762 (unit: Rs. Lacs) for the comprehensive system and 1,478:5,651 for the ID&T system. The total cost of the comprehensive system is 3.8 folds of that of the ID/T system. There is a big gap in the rate of the sewer cost to the STP cost, or 372% for the comprehensive system and 26% in the ID/T system.	**Probability: Middle** **Impact: Small** **Analysis of Probability and impact:** Since Ghazipur could not submit the ID&T DPR to the JICA survey team, it has somewhat high possibility that the comprehensive plan sewerage system will be adopted. The project cost of a sewer network for Ghazipur is not so big. **Mitigation measures:** **Action during the Implementation:** Watch the scope of work for Mirzapur and Ghazipur HAM-PPP projects. **Contingency Plan (If Applicable): None**
Overall Risk Rating	**Probability: Middle** **Impact: Low**
The role of UPJN who will be involved in both EPC and HAM-PPP projects is very important to adjust two project implementation schedule for sewer networks and STP/SPS. UPJN is also concerned with land acquisition and the decision on sewerage development method for the comprehensive or ID&T system.	

Chapter 21 Operation and Effect Indicators

<Objective of the Study>
Herein, the served population by sewage treatment, amount of sewage treatment are proposed for operation indicators and the coverage ratio by sewerage for an effect indictor, respectively.
<Result of the study>
Even though the BOD concentration of sewage will be improved from 20 mg/l to 10 mg/L by sewage treatment, the effect on the BOD concentration in the River Ganga will be only less than 0.1 mg/L so that it may be difficult to identify the water quality improvement effect in the Ganga, that is to say, the discharge of the River Ganga is too big in Varanasi in comparison to the sewage flow Due to the reason, Effect of the sewage treatment will be measured by BOD removal rate in STPs

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The construction period for sewer network development in District-I, District-II and District-III in Varanasi is estimated three years, respectively. According, it will be completed in 2020 including one-year preparatory period in 2017. The operation and effect indicators are set for the year of 2022 two years later after its completion.

It is assumed that the Yen Loan will be applied to the sewer network development of District-I, District-II and District-III in Varanasi and the construction of Ramnagar ID/T system under the EPC model. The sewerage project in other cities like Mirzapur, Ghazipur, Chunar and the Ramna STP project in Varanasi will be implemented under the HAM-PPP model.

For Varanasi, the wastewater generated in District-I, District-II and District-III will flow into the 80 MLD Dinapur STP (existing), 140 MLD Dinapur STP (new) and 50 MLD Ramna STP (new), respectively. The existing 80 MLD Dinapur STP and new 140 MLD Dinapur STP under the GAP-II Project have responded to the old effluent standards (say BOD/TSS=20/30), while the new 50 MLD Ramna STP will respond to the new effluent standards (BOD/TSS/T-N=10/10/10)

21.1 Operation Indicators

The operation indicators show to what extent the facilities have been operated efficiently to achieve the target.

(1) Served population by Sewage Treatment

As of November 2015, the number of connections for water supply and sewerage in Varanasi is reported as 99,876 units (**Table 12.1.2**) and 109,392 units (**Table 12.1.3**), respectively against the total

number of 150,236 connections. While in the Census 2011, the number of connections for sewerage counts 141,184 units for the total number of 180,865 connections. Since the per household population is 6.2 persons in the Census 2011, then the served population by sewerage is calculated as 889,000 persons. Although there is no actual data on the increase rate of a number of connections, referring to the actual data in Kyoto, Japan of which the population size is almost same, the increase rate is set at 4.0% per annum, the served population is estimated as 962,000 persons in the year of 2022.

(2) Amount of Sewage Treatment

Assuming the per capita water supply at 150 lpcd, the conversion factor to sewage at 0.80 and the groundwater infiltration rate as 25% for a mega city like Varanasi, the amount of sewage treatment in 2022 is calculated as 144.3 MLD as shown below.

2020 889,000 x (150 lpcd / 1,000) x 0.8 x (1 + 0.25) = 133.5 MLD
2022 962,000 x (150 lpcd / 1,000) x 0.8 x (1 + 0.25) = 144.3 MLD

21.2 Effect Indicators

The effect indicators show the extent of amenities in the people's life and the conservation of water environment

(1) Coverage Ratio by Sewerage

According to the results of the Census 2011, the number of connection was 141,184 units for the total households of 180,805 units, the coverage ratio by sewerage is then calculated as 78.1%. While "City Development Plan for Varanasi, 2041" prepared in March 2015 says that the coverage of sewerage service network is 78%. The people are seeing the progress of pipe-laying works with their own eyes extended throughout the city with much expectation for comfortable life in addition to the awareness campaign to promote the household connection to a sewerage system. It is the usual pattern that the growth rate of household connections to a sewerage system is high for some years after the project completion and then gradually declining to less than one percent. Similarly to the served population by sewage treatment, the growth rate of household connections is assumed at 4% per annum for the first two years and the coverage ratio by sewerage is calculated at 84.5% In the year of 2022.

(2) Water Quality Improvement Effect in the Receiving Water Bodies

The river discharge of the Ganga fluctuates drastically by season or the monsoon (Jun.-Sep.), post-monsoon (Oct.-Nov.), winter (Dec.–Feb.) and summer (Mar. – May) as shown in **Figure 19.2.6** and even in the winter or the dry season, the river discharge (30,358.7 MLD, see below) is too big in comparison with the sewage flow (144,3 MLD). The sewage flow is only 0.5% of the river discharge,

therefore it is difficult to show the improvement effect in terms of river water quality numerically.

Therefore, effect of improvement for the receiving water body shall be measured by effluent BOD level and sewage treatment efficiency.

Since the BOD of raw sewage is 250mg/l and that of effluent is expected to be 10 mg/l after the completion of the construction, BOD removal rate will be 96 %.

Table 21.1 Operation Indicators and Effect Indicators

Indicators	Present	Target Year	Remarks
Served population by Sewage Treatment	889,000	962,000	Population
Amount of Sewage Treatment	133.5MLD	144.3MLD	
Coverage ratio by Sewerage	78.1%	84.5%	
Sewage Water Quality Improvement Effect	Inflow BOD:250mg/l	Effluent BOD:10mg/l	Removal rate 96%

Source: JICA Survey Team

Note:
The river discharge is 2,793 million m^3 as the total amount during the summer from March to May or 92 days as shown in **Table 19.10.1**, which is converted to 30.358.7 MLD.

Chapter 22 SAFETY MEASURES

<Objective of the Study>

This chapter introduces the most important two acts regarding the safety control in the construction works in India, especially focusing on submission of documents concerning safety and health to the administrative office, obligation compensation, safety control structure for offices/ establishment and administrative measures, social sanctions, etc., when worker's accidents occurs using the latest data.

<Result of the Study>

Based on the JICA's safety management policy, Safety measure of construction work in India such as, Laws and Regulations concerning Safety and Health,Worker's accidents, Compensation and Safety Control , Expenses, Administrative measures and Factories Act were studied and summarized.

22.1 Basic Policies for Safety Management in Japan's Official Development Assistance

Japan's Official Development Assistance Charter was formulated to assure fairness by giving consideration to the condition of the socially vulnerable, and the gap between the rich and the poor as well as the gap among various regions in developing countries whilst paying great attention with respect to factors such as the environmental and social impact on developing countries arising from the implementation of ODA. In particular, emphasis is put on "ensuring human safety" by focusing on individuals when implementing safety management on ODA construction works.

"Ensuring human safety" and "respect for basic human rights" have the top priority in ODA construction works. The stakeholders are therefore obliged to comply with the relevant laws and regulations of the recipient country in order to establish a safe and health-conscious working environment. They also need to establish a "culture of safety", whereby all organizations and individuals involved in the works prioritize safety, is clearly understood, establish a mechanism that automatically promotes active implementation of occupational safety measures in the relevant organizations, and enhances people's awareness of safety.

JICA provides the following eight basic principles for safety management.

(1) Safety is a top priority
All Project Stakeholders shall put top priority on safety and use their best endeavours to eliminate the occurrence of accidents.

(2) Elimination of causes
The Contractor shall identify every possible danger in each process of construction work, and examine, analyze and eliminate the causes of such danger and take appropriate action to ensure the safe execution of the work.

(3) Thorough precautions
The Contractor shall give consideration to in advance the inherent risk of accidents at each stage of construction work, review appropriate measures to cope with such risks, and commence work once these preventive measures have been implemented

(4) Thorough compliance with relevant laws and regulations.
Compliance with Relevant Laws and Regulations shall be complied with.

(5) Thorough prevention of public accidents
All Project Stakeholders shall implement safety management measures taking the interests of third parties duly into consideration in order to prevent public accidents

(6) Thorough implementation of PDCA cycle for safety management
PDCA for Safety Management shall be complied with.

(7) Thorough sharing of information
All Project Stakeholders shall share all safety-related information they possess in a manner and at times as appropriate in the circumstances.

(8) Thorough participation of all Project Stakeholders
All Project Stakeholders shall actively participate in activities related to safety management at construction sites.

Source: JICA, "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects", September 2014

22.2 Safety Measures in India

The safety control in the construction works is mainly regulated by the following two acts:

- The Factories Act, 1948
- The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996

(1) Laws, Regulations, etc. Concerning Safety and Health

In India, both the central and state governments can enact the Labour-related legislations

- "The Factories Act, 1948" provides conditions of service for workers in the manufacturing factories and basic requirements for safety, health and welfare.
- "The Building and Other Construction Workers Act 1996" is the comprehensive Central Legislation for regulating their safety, health, welfare and other conditions of service which is applied to the establishments for construction works with more than fifty workers. The regulations enacted by the state government is applied to other establishments that the Central legislation is not applied.

(2) Submission of Documents Concerning Safety and Health to the Administrative Office

- "The Building and Other Construction Workers Act 1996" regulates the scaffolds, plan on dangerous process, etc. but their notification is not the contractor's obligation.
- In India, it is usual that the sub-contractor's agreement covers the temporary works in addition to the body works and the clients may require the submission of temporary plans and construction statements of steel frameworks.
- In case of road occupation and detour, the submission of documents is required to get an approval from the police station.

(3) Obligation When Worker's Accidents or Accidents Occurs

1) Obligation of Notice on the occurrence of worker's accidents or accidents to the administrative office

- "The Building and Other Construction Workers Act 1996" defines the obligation of "Notification of Accidents and Dangerous Occurrences" as Form-24
- "The Factories Act, 1948" also defines "Notice of Certain Accident (Section 88), "Notice of Certain Dangerous Occurrences (Section 88A)" and "Notice of Certain Diseases (Section 89)".

  "Notice of Certain Accident (Section 88)"

  "(1) Where in any factory an accident occurs which causes death, or which causes any bodily injury by reason of which the person injured is prevented from working for a period of forty-eight hours or more immediately following the accident, or which is of such nature as may be prescribed in this behalf, the manager of the factory shall send notice thereof to such authorities, in such form and within such time, as may be prescribed."

  (2) Where a notice given under sub-section (1) relates to an accident causing death, the authority to whom the notice is sent shall make an inquiry into the occurrence within one month of the receipt of the notice or if there is no such authority, the Chief Inspector cause the Inspector to make an inquiry within the said period.

  (3) The State Government may make rules for regulating the procedure inquires under this section.

2) Survey by the Authority when worker's accidents or accidents occurs

a) Target of survey

- "The Building and Other Construction Workers Act 1996" defines "Procedure for enquiry into causes of accident or dangerous occurrence (Clause 211)".
- "The Factories Act, 1948" also defines "Safety and Occupational Health Surveys (Section

91A), "Notice of Certain Dangerous Occurrences (Section 88A)" and "Notice of Certain Diseases (Section 89)". The authority to whom the notice is sent shall make an inquiry into the occurrence within one month of the receipt of the notice

b) Enquiry Officer, etc.

- "The Building and Other Construction Workers Act 1996" defines "Notification of Accidents and Dangerous Occurrences" in Form-24. The enquiry is commenced by the the authority or enquiry officer as early as it may be, and in any case, within fifteen days of the receipt of notice of accident or dangerous occurrence under rule 210.

(4) Compensation, etc. to Sufferers when Worker's Accident or Accident Occurs

Employees' State Insurance (ESI) is a self-financing social security and health insurance scheme for Indian workers. This fund is managed by the Employees' State Insurance Corporation (ESIC) according to rules and regulations stipulated there in the ESI Act 1948. ESIC is an autonomous corporation by a statutory creation under the Ministry of Labour and Employment, the Government of India. The ESI Act applies to any premises/precincts, where 10 or more persons are employed.

1) Outline of the Insurance

Employees covered under the scheme are entitled to medical facilities for self and dependants. They are also entitled to cash benefits in the event of specified contingencies resulting in loss of wages or earning capacity. The injured women are entitled to maternity benefit for confinement. Where death of injured employee occurs due to employment injury or occupational disease, the dependants are entitled to family pension payment as the dependants benefit. Various benefits that the insured employees and their dependants are entitled to, the duration of such benefits and contributory conditions thereof

2) Contribution

For all employees earning Rs. 21,000/- (US$330/-) or less per month as wages, the employer contributes 4.75 percent and employee contributes 1.75 percent, total share 6.5% percent. State government's share is 1/8th and that by central government is 7/8th. which oversees the provision of medical and cash benefits to the employees and their family. ESI scheme is a type of social security scheme for employees in the organized sector.

3) Compensation for permanent total disablement and for the death

- In case of permanent total disablement from the injury, the amount of compensation shall be 60% of the monthly wages of the injured workman multiplied by the relevant factor or an amount Rs. 140,000//- whichever is more.
- In case of death resulting from the injury, the amount of compensation shall be equal 50% of the monthly wages of the decreased workman multiplied by the relevant factor, or an amount

of Rs. 120,000//- thousand whichever is more.

(5) Safety Control Structure for Offices/Establishments

1) Safety and Health Control Structure for Establishments

- "The Building and Other Construction Workers Act 1996" defines "208. Safety Committees" and "209. Safety Officer" as follows:

208 Safety Committees

(1) Every establishment wherein five hundred or more building workers are ordinarily employed, there shall be a Safety Committee constituted by the employer which shall be represented by equal number of representatives of employer and building workers employed in such establishment. In no case the number of representatives of the employer shall exceed the representatives of building workers. The Committee shall be represented by representatives of the recognised unions wherever such unions exist.

(2) The main functions of the Safety Committee shall be—

(a) to identify probable causes of accident and unsafe practices in building or other construction work and to suggest remedial measures;

(b) to stimulate interest of employer and building workers in safety by organising safety weeks, safety competition, talks and film shows on safety, preparing posters or taking similar other measures as and when required or as necessary;

(c) to go round the construction site with a view to check unsafe practices and detect unsafe conditions and to recommend remedial measures for their rectification including First Aid Medical and Welfare Facilities;

(d) to look into the health hazards associated with handling different types of explosives, chemicals and other construction material and to suggest remedial measures including use of proper personal protective equipment;

(e) to suggest measures for improving welfare amenities in the construction site and other miscellaneous aspects of safety, health and welfare in building or other construction work;

(f) to bring to the notice of the employer the hazards associated with use, handling and maintenance of the equipment used during the course of building and other construction work.

(3) The Safety Committee shall meet at regular intervals at least once in a month and it shall be chaired by the senior person having overall control over the affairs of the construction site.
(4) The agenda and minutes of the meeting shall be circulated to all concerned and it shall be in the language understood by majority of the building workers and shall be produced to the Inspector on demand for inspection.
(5) The decisions and recommendations of the Safety Committee shall be complied with by the employer within reasonable time limits.

209. Safety Officer

(1) In every establishment wherein five hundred or more building workers are ordinarily employed, the employer shall appoint Safety Officers as per the scale laid down in Schedule VIII annexed to these rules. Such Safety Officers may be assisted by suitable and adequate staff.
(2) Duties, qualifications and the conditions of service of Safety Officers appointed under sub-rule (1) shall be as provided in Schedule VIII annexed to these rules.
(3) Wherever number of workers employed by single employer is less than five hundred, such employers may form a group and appoint a common Safety Officer for group of employers with prior permission of Director General.

(6) Expenses for Safety

- The expenses for safety in public works is estimated at 5-8% of the total construction cost, of which the contents are specified in the tender documents.
- The expenses for safety in private works is estimated at 3-5% of the total construction cost which is usually included in the contract amount.

(7) Administrative Measures, Social Sanction, etc. by Worker's Accident or Accident Occurrence

1) Administrative measures to Contractors
As the result of trial, the particular project manager may have a possibility to be arrested, but the administrative measures to cancel the contractor's qualification for bidding has not been confirmed.
2) Administrative measures to Subcontractors
As the result of trial, the persons concerned (for example, crane operator) may have a possibility to be arrested,
3) Social Sanction

Nothing in particular.

(8) The Factories Act, 1948 (Act No. 63 of 1948) as amended by the Factories (Amendment) Act, 1987 (Act No. 20 of 1987)

The Factories Act, 1948 (Act No. 63 of 1948) as amended by the Factories (Amendment) Act, 1987 (Act No. 20 of 1987) regulates the following issues which may be faced at the construction sites,

Chapter I describes the preliminary issues such as interpretation, etc. which defines the "factory" as follows:

Section 2. Interpretation.-
(m) "factory" means any premises including the precincts thereof-
(i) whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on, or
(ii) whereon twenty or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily so carried on,- but does not include a mine subject to the operation of the Mines Act, 1952 (XXXV of 1952) or a mobile unit belonging to the armed forces of the Union, a railway running shed or a hotel, restaurant or eating place;

Chapter II presents the matters on the inspecting staff.

Chapter III regulates the matters on health such as cleanliness (Section 11), disposal of wastes and effluents (S-12), dust and fume (S-14), lighting (S-17), drinking water (S-18), latrines and urinals (S-19), etc.

Chapter IV mentions the matters on safety on fencing of machinery (S-21), working on or near machinery in motion (S-22), employment of young person on dangerous machineries (S-23)

Chapter V provides the matters on welfare such as first-aid0-applianes (S-45), etc.

Chapter VI ordains the matters on working hours of adults on weekly hours (S-51), weekly holidays (S-52), compensatory holidays (S-53), daily hours (S-54), intervals for rest (S-55), extra wages for overtime (S-59), etc.

Chapter VII specifies the matters on employment of young persons such as prohibition of employment of young children (S-67), certificate of fitness (S-69), working hours for children (S-71), notice of period of work for children (S-71), register of child workers (S-73), etc.

Chapter VIII states the matters on annual leave with wages such as annual leave with wages (S-79), wages during leave periods (S-80), etc.

Chapter IX prescribes the special provisions such as notice on certain accident (S-86), notice on certain dangerous occurrences (S-88A), notice of certain diseases (S-89), etc.

APPENDICES

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1. Supplements of main part

2. Minutes

会 議 議 事 録

会議名	ガンジス川浄化事業準備調査　ICR 説明	場　所	JICA 本部 2B 会議室
日　時	平成 27 年 9 月 16 日（月）11：30－13：00	記録者	富士

出席者

<JICA>
市川　建作　　南アジア部南アジア第一課
佐々木　　資金協力業務部
千葉　周　　インド事務所調査役　（TV にて参加）

＜コンサルタント＞

美和　いく男	総括／下水道計画	㈱NJS コンサルタンツ
冨士　孝	下水処理場計画 A	㈱NJS コンサルタンツ
中村　一彦	副総括／積算調達	㈱NJS コンサルタンツ
花房　政英	下水管渠 B	㈱日本工営
阿辺山　一輝	下水処理場計画 B	㈱NJS コンサルタンツ
向野　能里子	住民啓発	㈱NJS コンサルタンツ
池田　正昭	経済財務分析 1	㈱NJS コンサルタンツ
中込　昭弘	経済財務分析 2	㈱NJS コンサルタンツ
名取　哲平	業務調整	㈱NJS コンサルタンツ

資料等

1. 業務計画書　（コンサルタント）
2. Inception Report　（コンサルタント）
3. Service levels in urban water and sanitation sector status report(抜粋)等その他補足資料
4. 案件形成（JICA）
5. キックオフミッション（JICA）

議題次第

1. ICR 説明・コメント等
2. 調査スケジュール
3. 案件形成スケジュール
4. キックオフミッション

内容

1. 業務計画書に基づいて ICR 説明実施（コンサルタント）
2. 課題：
   (1) TOR に記載 11DPR のうち 6DPR が未入手。
   (2) ムガルサライの処理場用地に問題の懸念。
   (3) 「バラナシ市環境改善に関する情報収集・確認調査」の調査団との連携。
   (4) パイロット事業について、プロポーザル提案の手法に加えて、群馬高専 小島博士の提案方法について、適用を検討。
   (5) 京都市との連携について、PWC を主体に検討。
   (6) 本プロジェクト実施体制については、現地で関係者と協議の上、提案。
3. フェーズ 2 対象都市は、汚濁負荷量等を検討の上、プライオリティを明確にして提案。
4. セクターローンの本事業への優位性とその適用の説明（JICA）
   予定：2015 10 月 審査、2015 12 月事前通報、2016 2 月 E/N, L/A
5. 渡航後の予定
   9/18　JICA デリー事務所 10：00「バラナシ市環境改善に関する情報収集・確認調査」の調査団とのミーティング、11：00 ガンジス川浄化事業準備調査 打ち合わせ、15：00 NMCG 協議

●協議内容：調査概要説明、案件形成スケジュール、セクターローン説明、L/A までのアクションプラン提示、審査頭出し

以上

THE PREPARATORY SURVEY ON
GANGA REJUVENATION PROJECT
IN THE STATE OF UTTAR PRADESH, INDIA

Minutes of Meeting
for
INCEPTION MEETING

Venue: **Conference Room, 1st Floor Rivatas Hotel, Varanasi City**
Time & Date: **11.30 am – 14.30 pm, Monday 21st September 2015**

Attendees:

JICA Delhi

Mr. M P Singh	Additional Chief Development Specialist

UPJN

Mr. R K Dwivedi	Chief Engineer
Mr. J B Rai	General Manager
Mr. S K Barman	Project Manager

VNN

Mr. S C Singh	Executive Engineer
Mr. B K Dwivedi	Additional M C VNS

Jal Kal Varanasi

Mr. B K Singh	Executive Engineer

Project Management Consultants

Mr. U N Tiwari	DTL (IDP)
Mr. B N Sharan	DTL (Non Sewerage)
Mr. B R Gupta	DTL (Sewerage)

NJS Consultants

Mr. T Fuji	Sewage Treatment Plant A
Mr. K Nakamura	Cost Estimates/ Procurement
Mr. K Abeyama	Sewage Treatment Plant B

Refer to the attached list of the attendees.

Agenda:

1. Explanation of Outline of the Project
2. Schedule of project formation
3. Explanation of Sector Loan
4. Presentation of Action Plan by L/A
5. Preparation for Appraisal

	Minutes	Action
1	**Objective** Presented by Mr. Singh from JICA Delhi.	
2	**Survey Outline and Schedule** Presented based on the Inception Report by Consultant. In the discussion, Status of the DPRs was discussed and concluded as follows: (1) Mirzapur: 2DPRs are expected in total. 1DPR done, 1 DPR will be submitted by the end of Sept 2015. (2) Chunar: 1DPR in total and done. (3) Ramnagar:1DPR is expected and it will be submitted by the end of Sept 2015. (4) Varanasi: 5DPRs are expected in total. 3DPRs done, 2DPRs will be submitted by the end of Sept 2015.. (5) Saidpur: 1DPR is expected and it will be submitted by the end of Sept 2015. (6) Ghazipur: 1DPR is expected and it will be submitted by the middle of Oct 2015. (7) Mugahalsarai: No submission of DPR due to issues of STP lot 11DPRs in total for six cities will be submitted for review. 5 DPRs were already submitted, 5 DPRs will be submitted by the end of Sept 2015. 1 DPR will be submitted by the middle of Oct 2015. Thus, scope was changed from the original scope of work, but the quantity was remained same as the original.	NMCG and concerned municipalities
3	**Project Formulation** Presented by Mr. Singh from JICA Delhi. Sector Loan was recommended for immediate and timely commitment.	
4	**Request for Indian Side** Official loan request, confirmation of implementation structure before L/A signing and immediate DPR submission were requested by JICA.	GoI
5	**What to be agreed at appraisal** Explanation of Implementation plan, Selection Criteria, Selection Procedure, Implementation structure, Candidate sub-projects and Total Project cost were presented by Mr. Singh.	
6	**Schedule** Appraisal Mission: Oct. 2015 Pledge: Dec. 2015 E/N, L/A: Feb. 2016 Effectuation of L/A: within 120 days after L/A	
7	**JICA ODA LOAN** Details were presented by Mr. Singh.	
8	**Key Actions before L/A signing** Details were presented by Mr. Singh.	

THE PREPARATORY SURVEY ON
GANGA REJUVENATION PROJECT
IN THE STATE OF UTTAR PRADESH, INDIA

Minutes of Meeting
for
MEETING ON DPRS

Venue: **Chief Engineer Room, UPJN Bhagwanpur Office, Varanasi City**
Time & Date: **15:00 – 16:00, Friday 27th November 2015**

Attendees:

UPJN

Mr. R K Dwivedi	Chief Engineer
Mr. J B Rai	General Manager
Mr. S K Singh	Project Manager (Varanasi, Mirzapur, Chunar)

JICA Study Team

Mr. I. Miwa	Team Leader
Mr. T Fuji	Sewage Treatment Plant A
Mr. V. Sontakke	Sewer Network A
Mr. M. Hanabusa	Sewer Network B
Mr. K Nakamura	Cost Estimates/ Procurement

Project Management / DPR Consultants

Mr. B R Gupta	DTL (Sewerage)
Mr. Renganathan K.	Engineer (DPRs Varanasi, Mirzapur, Chunar)

Refer to the attached list of the attendees.

Agenda:

1. Discussion for selection from 1) Interception Diversion & Treatment (ID&T), 2) Comprehensive, 3) Combination of ID&T and Comprehensive
   * JICA requested to choose option-3
2. Necessary adjustments for combination of ID&T and comprehensive for said cities if agree to select combination
3. Current idea and schedule of DPR for ID&T or combination by UPJN for Saidpur and Ghazipur Cities
4. Necessary steps for final decision by NMCG for the selected (proposed) policies

	Minutes	Action
1	**Discussion for selection from 1) Interception Diversion & Treatment (ID&T), 2) Comprehensive, 3) Combination of ID&T and Comprehensive** (1) CE of UPJN explained that MOUD issued an official letter with regard to clean Ganga on 21st August, 2015 with following contents; 1) The Class-I cities having population of 1 lakh and above as per 2011 census shall be developed with two projects comprising of ID&T method controlled by NMCG and following sewerage network controlled by MOUD, 2) Components of two projects should match each other in each city, 3) The other cities can be developed with only ID&T method, 4) The DPRs for sewerage networks shall be approved by MoUD before March 2016. The cost incurred by the States to prepare/revise DPRs for sewerage networks can be reimbursed from MoUD in consultation with NMCG. (2) CE explained that Varanasi, Mirzapur, and Ghazipur are Class-I cities (ID&T with sewer networks) and Chunar, Ramnagar, and Saidpur are the other cities (only ID&T).	N/A
2	**Necessary adjustments for combination of ID&T and comprehensive** (1) CE explained that combination of ID&T and comprehensive in one DPR is not possible at this stage due to the above reasons concerning supervising ministries and domestic funds. (2) However, the possibility of JICA fund at one project to the works under two ministries and the clarification of fund allocations should be discussed in Delhi between NMCG, MOUD and JICA.	N/A JICA/GoI
3	**Current idea and schedule of UPJN for Saidpur and Ghazipur Cities** (1) Based on the above rules stated in 1, the current status and next actions for Saidpur and Ghazipur with other target cities are as follows; 1) Varanasi: Has developed and designed with comprehensive method (no change of policy) 2) Mirzapur: both of ID&T and comprehensive were prepared and sewer network part by MOUD can be confirmed with comprehensive. (revisions of comprehensive into only sewer network and ID&T to match with sewer network are better but no urgent actions would be taken so far) 3) Chunar, Ramnagar: To be developed with existing DPRs ID&T 4) Saidpur: To be developed with ID&T (DPR ID&T would be prepared by end of December) 5) Ghazipur: To be developed with ID&T and sewer network (Existing DPR comprehensive should be revised with update of base year from 2015 to 2020 and split into two DPRs of NMCG and MOUD parts: No clear mention about deadline) (2) CE requested JICA Study Team to give suggestions to UPJN as much as possible to improve the qualities of new DPRs for Saidpur and Ghazipur to be prepared based on ongoing survey results of nala elevations by the team.	UPJN JICA Study Team
4	**Necessary steps for final decision by NMCG for the selected (proposed) policies** As stated in 2(2) above, the project scope under JICA project, the implementation structure, and the fund allocations should be discussed and concluded in Delhi.	JICA/GoI

THE PREPARATORY SURVEY ON
GANGA REJUVENATION PROJECT
IN THE STATE OF UTTAR PRADESH, INDIA

Minutes of Meeting
for
MEETING ON DPRS

Venue: **UPJN Bhagwanpur Office, Varanasi City**
Time & Date: **15:00 – 17:00, Wednesday 9th December 2015**

Attendees:

UPJN

Mr. S. K. Barman	Project Manager (Varanasi, Ramnagar, Saidpur, Ghazipur)
Mr. Attur Gupta	Junior Engineer

JICA Study Team

Mr. K Nakamura	Cost Estimates/ Procurement
Mr. M. Hanabusa	Sewer Network B

DPR Consultants

Mr. Renganathan K.	Engineer (DPRs Varanasi, Mirzapur, Chunar)

Refer to the attached list of the attendees.

Agenda:

1. DPR Ramna STP, Ramnagar
2. DPR Saidpur
3. DPR Ghazipur
4. DPR Varanasi District-I, III

	Minutes	Action
1	**DPR Ramna STP, Ramnagar** (1) Soft copies including original calculations sheets (technical, financial) of Ramna STP, Ramnagar comprehensive and ID&T were provided by Mr. Barman. (2) The rising main alignment for Ramnagar ID&T was confirmed on the map.	N/A
2	**DPR Saidpur** (1) Mr Barman assured that the DPR Saidpur ID&T will be prepared by UPJN by end of January 2016. (2) UPJN has conducted the site survey in Saidpur and prepared a drawing of roads and drains with hand writing. It was provided to JICA survey team for scanning the data. It will be returned to UPJN as soon as possible. (3) JICA Survey Team stressed that the flow survey of drains should be done by UPJN but the topographic survey for interceptor and rising main route and drains can be carried out by outsourced topographic surveyor. Mr Gupta will give instruction to surveyor in Saidpur on the route and locations on December 15.	UPJN JICA Survey Team UPJN/JICA Survey Team
3	**DPR Ghazipur** (1) The soft copies of DPR Ghazipur comprehensive have not been submitted by local consultant. (2) DPR Ghazipur is still issue how to revise the DPR. UPJN cannot fix the schedule for preparation of DPR ID&T. Since interception is difficult in Ghazipur there is a possibility to proceed with the current DPR comprehensive. If UPJN will prepare the DPR ID&T it will be prepared by end of March 2016.	UPJN
4	**DPRs Varanasi District-I and III** (1) Desilting work for Old Trunk Sewer is included in BOQ of District-I but it has been started under GAP-II. It should be removed from the DPR. Basically the desilting work is only for existing branch sewer network. (2) Reroute of Assi Secondary Interceptor due to the collapse beside Ganga River will be also conducted under GAP-II. But UPJN will not revise the DPR District-III since it is negligible.	UPJN/JICA Survey Team N/A

PREPARATORY SURVEY ON GANGA REJUVENATION PROJECT

MINUTES OF THE MEETING

Date: 10 December 2015

Meeting 1:

Time: 1200H – 1400H

Agenda Explanation on the Role of SPMG;

Place: Office of the Technical Adviser, SPMG

Present:

1	Mr. Jawed Ansari	Technical Adviser, SPMG
2	Ms. Consuelo Estepa	Institution A
3	Ms. Edna Bayan	Environmental Specialist
4	Mr. Siddiqur Rehman	National Institution Specialist / Researcher

	DESCRIPTION	REMARKS
1	**Welcome** Mr. Ansari welcomed the group to his office. Ms. Estepa introduced the members of the JICA Survey Team to Mr. Ansari and the agenda for the meeting.	
2	**On SPMG's role** with focus during the implementation stage in similar projects as the Ganga Rejuvenation Project under NMCG	• SPMG's major role is that of oversight on the Projects being implemented in the State that are under the auspices of NMCG. It has technical review over the projects to ensure that it complies with State and NMCG regulations. • It has also *coordinative role* over the projects within the State. • The *monitoring role* as to completion based on physical progress of the projects.
3	**On linkages / relationship** with of state government organizations / agencies	• SPMG operates as the State Ganga River Conservation Agency, which is under the Urban Development Department. • Projects in all cities in the State which are funded by NMCG under the Ministry of Water Resources, River Development

		and Ganga Rejuvenation are being monitored by SPMG. However, the monitoring does not come with any kind of authority over the Projects' implementation.
4	**On Ganga Rejuvenation projects** under Ministry of Urban Development and MoWR RD&GR	On the national or central government level, Ganga rejuvenation projects are undertaken by two ministries: – • MoUD projects for Ganga Rejuvenation are implemented under AMRUT or Atal Mission for Rejuvenation and Urban Transformation; and • MoWR RD&GR projects for Ganga Rejuvenation are implemented under the NMCG. AMRUT takes over the projects implemented under JnNURM.
5	**On Compliance on No Objection Certificate**	It was discussed during the meeting with SPMG that UPJN will be responsible in securing NOC on behalf of the Local Body which is consider the owner or proponent of the project. If JICA Survey Team will initially prepare those checklists, UPJN will do the assistance and provide the information needed.
6	**On Environmental Management and Monitoring Plans**	With regards to EMP and EMoP, a monitoring report should be prepared stating the monthly environmental status of the project. This will be done by the proponent and be submitted to the Pollution Control Board.
7	**On Letters of Mr. Nagai** to UPJN MD and Secretary UDD	The letters were given to Mr. Ansari who said these will be delivered to the offices which were addressed in the letter. Note that the Secretary of UDD is the ex-officio Head of SPMG.
8	**Adjournment** Meeting was adjourned at 1400	

By: Consuelo B. Estepa, PhD

会議議事録

会議名	ガンジス川浄化事業準備調査　第二回帰国報告会	場　所	JICA 本部 219 会議室
日　時	平成 27 年 12 月 22 日（月）15：00－16：15	記録者	富士
出席者	<JICA> 須之内　龍彦　南アジア部南アジア第一課　主任調査役 市川　建作　南アジア部南アジア第一課 佐々木　稔　資金協力業務部　技術主任 <コンサルタント> 美和　哉男　総括／下水道計画　㈱NJS コンサルタンツ 富士　孝　下水処理場計画 A　㈱NJS コンサルタンツ 中村　一彦　副総括／積算調達　㈱NJS コンサルタンツ 花房　政英　下水管渠 B　㈱日本工営 阿辺山　一輝　下水処理場計画 B　㈱NJS コンサルタンツ 夏井　明生　プラント機械　㈱NJS コンサルタンツ 新飯田　豊　プラント電気　㈱NJS コンサルタンツ 池田　正昭　経済財務分析 1　㈱NJS コンサルタンツ 中込　昭弘　経済財務分析 2　㈱NJS コンサルタンツ 名取　哲平　業務調整　㈱NJS コンサルタンツ		
資料等	1. Agenda（JICA） 2. 説明資料（パワーポイント）　（コンサルタント） 3. 現地入手レター　コピー（コンサルタント） 4. バラナシコンベンションセンター資料		
議題次第	1. 第二次現地調査報告 2. SPV、Annuity イシューへの対応・今後の調査への影響 3. 今後のスケジュール 4. バラナシコンベンションセンター		
	1. 第二次現地調査報告 1）対象区域 2）GAP II 現況 3）DPR プロジェクト概要 4）処理方式まとめ 5）下水道施設維持管理方式 6）事業費算定方法 7）ガンジス川流況 8）ガンジス川水質現況 9）処理場用地取得状況 10）タリフ 11）現況下水道管理体制・組織及び提案内容 12）JICA Phase II 対象都市 13）新水質基準 14）課題：新水質基準への対応、プロセス変更の影響、SPV への対応 15）パイロットプロジェクト 16）第二次現地調査の課題と今後の対応 2. 須之内主任調査役コメント 1）積み上げ方式とはどのような方式を指すか。費用関数と比べると積み上げ方式は二倍になっているとされているが、積み上げ方式を採用したときの対策は考えている		

か。
→積算書の費目が工事全体をカバーしているかを確認する。ガバメントレートの妥当性を確認する

2) JICA Phase II 対象都市
ドナー間のプロジェクトの争奪があることに留意。他州も取り込む可能性があるので資料の収集に当たっては考慮のこと。
候補地が UA、AP の二州に限定されているが、ガンジス川流域全体に拡げて検討すべきである。
→プロジェクトの取り合い、他州の取り込みを考慮し、今回渡航では対象範囲を拡大すること・その効果を検討する。

3) セクターローンのアイデア
Annuity 方式の適用について情報収集のこと
→現地で他ドナーの進捗状況・SPV・Annuity について情報収集し検討する。

4) Comprehensive と ID&T の取り扱い
SPV において上記の両者を包括的に実施することも考えられるので、念頭に置いて調査のこと
→包括的実施を考慮の上、調査を進める

3. 佐々木主任コメント

1) 新基準だとどのような処理方式が考えられるか
→窒素基準をクリアするために、A2O あるいは循環法になるのではないかと考えている。循環法が DPR の一部で採用を考慮されているので、適用しやすい。A2O については、リンの基準が厳しくないので必ずしも適当でない。(冨士)

2) Mirzapur （234000 人）には、ID&T・comprehensive の両者が入っているが取り扱いをどうするか（花房）
→Mirzapur は人口 10 万人以上で comprehensive となるが、実際の事業は ID&T が先行している。Ghazipur は ID&T 方式は難しい。(花房)

4. 市川担当コメント

1) バラナシコンベンションセンター
現地の意向としてバラナシコンベンションセンターの建設が上がっている。必要に応じて支援を検討する。
→現地で必要性を確認のうえ、対処すべき対象を検討の上、先方と協議する。

2) Phase -I プロジェクト対象都市
GoI からの 2 都市採択の提案があったが、6 都市採択でどうかという逆提案を行って、返答待ちになっている。
→現地確認

3) SPV 方式
その詳細について GoI からの返答待ちになっている。
→現地確認

4) Annity 方式
Annity 方式の検討を実施のこと
→現地確認

5.今後のスケジュール
→第三次現地調査は 2016/1/20 に渡航とする。

以上

会議議事録

会議名	ガンジス川浄化事業準備調査　第三回渡航前対処方針会議	場　所	JICA 本部 2F 会議室
日　時	平成 28 年 1 月 15 日（金）10：30－12：00	記録者	富士
出席者	<JICA> 須之内　龍彦　南アジア部南アジア第一課　主任調査役 市川　建作　南アジア部南アジア第一課 <コンサルタント> 美和　彧男　総括／下水道計画　㈱NJS コンサルタンツ 富士　孝　下水処理場計画 A　㈱NJS コンサルタンツ 中村　一彦　副総括／積算調達　㈱NJS コンサルタンツ 阿辺山　一輝　下水処理場計画 B　㈱NJS コンサルタンツ 池田　正昭　経済財務分析 1　㈱NJS コンサルタンツ 名取　哲平　業務調整　㈱NJS コンサルタンツ		
資料等	1. 説明資料（パワーポイント）　（コンサルタント） 2. SPV 資料（インド国鉄道省） 3. 団員 M/M 予定表 4. 平成 27 年 12 月 22 日　会議議事録		
議題次第	1. 第三次渡航前　各課題への対処方針 2. 今後のスケジュール		
	1. 第三次渡航前　対処方針資料説明 配布資料及びパワーポイント 1）SPV 貴機構より質問状既送付、回答待ち 2）新放流水質基準への対応 循環法・UV 滅菌で提案 3）プロセス選定 循環法で提案 4）用地 ・プロセスの変更により、追加購入・用地の変更が必要となる ・加えて、測量・土質追加調査が必要 →要協議 5）実作業への支障 →要協議 6）スケジュール 大幅な工期延長が必要 →先方と方針協議、貴機構と協議 7）概算工事費 →先方と協議 8）Phase I　プロジェクトの方針 →採択都市（6 都市 or　2 都市）について現地確認 JICA インド Mr.Sin 9）バラナシコンベンションセンター →進捗状況、現地確認。JICA 支援の在り方について協議・確認 2. コメント 1）SPV		

体制組織―SPV の意思決定ルート要確認
―組織図・権限、要確認
―構成メンバー　要確認
―人数・規模　要確認
―SPMG の教訓の活かし方

・Hybrid Annuity の PPP モデルとすれば、JICA の関与する額はどの程度か確認
（新聞報道では、政府負担額は 40％）

・既往プロジェクト―ADB ルーラルウォータカルナタカの例を確認
―ヒアリング実施　世銀（PPP、Mr Rajesh Barman）
及び　元日本工営 松本氏
・所管官庁・責任分担方法の確認
・ディスバースの実例を確認
・JICA 標準入札図書がどのように使用可能か確認

2）コンベンションセンター
具体化しつつある模様。詳細を確認する。

3.今後のスケジュール
→第三次現地調査は 2016/1/20 に渡航とする。

以上

THE PREPARATORY SURVEY ON
GANGA REJUVENATION PROJECT
IN THE STATE OF UTTAR PRADESH, INDIA

Minutes of Meeting
for
MEETING ON DPRS

Venue: **UPJN Bhagwanpur Office, Varanasi City**
Time & Date: **11:00 – 12:30, Monday 8th February 2016**

Attendees:

UPJN

Mr. S. K. Singh	General Manager
Mr. S. K. Barman	Project Manager (Varanasi, Ramnagar, Saidpur, Ghazipur)

JICA Study Team

Mr. M. Hanabusa	Sewer Network B
Mr. Manjunath Bendigeri	Support Engineer (Sewer Network)
Mr. Ram Kishan	CAD Operator

Refer to the attached list of the attendees.

Agenda:

1. DPR Varanasi District-I, II and III
2. DPR Saidpur
3. DPR Ghazipur
4. Nala names in Ghazipur
5. DPR Mirzapur
6. DPR Ramnagar
7. STP Land Acquisition in Saidpur

	Minutes	Action
1	**DPR Varanasi District I, II and III**	
	(1) DPR District-II was submitted to UPJN by the consultant and UPJN has given comment on some narrow road with difficulty to install major sewer line with big diameter and deep pipe. The consultant has to reroute the alignment (or propose the micro tunnelling).	DPR consultant
	(2) DPR District-I is under preparation by the consultant and UPJN is waiting for the submission.	DPR consultant
	(3) DPR District-III was submitted to central government. However, the cost should be revised with new SOR Basically UPJN will revise the cost.	UPJN(/DPR consultant)
	(4) These projects are expected to funded by JICA as NMCG projects but if JICA would not fund for them AMRUT scheme (UPJN) would be adopted.	N/A
2	**DPR Saidpur**	
	(1) Flow survey of nalas in Saidpur was done by UPJN on last May.	N/A
	(2) UPJN has been preparing DPR I&D and would complete on middle of March.	UPJN
	(3) UPJN has been utilizing the base map which was provided by JICA study team with route survey result and there is no problem so far.	UPJN
3	**DPR Ghazipur**	
	(1) UPJN would like to proceed with DPR comprehensive due to the difficulty of interception in the city but NMCG has insisted on preparing DPR I&D. Therefore, UPJN Ghazipur Office would prepare the said DPR. For that purpose the flow survey of nalas should be carried out but the coordination for the work has not been progressed yet.	UPJN
	(2) Due to the difficulty to coordinate with central government and UPJN Ghazipur office, the preparation of DPR is still pending and left with same urgency with one for Mugalsarai (excluded from JICA scope) without any deadlines. The flow surveys of nalas in Ghazipur and Mugalsarai would be carried out in the similar timings.	UPJN
	(3) Like the case of Mirzapur the existing DPR comprehensive will be utilized for future sewer network after I&D. However, the original files of the DPR have not been submitted from the consultant and UPJN recommended JICA study team to ask the Executive Engineer of UPJN Ghazipur Office if it is necessary for JICA study report.	JICA Study Team
4	**Nala names in Ghazipur**	
	(1) JICA study team requested UPJN to provide the list of nalas and the locations again for the purpose of existing drains in JICA study report. UPJN suggested that UPJN Ghazipur Office may have the information. JICA Study Team would contact to Executive Engineer of UPJN Ghazipur Office.	JICA Study Team
5	**DPR Mirzapur**	
	(1) The coordination meeting on I&D and comprehensive (adjustment of interceptor depth) was held between UPJN and DPR consultant on last December. But UPJN has not received any revised output of DPR. UPJN called DPR consultant and instructed to inform the status to JICA study team.	DPR consultant
6	**DPR Ramnagar**	
	(1) UPJN setup some allowance for interceptor diameter to cope with the future wastewater inflow from industry or other area.	N/A
	(2) UPJN left Hanuman Ghat Nala without interception since it is far and very little flow where is almost dry in sunny days.	N/A

	Minutes	Action
7	**STP Land Acquisition in Saidpur (for Survey Purpose)** (1) UPJN has been trying to obtain the letter of consent with land owner of proposed STP site but it takes more time due to some local procedure (Saidpur Nagal Palika matter). JICA study team requested UPJN to obtain it within February together with site for access road to STP. (2) JICA study team also requested UPJN to inform the team if there is any progress and UPJN accepted.	UPJN UPJN

会 議 議 事 録

会議名	ガンジス川浄化事業準備調査-情報収集	場　所	E&Y 会議室
日　時	平成 28 年 2 月 9 日（火）13：30－15：30	記録者	池田・冨士
出席者	＜コンサルタント＞ 美和　いく男　総括／下水道計画　㈱NJS コンサルタンツ 池田　正昭　経済財務分析 1　㈱NJS コンサルタンツ（補強 EY） 冨士　孝　下水処理場 1　㈱NJS コンサルタンツ Mr. Rajesh　EY・India Mr.Gaurav　EY・India		
資料等	—		
議題次第	1. 概況説明 2. SPV・Annuity 方式意見聴取		
内容	●SPV/Annuity Scheme についての今までの経緯と一般論 ・当初のインドの PPP モデルの大半は BOT モデル。Financing は 100%、Private-Sector。コマーシャルリスクの大半が Private Sector へ移転された。 ・大半のプロジェクトは失敗した。セクタが成熟していなかったこと、セクタがリスクを取らなかったこと等が原因。 ・2005 年頃から BOT-Annuity-model が採用されるに至った。これにより、Commercial-Risk が Private Sector に及ばなくなり、成功。 ・さらにそれに加えて PPP に Government がファンディングする、ハイブリッドモデルが出現。70-80%が政府、Private sector が残り 20-30%。建設期間 2 年間。 ・成功事例：Nagpur のケース（Hybrid BOT Annuity Model）： このセクタは政治的性格があるので（Private sector の関与はセンシティブなので）20 ゾーンから 1 つを選定・適用した。月額の Fixed-Payment とパフォーマンスベースの Various-Payment で構成。他の Zone へも展開することとした。 ・今回プロジェクトは Treated-Effluent のバルクユーザーへの利用提供などが特徴の 1 つになると考えられる。 ・SPV が Program レベルか Project レベルなのか（双方なのか）確認する必要がある。 Project レベル：SPV に対して State と Private が出資。前者は土地と投資。後者は Financing と Management を提供。双方でリスクとレベニューを共有 以上		

会議議事録

会議名	ガンジス川浄化事業準備調査　WB 協議	場　所	WB 1F会議室
日　時	平成 28 年 2 月 9 日（火）16：00－17：00	記録者	池田・富士
出席者	＜World Bank＞ 松本　順　　水資源管理 ＜JICA　India＞ 千葉　周　（JICA　デリー）　　JICA ＜コンサルタント＞ 美和　いく男　総括／下水道計画　　㈱NJS コンサルタンツ 池田　正昭　　経済財務分析 1　　㈱NJS コンサルタンツ（補強 EY） 富士　孝　　下水処理場 1　　㈱NJS コンサルタンツ Mr. Rajesh　　EY・India Mr.Gaurav　　EY・India		
資料等	—		
議題次第	1.　概況説明 2.　SPV・Annuity 方式意見聴取		
内容	●SPV/Annuity Scheme についての今までの経緯と一般論 ・JICA には 6 都市の中でバラナシと ラムナガールを除く所に PPP スキームの要望が来ている。WB の PPP チームが以前からこの件に関してインド政府と検討していると聞いていたので情報提供をお願いしたく伺った。 ・松本氏に Cabinet Note を提供。（会議時、JICA より情報提示） ・PPP-Financing Scheme の話は 1 年ほど前に来た。しかし、WB の$1billion の予算の中において SPV モデルを承認、合意する段階まで至っていない。WB パトナプロジェクトについては、PPP だが大きな遅れが問題となっている。また WB カンプールプロジェクトも PPP で、未着手。先行している他セクターでの PPP とは違い、Sewerage でのレベニュースキームが不明確な点が課題。（松本氏） ・WB はカルナタカ州バンガロールで PPP について取り組む。今月中にその検討を終える予定。SPV や Annuity モデルについては、WB として検討結果や計画書ドラフトを持っていない。（松本氏） ・この新しい Model については WB と JICA が一緒に検討するのも一案か。 ・PPP をどのように Water/Sewerage-Sector に適用するかは要検討。 ・個人的には、PPP のファイナンススキームよりも従来の EPC が好ましい。（松本氏） 以上		

会 議 議 事 録

会議名	ガンジス川浄化事業準備調査	場　所	NMCG 2F 会議室
日　時	平成 28 年 2 月 10 日（水）11：30－13：00	記録者	池田・冨士
出席者	＜NMCG＞ Mr Rajat Guputa　Sen. S W M Speialist　NMCG ＜JICA　India＞ 千葉　周　（JICA　デリー）　JICA Mr M P Singh（JICA　デリー）　JICA ＜コンサルタント＞ 美和　いく男　総括／下水道計画　㈱NJS コンサルタンツ 池田　正昭　経済財務分析 1　㈱NJS コンサルタンツ（補強 EY） 冨士　孝　下水処理場 1　㈱NJS コンサルタンツ Mr. Rajesh　EY・India Mr.Gaurav　EY・India		
資料等	1. Agenda		
議題次第	1. 新放流水質基準 2. 処理方式 3. プロジェクト用地 4. DPR 5. スケジュール 6. SPV/Annuity 7. Phase I Project 8. コンベンションセンター		
内容	1. 新放流水質基準 1.1 周知予定 実施することは既定だが、日程は決まっていない 1.2 放流水質基準 10 mg/l of BOD, SS, N、大腸菌 100MPN/100ml 達成可能な方式を採用すればよい。GoI に腹案はない。 1.3 新基準における急速砂ろ過あるいは MBR の必要性について 必要に応じて設置すればよい 2. 処理方式 2.1 特別な処理方式の必要性 1.2 の通り 3. プロジェクト用地 3.1 サイドプル用地の取得は難航中（報告事項） 3.2 処理場によっては処理方式の変更による用地不足の懸念（報告事項） 4. DPR		

4.1 ガジプルについて ID/T の採用の指示があったが、既提出の DPR の通り comprehensive で提出してよいか。
本プロジェクトは NMCG の所管であるので、NMCG の指示に従うこと。ID/T プランを採用のこと。

4.2 SPV 方式であれば、NMCG、MoUD のいずれからも独立したプランとできるのではないか
NMCG 所管である。NMCG の指示に従うこと。

5. スケジュール

5.1 DPR 完成のスケジュール
コンサルタントは、新水質基準に合わせた DPR の修正・入札方式等の SPV/annuity 方式への適応のため、6 か月の工期延伸を JICA に申請中である。

5.2 DPR 作成のための追加契約
GoI は ULB の DPR 作業のためのファンドがあり使用可能である。

5.3 Annuity 方式の詳細
GoI において検討中である。この件のステークホルダーミーティングを 2/24 に開催予定。

5.4 バラナシ・ラムナガール
申請承認手続き中であるので 2 都市の DPR 作業を早く完了させること（JICA→コンサルタント）

6. SPV/Annuity

・SPV、Annuity モデルについてはインド政府が決定、発表。建設完了時（例えば 2 年後）にキャピタル投資額の上限 40%がインド政府から支払われ、残額は最長 20 年間、毎年または半年毎に Annuity モデルとして支払われる。
・資金の支払やコンセッショナーとの契約は SPV が行う。また SPV の資金の源泉は、インド政府である。
・今後インフラ投資の案件は EPC ではなくハイブリッドモデルで実施予定。
・但し小規模の町では BOT 方式もありえる。ケースバイケースで ESC（Empowered Steering Committee）が決める予定。
・本スキームの狙いは必ずしもファイナンスの視点ではなく、長期のアカウンタビリティの確保、サステイナビリティの維持である。
・Annuity でのレベニューストリームでは、バイプロダクトである処理水の販売がある（＝ボーナスの位置付け）。想定利用者は農業セクター、鉄道セクター、電力セクター等。
・ガンガプロジェクトで水道所管は NMCG ではないので、SPV スキームには水道計画は含めない。
・本件のビジネスモデル、ファイナンスプラン、ビジネスプランの詳細検討は、2016 年 3 月までに（GoI の Agency 実行中）完了予定。よって本日時点では詳細内容は出せない。

7. Phase I Project

7.1 2 or 6 cities
バラナシ・ラムナガール 2 都市採択、プラス残り 4 都市 PPP 予定
2 都市については GAP に入れるか、本プロジェクトに入れるかは検討中。
PPP についてはプロジェクトごとに Annuity 方式適用の可能性を検討。

8. コンベンションセンター

別枠で検討中

会議議事録

会議名	ガンジス川浄化事業準備調査　TV 会議	場　所	JICA 2F 会議室
日　時	平成 28 年 2 月 10 日（水）14：00－15：20	記録者	池田・富士
出席者	＜JICA　India＞ 千葉　周　（JICA　デリー）　JICA ＜JICA　東京＞ 市川　建作　JICA ＜コンサルタント＞ 美和　いく男　総括／下水道計画　㈱NJS コンサルタンツ 池田　正昭　経済財務分析 1　㈱NJS コンサルタンツ（補強 EY） 富士　孝　下水処理場 1　㈱NJS コンサルタンツ		
議題次第	1.　協議結果報告 2.　今後の見通し		
内容	1.　NMCG 協議結果報告 1.1 新放流水質基準 a.　周知予定：実施することは既定だが、日程は決まっていない b.　放流水質基準 10 mg/l of BOD, SS, N、大腸菌 100MPN/100ml：達成可能な方式を採用すればよい。GoI に腹案はない。 c.　新基準における急速砂ろ過あるいは MBR の必要性について：必要に応じて設置すればよい 1.2 処理方式 d.　特別な処理方式の必要性：1.2 の通り 1.3 プロジェクト用地 e.　サイドプル用地の取得は難航中（報告事項） f.　処理場によっては処理方式の変更による用地不足の懸念（報告事項） 1.4DPR g.　ガジプルについて ID/T の採用の指示があったが、既提出の DPR の通り comprehensive で提出してよいか。：本プロジェクトは NMCG の所管であるので、NMCG の指示に従うこと。ID/T プランを採用のこと。 h.　SPV 方式であれば、NMCG、MoUD のいずれからも独立したプランとできるのではないか：NMCG 所管である。NMCG の指示に従うこと。 1.5 スケジュール i.　DPR 完成のスケジュール：コンサルタントは、新水質基準に合わせた DPR の修正・入札方式等の SPV/annuity 方式への適応のため、6 か月の工期延伸を JICA に申請中である。 j.　DPR 作成のための追加契約：GoI は ULB の DPR 作業のためのファンドがあり使用可能である。 k.　Annuity 方式の詳細：GoI において検討中である。この件のステークホルダーミーティングを 2/24 に開催予定である。 l.　バラナシ・ラムナガー：2 都市の DPR 作業を早く完了させること（JICA→コンサルタント） 1.6　SPV/Annuity ・SPV、Annuity モデルについてはインド政府が決定、発表。建設完了時（例えば 2 年後）にキャピタル投資額の上限 40%がインド政府から支払われ、残額は最長 20 年間、毎年または半年毎に Annuity モデルとして支払われる。 ・資金の支払やコンセッショナーとの契約は SPV が行う。また SPV の資金の源泉は、インド政府である。		

・今後インフラ投資の案件はEPCではなくハイブリッドモデルで実施予定。
・但し小規模の町では BOT 方式もありえる。ケースバイケースで ESC（Empowered Steering Committee）が決める予定。
・本スキームの狙いは必ずしもファイナンスの視点ではなく、長期のアカウンタビリティの確保、サステイナビリティの維持である。
・Annuity でのレベニューストリームでは、バイプロダクトである処理水の販売がある（＝ボーナスの位置付け）。想定利用者は農業セクター、鉄道セクター、電力セクター等。
・ガンガプロジェクトで水道所管はNMCGではないので、SPV スキームには水道計画を含めない。
・本件のビジネスモデル、ファイナンスプラン、ビジネスプランの詳細検討は、2016 年 3 月までに（GoI の Agency 実行中）を完了予定。よって本日時点では詳細内容は出せない。

1.7 Phase I Project

・2 or 6 cities
バラナシ・ラムナガール 2 都市採択、プラス残り 4 都市 PPP 予定

1.8 コンベンションセンター

・今後の検討

2. 追加 TOR
・メール資料受領、確認。延伸工期、確認
・MM スケジュールについて詳細は、プロポーザル中で検討・提示する（全 MM は貴機構方針通りとする）ことを確認。

以上

THE PREPARATORY SURVEY ON
GANGA REJUVENATION PROJECT
IN THE STATE OF UTTAR PRADESH, INDIA

Minutes of Meeting
for
MEETING ON DPRS

Venue: **UPJN Bhagwanpur Office, Varanasi City**
Time & Date: **12:30 – 13:30, Friday 19th February 2016**

Attendees:

UPJN

Mr. S. K. Singh	General Manager
Mr. S. K. Barman	Project Manager (Varanasi, Ramnagar, Saidpur, Ghazipur)

JICA Study Team

Mr. Vidyadahl Sontakke	Sewer Network A
Mr. M. Hanabusa	Sewer Network B

DPR Consultant

Mr. Renganathan K.	Engineer (DPRs Varanasi, Mirzapur, Chunar)
Mr. Manish Bansal	Engineer (DPRs Varanasi, Mirzapur comprehensive)

Refer to the attached list of the attendees.

Agenda:

1. DPR Varanasi District-II
2. DPR Varanasi District-I
3. DPR Varanasi District-III
4. DPR Mirzapur
5. DPR Chunar

(Prepared by M. Hanabusa)

	Minutes	Action
1	**DPR Varanasi District II**	
	(1) For the commented section by UPJN with much deep sewer in narrow and congested road (around 1.5km) the DPR consultant proposed to adopt trenchless method since there is no space for additional pumping station and laying by open cut is impossible after site visit with UPJN. UPJN accepted the proposal.	N/A
	(2) DPR consultant will revise the DPR by 25th February and UPJN will submit to central government immediately.	DPR consultant /UPJN
2	**DPR Varanasi District I**	
	(1) DPR consultant will submit the DPR by 5th March. UPJN will submit to central government immediately.	DPR consultant /UPJN
3	**DPR Varanasi District III**	
	(1) UPJN accepted the proposal by DPR consultant that branch sewers will cross the upstream in tributary of Assi Nala since it is a few flow.	N/A
	(2) Including the remodelling of sewer networks to avoid crossing of Assi Nala DPR consultant will revise a set of drawings, BOQs and cost estimates after the submission of DPRs District-I and II. The output will be utilized by JICA Study Team for their proposal.	DPR consultant/JICA Study Team
4	**DPR Mirzapur**	
	(1) The coordination between comprehensive and I&D will be re-discussed in JICA study team office on 20th Feb so that future sewer network can be connected to interceptor.	All party
5	**DPR Chunar**	
	(1) JICA study team asked UPJN the reason why now UPJN tries to intercept the wastewater toward Jargo River despite it had been left because of no inflow of wastewater to River Ganga ultimately (use of water for irrigation). UPJN answered that NMCG commented the wastewater may inflow to River Ganga through Jargo River in future. Particularly Nala Number 21 (Ganda Nala) with much flow was raised as issue. Now UPJN would like to add another interceptor for Jargo River (basically with gravity).	UPJN
	(2) The detail will be discussed in JICA study team office on 20th Feb	UPJN/JICA Study Team

THE PREPARATORY SURVEY ON
GANGA REJUVENATION PROJECT
IN THE STATE OF UTTAR PRADESH, INDIA

Minutes of Meeting
for
MEETING ON DPRS

Venue: **UPJN Bhagwanpur Office, Varanasi City**
Time & Date: **13:00 – 14:00, Saturday 20th February 2016**

Attendees:

UPJN

Mr. S. K. Singh	General Manager
Mr. Sanjith Katiyar	Project Manager (Mirzapur, Chunar)

JICA Study Team

Mr. Vidyadahl Sontakke	Sewer Network A
Mr. M. Hanabusa	Sewer Network B
Mr. T. Fuji	STP A

DPR Consultant

Mr. Renganathan K.	Engineer (DPRs Varanasi, Mirzapur, Chunar)
Mr. Manish Bansal	Engineer (Ditto)

Refer to the attached list of the attendees.

Agenda:

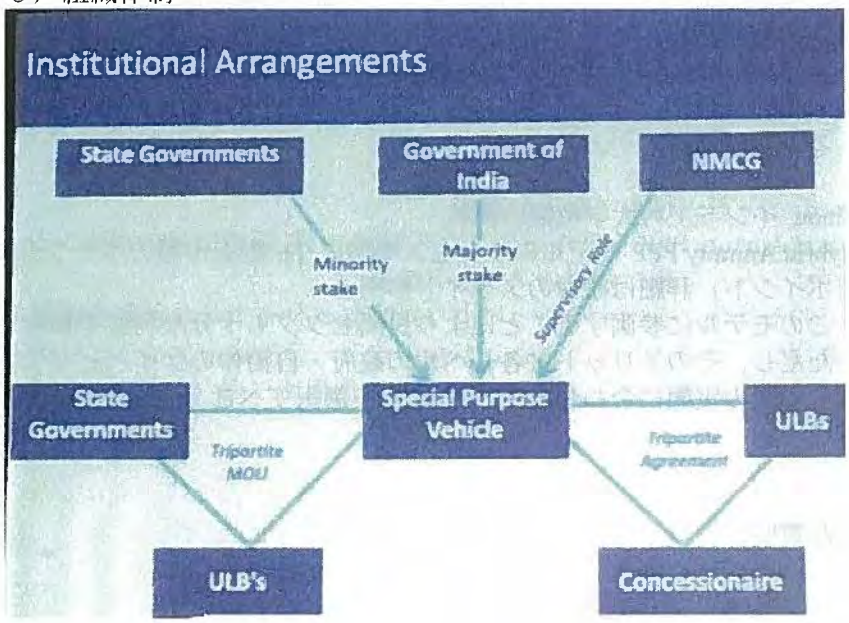
1. DPR Mirzapur
2. DPR Chunar

(Prepared by M. Hanabusa)

	Minutes	Action
1	DPR Mirzapur	
	(1) The tapping points will be adjusted to Ganga River to intercept the wastewater at the downstream of habitation area as much as possible.	DPR Consultant
	(2) The connection sewers from tapping points to interceptor will be utilized as branch sewer in one side of nala and another branch sewer will be laid in another side of nala in future as comprehensive work.	Ditto
	(3) After the adjustments for the above works the depth of interceptor should be less than 10m.	Ditto
	(4) The revision of DPR (I&D, comprehensive) will be finished by March 15.	Ditto
2	DPR Chunar	
	(1) UPJN informed that there were following comments from NMCG for submitted DPR draft. Without the revision for this the approval of DPR Chunar I&D by NMCG will be difficult. 1. The Jargo River side also should be intercepted. 2. The septic tank areas also should be revised to interception as much as possible	N/A
	(2) In order to take action to the above issues, mainly the following actions will be taken after careful consideration of GLs. 1. The location of proposed IPS-1 would be changed to any location in nearby septic tank area (low land). 2. Additional interceptor will be laid for Jargo River side. Due to the low GL in some nalas, the same proposed P/S with comprehensive case would be proposed.	DPR consultant
	(3) The availability of lands for the said P/Ss will be checked with Chunar Nagar Palica by Project Manager, UPJN and the result will be informed to DPR consultant.	UPJN
	(4) The revision of DPR I&D will be finished by March 15.	DPR Consultant
3	DPR Schedule	
	(1) JICA Study Team requested UPJN and DPR consultant to keep the time of above schedule including ones for Varanasi which was discussed in previous day (District-II: Feb 25, District-I: Mar 5, District-III: try to finish with same day with District-I but Dist-I should never be delayed due to Dist-III). UPJN and DPR consultant accepted.	UPJN/DPR Consultant

会議議事録

会議名	ガンジス川浄化事業準備調査　Market Conference	場　所	Bigyan Bahwan 3F 会議室
日　時	平成 28 年 2 月 24 日（水）9：00－11：00－13：15	記録者	持田・池田・富士
出席者	＜GOI＞ Shasi Shekhar　Secretary　Ministry of WR,RD and GR Puskal Upadhay　Additional Mission Director,　NMCG Harihar Mishra Director Finance, NMCG NV Satish Seemakurti Director Technical1, NMCG Sundeep Director Technical-2, NMCG <IIT> Dr. Vinod Tare　Professor, IIT Kanpur ＜JICA　India＞ 坂本威午　（JICA デリー、　所長）、千葉　周　（JICA　デリー）、Mr M P Singh（JICA　デリー） ＜WB＞ Mr. Rajesh Balasubramanian　Senior Water and Sanitation Specialist ＜コンサルタント＞ 持田　圭介　経済財務分析 1　㈱NJS コンサルタンツ（補強 EY） 池田　正昭　経済財務分析 1　㈱NJS コンサルタンツ（補強 EY） 富士　孝　下水処理場 1　㈱NJS コンサルタンツ Mr. Rajesh　EY・India Mr.Gaurav　EY・India ＜その他の参加者＞ 約 250 名の現地及び海外のコンサルタント、コントラクタ等		
資料等	説明資料（パワーポイント）　（NMCG）		
議題次第	1. Sateesh Director より開会挨拶 2. Shasi Shekar 水資源・河川開発・ガンジス河再生省セクレタリーよりプレゼンテーションに先立ち基調スピーチ 3. Puskal AMD より Hybrid Annuity PPP for STP についてプレゼンテーション 4. Vinod 教授より海外におけるサクセス事例と処理水のリサイクルに関するプレゼンテーション 5. 質疑応答		
	＜概要＞ １．インド国水資源保全省の Shri Shashi Shehkar 長官コメント NMCG では、Namami Gange プログラムの下、下水処理インフラ整備のためのハイブリッドアニュイティベースの PPP モデルの SPV モデルを来月中に構築する予定である。 このモデルはプログラムにより多くの市場性を導入し（リスクに見合ったリターンを提供して）、参加者のすそ野を広げてより大きなチームで大きなミッションを達成する”Achieve Big task with big team”という意味で非常に重要である。 ２．主要タイムライン 2016 年 3 月末　RFP for Transaction Advisory Service の発行 SPV の組成		

	2016年4月　Condition Study Reportの回収開始 2016年6月　Transaction Advisor選定プロセス開始 2016年12月　Transaction Advisorの成果物（プロジェクト計画）完成 2017年1月-3月　コンセッショネア選定プロセス ３．まとめ 長官及びNMCG幹部からの前向きなコメントの一方で、参加者からは多くの質問や懸念が寄せられ、一部については議論中であることが明らかになるなど、未だPublic commentの収集段階のような印象もあった。また、Hybrid Annuity PPPモデルについてもスキームの詳細は提示されたとはいえず、情報収集を継続する必要がある。（これに先立つミーティングで3月末にビジネスモデル等が公表されるとのNMCG幹部の説明があった）
	＜プレゼンテーション及び質疑応答の内容＞ 1. Hybrid Annuity PPP Model for STP プレゼン：NMCG Puskal 氏 １）流域の下水処理にこれまでRs.4000Crore以上を費やしてきたが、未だ十分に機能しておらず、ガンジス川流域11州の下水処理需要と処理能力には6300MLD以上のギャップがある。このため河川水質汚染は改善されていない。現場のモニターの結果、下水処理は30％しか機能しておらず、94％は水質基準を満たしていなかった。Medium termにおけるMunicipal Sewage Management として、政府はさらに4000MLDの下水処理能力の増強を計画中である。全投資額の63%が下水関係。 ２）Hybrid Annuity Model Construction Phase(想定2年)：最大40%までのCapital Costを政府が拠出 O&M Phase(最大20年)：Annuity－残りのCapital cost、毎年のO&Mコスト、パフォーマンス基準に応じたインセンティブ、TE(Treated Effluent, 処理水)買い取り収益 ３）組織体制  SPVへの出資：GOIがマジョリティ、州政府がマイナー出資 ２つの3者間契約：SPV-ULB‐コンセッショネア、SPV-州政府-ULB ４）役割 SPV：コンセッショネア選定の推進、建設コストの調達、TEの質に応じたパフォーマンスペイメントによるO&Mコストの回収、TE販売マーケットの開発 州政府：用地確保に関する必要な承認の事項、コンセッショネア選定プロセスへの参画、タリフ体系及びガイドラインを通じたTE再利用の促進、SPVへのマイナー出資

ULB：SPV に対して必要な権限の委譲、コンセッショネア選定プロセスへの参画、O&M コストに見合ったタリフ体系の導入
コンセッショネア：インフラの建設、コンセッション期間における STP の運転管理、TE の水質基準への適合、TE 販売市場開発

5）アニュイティ支払確保の仕組みについて
・SPV が支払を行う
・一般会計からの予算サポートを含め 2 年分の支払金額を確保した特別会計で管理
・必要に応じて Clean Ganga Fund その他の Fund からの追加的支援も実施

6）施設整備内容
・市中の下水処理
・既存下水施設の維持管理
・既設施設の補修・更新
・新規処理場・ID/T の建設
・20 年間の維持管理
・可能な場合、施設統合

7）その他
SPV は各都市につき一つ
TE 販売マーケットのポテンシャルに関する調査が世界銀行により実施中
（長官からの補足コメント）
・既存の進行中プロジェクトを除き、今後 Namami Ganga プログラムの下で行われる STP プロジェクト（管路含む）は全てこの Hybrid Annuity モデルで実行する
・TE 再利用は、近い将来法的に義務付けられる予定で、政府としてもその準備を始めている。5 月までに 2－30 市のプロジェクトを発表する予定である。発電所ではすでに、半径 50km 以内に STP がある場合には TE 購入が義務付けられる。鉄道・石油関連との協定も結ばれる。
・TE 販売収益をどの程度見込むのかについては入札の評価基準とはしない予定だが、TE 販売収益が多く見込めるほど、プロジェクトの経済性は向上するので、政府としてもその点を期待している。

2. Vinod インド工科大学教授の講演
Hybrid Annuity PPP モデルのサクセス事例と TE 販売市場のポテンシャルについて
（ポイント）詳細は添付のスライド参照
・このモデルに参画することにより民間セクタも十分な利益を確保できる
・ただし、そのメリットは各レベルの政府・自治体のケイパビリティに依存する
・その国の実態に合わせた PPP モデルを選択すべき（シンプルなスキームから開始する）

3. 主な質疑応答
1. コンセッショネアの評価はだれがするのか
→関連する州政府、ULB が行う

2. 最大 40%の出資金額は、どのようにして決まるのか
→Transaction Advisor の検討結果に基づき決定する

3. Concession Agreement に関するポリシーは全国共通なのか、州によって違うのか
→基本的には共通だが、プロジェクトによって適用される条項が異なるということはありうる

	4. Annuity の支払に関して政府の保証はあるのか →パフォーマンスを満たす限り、Annuity は支払われるので、コンセッショネアのリスクは適切に担保されていると考えている。Guarantee の有無、内容については検討中。 5. Annuity の保全のための Escrow Account は用意するのか →プレゼンにあった通り、2 年分のアニュイティ相当額を Namami ganga Fund が拠出する別会計で保全する。さらにそれとは別に TE 売却収益を Escrow アカウントで保全する。 6. コンセッショネアの選定基準は →Annuity の Net Present Value である。 7. TE マーケットが未開拓の現状では Hybrid Annuity PPP モデルは実行困難ではないのか →民間事業者へのメリットを明確にすることで多くの業者に参入を促し、同時に市場の開発も進めていくというアプローチであり、早く参入すれば得られるメリットもより大きい。 長官からカンファレンス参加者に対して、月 Rs.10 を Namami Ganga Program に寄付をするように呼びかけた。 以上

PREPARATORY SURVEY ON GANGA REJUVENATION PROJECT

MINUTES OF THE MEETING

Date:	5 August 2016
Time:	1100H – 1500H
Agenda	Follow up on: • Water Supply: Service hours per day against service level benchmark • Billing and Collection of water tariff: System, collection mode and collection efficiency • Complaint Redressal: Efficiency rate per annum
Place:	Office of : • The Executive Officer - Ghazipur Nagar Palika Parishad • The Executive Engineer Office - UPJN Ghazipur.

Present:

1	Mr. Bijay Sankar	Tax Superintendent, Ghazipur Nagar Palika Parishad
2	Mr. S. K. Yadav	Executive Engineer, UPJN Ghazipur
3	Ms. Consuelo Estepa	Institution A
4	Mr. SiddiqurRehman	National Institution Specialist / Researcher

	DESCRIPTION	REMARKS
1	**Welcome** Mr. Bijay Sankar welcomed the group to the Nagar Palika Parishad Office.	
	Ms. Estepa introduced the members of the JICA Survey Team to Mr. Bijay Sankar and Mr. S. K. Yadav and the agenda for the meeting.	
2	**On Water Supply provided by Ghazipur NPP** - Service hours per day against service level benchmark (SLB) 24/7	• It was ascertained that water supply is intermittent. Total hours of water supply during the day is nine hours with a supply of five hours in the morning between 0400H-0900H and four hours in the evening between 1600H-1900H. • Exceptions do occur sometimes due to disruption in electricity supply and break down of pumps or equipments.
3	**On billing and collection** (Water Supply)	• Follow paper-based manual billing and collection system. • Collection of water supply tariff is done using 11 bill collectors (bill collectors along with collection of water tariff also collects other taxes of NPP) and 1 dedicated water tariff collector clerk posted in the NPP office. • Collection efficiency is ascertained at 80% of demand. It was communicated that due to under staffing in the office, collection efficiency fails to meet efficiency benchmark of 90%.

4	**On Complaint Redressal of Water Supply Service** (Average redressal efficiency rate per annum)	Complaint redressal for water supply stands at 90% against the benchmark of 80% per annum.
5	**Discussion with Executive Engineer, UPJN-Ghazipur**	• Mr. S.K Yadav, Executive Engineer joined the office on 17 July 2016. As such he has very little insight into the development of proposed STP at Ghazipur. • In the meeting, he was updated on the STP strength and sewerage network length for Ghazipur. • He also mentioned he was in talks regarding the Saidpur DPR which we informed is no longer included in the JICA scope of work. He remarked that he would explore the possibility of developing a DPR for Saidpur under his initiative. • He further assured support to the survey if required.
6	**Adjournment** Meeting was adjourned at 1500H.	

Prepared by:
Siddiqur Rehman

Noted:
Consuelo B. Estepa, PhD

PREPARATORY SURVEY ON GANGA REJUVENATION PROJECT

MINUTES OF THE MEETING

Date: 08 August 2016

Meeting Time: 1030-1145 H

Agenda:

1) Experience of SPMG in selection of private institutions for *special purpose vehicles* and/or the formation of SPVs.
2) The draft project implementation framework indicating SPMG as the "project management unit" and the resource wise and people wise capacity to implement projects under the JICA programme
3) Coordinative nature of SPMG in the implementation of the projects sanctioned by NGRBA / NMCG in UP State with State departments and organizations and the urban local bodies
4) Procurement role of SPMG

Place: Office of SPMG Finance Director, Lucknow, U.P.

Present:

1	Mr. Jawed Ansari	Technical Adviser, SPMG
2	Mr. Mumtaz Ahmad	Finance Director, SPMG
3	Ms. Consuelo Estepa	Institution A, JICA Study Team
4	Mr. Siddiqur Rehman	National HR Specialist, NJSEI

	DESCRIPTION	REMARKS
1	**Welcome** Mr. Ahmad welcomed the team to his office. Ms. Estepa, on the other, thanked Mr. Ansari and Ahmad for receiving her and Mr. Rehman, and explained the agenda of the meeting.	During the first visit in December 2015, the idea of implementing the Project through SPV / HAM-PPP was not yet brought up by GoI ad JICA, hence the need for a second meeting, precisely to discuss this development.
2	On the **experience of SPMG in selection of private institutions for *special purpose vehicles*** and/or the formation of SPVs for project implementation.	• Mr. Ansari said that UPSGRCA / SPMG has not selected and/or formed SPVs to implement infrastructure projects under NGRBA/ NMCG programme. • Ms. Estepa asked if there were any other SPVs formed and operating in the State, to which Mr. Ansari answered in the affirmative. He mentioned said that there was one in the transport (metro) sector; but none in the water supply or sewerage sector.
3	On the **draft project implementation framework** indicating SPMG as the "project management unit" and its readiness to assume the proposed role.	• Mr. Ansari reiterated the role of SPMG as a monitoring body (which was described in the Interim Report). He added that SPMG, as the name suggests, manages projects, particularly those being implemented under the World Bank programme. Under this scenario, SPMG is the "proper office in the State" to undertake the role of Project Management Unit for projects to be implemented under the JICA programme. • Mr. Ansari said that they are in agreement with attaching the Project Management Consultants (PMC) to the SPMG during project implementation phase, as indicated in the draft implementation framework. • Mr. Ansari said that SPMG has currently 21 personnel. But people and resource wise, SPMG is ready for the role to be given under JICA programme.

4	On the **coordinative nature of its work** with State departments and organizations and the urban local bodies n the implementation of the projects sanctioned by NGRBA / NMCG in U.P.	• Mr. Ansari said that SPMG does not implement projects but it coordinates the implementation of projects on the field works' level through State departments and organizations, as well as with urban local bodies. • For example, the DPRs for sewerage projects are prepared by UPJN; then these are coursed through SPMG, which in turn submits the same to NMCG for funding.
5	On **procurement functions / role of SPMG** in projects under NGRBA / NMCG	• Mr. Ahmad and the procurement officer explained that SPMG's role in procurement is basically on procurement planning only. It is the channel in the State level that receives and then submits the technical and financial requirements, such as the DPRs, for sanction to NMCG under its programme of work. In effect, is sees to it that all requirements are met by the State implementation agency before submission to the executing agency, which is the NMCG. For sewerage projects, U.P. Jal Nigam prepares the DPR; for river front projects, the development authorities prepare DPR; while for solid waste projects, DPRs are prepared by the ULBs, that is, the Nagar Nigam or the Nagar Palika Parishad. • There is a Procurement Manual (revised in 2013) that governs the procurement process for projects funded under the World Bank (WB) in NMCG. Embedded in the procurement process are three levels of approvals through a "no objection certificate" or NOC before a project sees actual implementation. - The State, through State departments or organizations, prepares and submits particular DPR through the SGRCA, which examines the compliance to technical and financial feasibility of said proposed project, to the NMCG and WB. If everything is in order, the latter then issues the first NOC. - The NMCG, through the empowered committee, then gives the administrative sanction or approves the proposed project, upon which the second NOC is issued. - Before the project is up for bidding, the WB approves the procedure plus the terms and conditions for bidding, in the same manner as the DPR is approved. - Then NMCG and the WB evaluate the bids technically and financially, after which the winning bidder is announced. The third NOC is issued together with a letter of acceptance. • According to Mr. Ahmad, the entire process takes from six to eight months to complete.
6	**Adjournment** There being no other matter to be discussed, the meeting was adjourned at 1145H	

Prepared by:

Consuelo Estepa, PhD
Institution A

PREPARATORY SURVEY ON GANGA REJUVENATION PROJECT

MINUTES OF THE MEETING

Date:	08 August 2016
Meeting Time:	1200-1300 H
Agenda:	1) Experience working / collaborating with SPMG for such NGRBA / NMCG projects 2) Status of vacancies at UPJN 3) Streamlining decision-making process in tendering
Place:	Office of Chief Engineer Ganga, UPJN Lucknow, U.P.

Present:

1	Mr. S.K. Sinha	Chief Engineer, Ganga
2	Ms. Consuelo Estepa	Institution A, JICA Study Team
3	Mr. Siddiqur Rehman	National HR Specialist, NJSEI

	DESCRIPTION	REMARKS
1	**Welcome** Mr. SInha welcomed the team to his office. Ms. Estepa, on the other, thanked Mr. Sinha for receiving her and Mr. Rehman, and explained the agenda of the meeting.	
2	On the **experience on working / collaborating with SPMG** in implementing NMCG programme of work	• Mr. Sinha said that UPJN has good working relationship with SPMG thus far. • For example, on the appraisal of DPRs submitted by UPJN: - He explained that the role of SPMG is that of a State channel before reaching NMCG on the central government level to ensure that DPRs are "approval-ready". - The evaluation the DPRs is actually done through "third party appraisal" composed of a consortium of IIT graduates on behalf of NMCG. - Said DPRs are strictly appraised both on the technical and financial sides. There are times that some components are curtailed to reduce project costs. • He said that slight problem of delays in the payment to project contractors and consultants. He explained that all requests for payments go through SPMG, which in turns submits the same to NMCG. When it comes to payments, there is the so-called "mother-child" accounts wherein the NMCG releases payments to the SPMG (mother account). However, there is a gap in the release of the payment to UPJN (child account) from SPMG side, which triggers delays also to the payments released to contractors or consultants.

3	On **SPV and HAM-PPP as the mode of implementation** for JICA projects	• Mr. Sinha commented that SPV may not be required for the project because of the following: - ULBs are not ready for SPV. Getting them ready will "create another problem" rather than solving a problem. - There may not be many PPP operators for STPs - There may not be revenue streams available for PPP proponents as water is readily available in U.P. considering that one source of revenue for the PPP proponent is the sale of treated water. - It will be difficult to impose proper tariff, as shown in resistance of the people even in a economically better off ULB like Lucknow. What more for other less affluent ULBs? - The NPPs receive financial subsidy for O&M of STPs through the 14th Finance Commission and such budget is allocated to UPJN for maintaining 50 STPs in the State of U.P.
4	On the **status of vacancy** in the technical posts in UPJN	• Mr. Sinha mentioned that there is very clear progress in this area. He said that the State has approved the following: - Recruitment of 727 junior engineers posts is on-going; - Recruitment of 100 assistant engineer posts in also on-going. • He said that full strength will be achieved by November to December this year as recruitment is in full swing, taking anywhere from three to four months.
5	On the **streamlining the decision making process** in tendering	• We discussed the tendering process, which Mr. Sinha described as very transparent. We went through the activities in procurement process, and came up with desired duration / time to complete each activity in the process.
6	**Adjournment** There being no other matter to be discussed, the meeting was adjourned at 1300H	

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