5.7 ENVIRONMENTAL MITIGATION PLAN

5.7.1 Introduction

The objective of preparing an Environmental Mitigation Plan (EMP) is to formulate measures, whose implementation will:

1) Mitigate adverse effects on various environmental components and resources as have been identified in the EIA study;
2) Protect environmental resources wherever possible;
3) Enhance the value of the environmental component wherever possible.

The EMP also includes a plan for monitoring so as to enable evaluation of the success or failure of environmental management measures and reorientation of the plan if found necessary. It is necessary that the resources required for the mitigation / protection / enhancement measures, as also for monitoring, are provided for in the cost estimates of the project so that their implementation is ensured.

The mitigation measures to be adopted cover both the construction phase and the operation phase. These measures normally are short term during the construction phase and long term during the operation phase.

It should be noted that individual mitigation measures implemented bit by bit, might only be partially effective. In addition, they may on occasion, result in further impacts on the local environment. It is recommended, therefore, that the undertaking contractors are required to produce an environmental management plan for all the proposed operations. To ensure that this plan is implemented adequately, a suitably qualified Environmental Engineer should be employed. This member of staff should report directly to the Management.

The community must be informed in advance about the benefits of the project and possible inconvenience to them. The implementing agency must seek co-operation of the local authorities, and execute the project effectively and efficiently. Success of the project depends upon participation and support of the community. Efforts need to be made to involve the population at different stages of project execution and in subsequent maintenance. These measures are proposed in a separate report. The construction work should be carefully planned and managed in order to cause minimum disturbances to people.

The consolidated mitigation measures are presented in Table 5.43. It contains details for both the construction and operation phases of the facilities. The main considerations are summarised below.

5.7.2 General Mitigation Measures

(1) Construction Phase

Following measures should be adopted in general for all activities:

1) Minimum damage to existing flora and fauna, structures, electricity and telephone cables
2) Minimum disturbance to the local activities and business should be ensured.
3) The sewer pipes should be stacked properly in a pre-determined location and should not be cluttered around blocking the pedestrian area alongside the roads.
4) Excavated earth should be prevented from getting washed into drainage channels, rivers and canals.
5) Surplus excavated earth should be disposed of immediately.

6) Measures should be taken to prevent direct discharge of polluted waters from construction activities into nalas / rivers.
7) Dust pollution should be controlled with the measures outlined in the Table 5.43.
8) Pavements and roads should be repaired immediately following the construction activity and the project and surrounding area should be restored to as near as possible pre-project conditions.
9) Adequate measures should be taken to minimise construction related noise.
10) Proper precautions should be taken against risk of accidents.

(2) Operation Phase

The following measures should be adopted in general for all activities:

1) The treated effluent quality should be maintained as per the discharge standards at all times.
2) Air and noise quality should be monitored and corrective action taken in case it exceeds applicable norms.
3) Proper precautions should be taken for the good health of the operators and the population.

5.7.3 Mitigation Measures for Sewerage

Selection of route for sewers is one of the most important activities in the pre-construction phase. In order to minimise adverse environmental impacts and for land acquisitions, to avoid resettlement and rehabilitation problems and in general, from a social point of view, to minimise severance and other problems due to pipe laying activities, the sewers will be laid along the roads.

All relevant codes of practice should be followed during detail engineering and construction phases to ensure pipelines safety and protection against corrosion.

The risk of accidents should be minimised by taking all the proper precautions during the sewer laying activity.

In some narrow roads and busy crossings, care must be taken for proper diversions of the traffic with the help of the traffic police.

Care should also be taken to avoid damaging existing infrastructure, telephone and power supply electric cabling, poles, etc. and thereby minimising the construction level impacts.

5.7.4 Mitigation Measures for Sewage Treatment Plant

(1) Treated Effluent Quality

First and foremost, care should be taken to ensure adequate treatment to meet the discharge standards. Since it is recommended in some cases that the treated wastewater be reused for irrigation purposes, the treated wastewater should meet the required standards for irrigation re-use and be conveyed upstream of an area that can be irrigated.

Treated effluent quality should be monitored carefully so as to meet the discharge standards effectively.

(2) Sludge Disposal

The sludge from the Rajapur, Kodara and Naini treatment plants should be disposed of in an environmentally acceptable manner. The sludge should be dewatered in sludge drying beds and the dried sludge should be used as fertiliser since it is biological in nature and has soil quality enhancing properties. However, the following precautions should be taken in the treatment, handling and disposal of the sludge:

1) To rake the wet sludge frequently and remove dried sludge immediately,
2) To facilitate proper drainage to avoid standing water leading to mosquito breeding,
3) To store the dry sludge in a covered place before its distribution to farmers,
4) To develop a green belt all around treatment plant, especially around sludge drying bed to reduce odour nuisance,
5) To take care that the operators handling the sludge are properly clothed with gloves and gum boots and will not handle the sludge with bare hands.

(3) Workers' Health

The workers' health should be monitored with medical check-ups at the time of joining and thereafter annually. In between, in case of any complaints, respiratory ailments, accidental chlorine leakage, etc., medical check-up should be conducted.

All the workers should be trained in first aid and emergency medical health should be available round the clock. It is also recommended from the safety point of view that one officer of the managerial cadre is available on duty round the clock.

5.7.5 Environmental Training

The Environmental Monitoring Plan will be successful only if it is implemented by trained and skilled staff. The training of the qualified staff should be necessary not only in day-to-day operation and maintenance of the treatment plant, but also in environmental aspects. National Environmental Engineering Research Institute, NEERI, Nagpur, and Central Pollution Control Board conduct training courses for environmental management, which will increase the capabilities of the staff in the Environmental Management Cell to execute independent plans for environmental management.

The training should include:

1) Basic concepts of pollution control techniques in the various methods of sewage treatment,
2) Operation and maintenance of the sewage treatment plant,
3) Emergency preparedness to handle adverse situations,
4) Principles of wastewater analysis,
5) Other environmental monitoring techniques,
6) Development of green belt and its maintenance,
7) Sewage farming,
8) Communication with farmers and general public.

This training is different from the mandatory training required for operation and maintenance of the Sewage Treatment Plants.

5.7.6 Block Cost Estimate for EMP

The impact mitigation measures suggested in this report naturally involve certain costs, but they are insignificant when compared to the total project cost.

The Environmental Mitigation Management Plan cost includes mainly the green belt development by compensatory plantation for loss of green cover along the sewer alignments and at the treatment plant site. Green cover along the sewers will be minimal, as most of the sewers will be laid under the roads. The green belt development cost is taken as Rs 30,000/ha for technical and biological reclamation of the disturbed area, planting of trees and planting of grass.

This cost estimate does not include: (i) the environmental monitoring, which is categorised with sewage treatment plant operation; (ii) the land acquisition costs and other compensation costs, which are categorised with the project investment costs; (iii) the costs of closing of trenches, cleaning of debris, soil compaction and relaying of roads which are included in the construction works.

For noise reduction, no special costs are involved. Silencers for vehicles should be included in the cost of vehicles. Design stage alterations for noise reductions such as enclosure buildings should be included in the civil works cost.

Details about the costs of the mitigation measures as defined above for the project components are as follows:

i. Green belt along sewer routes (provision of 10 ha)	Rs. 300,000
ii. 4 Sewage Treatment plants & SPS (provision of 15 ha)	Rs. 450,000
iii. Training of environmental officers	Rs. 1,500,000
TOTAL	**Rs. 2,250,000**

The Ministry of Environment and Forests' recommended costs have been adopted while compiling the block costs.

The construction phase EMP is to be incorporated at the planning and design stage and should form a part of the contract given out for construction (most of mitigation measures suggested would fall under this category).

Table 5.43 Environmental Mitigation Plan

	Environmental Issues	Adverse Impact	Nature of Impact	Proposed Mitigation Measures	Implementing Authority
1. CONSTRUCTION PHASE					
1.1	**Soil Quality**	• Due to excavation and earthwork: soil erosion, loss of top soil, silting and blocking of drainage/ nalas, which can cause slush; damage to existing structures • Due to compacting: loss of original quality, reduction in fertility	Significant and Permanent	• Stabilise all slopes with provision of benches/pitching • Avoid earthwork during monsoon • Provide adequate cross drainage facilities • Restrict traffic movements and use low ground pressure machines • Backfill and compact soil properly in the pipe trenches at the earliest. • Preserve top soil to be replaced after the completion of construction activity; avoid wet soils • Dispose of surplus earth after raising levels and refilling trenches, in low lying areas with proper compacting and planting of surfaces • Plant shrubs/trees/grass on exposed slopes and surfaces	Contractor/ UPJN
1.2	**Air Quality**	• Localised increase in dust due to excavation & earthwork • Temporary increase in the levels of SO_2/NO_x, from construction equipment and vehicles	Significant and Temporary	• Dust control through sprinkling / washing of construction sites and access roads particularly in congested areas • Use of dust cover over construction material • Dust collectors should be used in all drilling operations • Unnecessary idling of trucks should be avoided • Construction material trucks to be covered to minimise spills • Preventive maintenance of construction equipment and vehicles to meet emission standards • Roads to be black tapped at the earliest • Construction activities requiring heavy traffic street closing/ diversion to be carried out during night time • Excavated earth to be disposed to designated landfills speedily.	Contractor

	Environmental Issues	Adverse Impact	Nature of Impact	Proposed Mitigation Measures	Implementing Authority
1.3	**Noise Pollution**	• Increase in noise levels due to construction work, transport of construction materials etc.	Significant and Temporary	• Equipment emitting noise over 90 dB should be avoided / fitted with vibration isolators • Where residences are located within 200 m and in sensitive areas like hospitals, schools, zoos, noisy construction work should be carried out in day time only • Equipment maintenance strengthened to keep them low noise • Sound barriers should be installed if needed • Protective devices such as earplugs, muffs, etc to be provided to construction workers.	Contractor
1.4	**Water Quality/ Drainage**	• Increase in turbidity affecting surface water quality • Sanitary pollution	Significant	• Ensure steps to prevent earth and stone from silting up the nalas and drainage systems • Control run off and soil erosion through proper drainage channels and structures; improve existing cross drainage and provide extra cross drainage works wherever necessary • Provide adequate sanitation facilities to construction site workers • Carry out the sewer de-silting and rehabilitation works in phases. • Ensure proper disposal of de-silted material.	Contractor/ UPJN
1.5	**Loss of Natural Vegetation**	• Loss of avenue trees and natural vegetation, especially in the clearance for treatment plant site	Significant and Permanent	• Replantation on treatment plant and pumping station campuses as well as around the periphery (usually ten trees should be planted for every tree felled) • Replantation of avenue trees and ensuring proper care for growth	Contractor/ Forest Deptt./ UPJN

	Environmental Issues	Adverse Impact	Nature of Impact	Proposed Mitigation Measures	Implementing Authority
1.6	**Traffic**	• Traffic jams, bottlenecks, delays and inconveniences to general public • Serious disruptions of vehicular traffic, pedestrian access and commerce	Significant and Temporary	• Co-ordinate and plan all activities in advance • Adequate actions to direct traffic in consultation with highway and traffic police • Minimise vehicle movements • Preference for unused or low traffic roads • Construction of temporary roads and diversion of traffic • Use local construction materials to avoid long distance transportation, especially of earth and stones • Seek public co-operation through public awareness	Contractor/ UPJN/ Traffic Police
1.7	**Social Disruptions**	• Disruptions in utility services • Social hostility due to employment of outsiders on construction activities	Significant and Temporary	• Minimise interruptions to services through proper planning and scheduling of activities and strong inter-departmental co-ordination • Preference should be given to local labour/skilled persons during construction, operation and maintenance	Traffic Police/ AJS/ADA/ UPJN/ Contractor
1.8	**Risk of Accidents**	• Endangering lives of people/workers during construction due to inadequate safety measures	Significant	• Adequate traffic control measures should be taken • Sign board warning presence of open sewer trench • Guard rails to protect pedestrians • Strong safety policy for workers; protective helmets to be provided	Contractor/ UPJN
1.9	**Aesthetic Conditions**	• Visually anaesthetic conditions due to cluttering of waste, and spoils, dug up roads and pavements	Significant and Temporary	• Enhance aesthetics through proper housekeeping of construction site • Disposal of construction wastes at the approved sites quickly • Repair pavements and roads after sewer laying work is completed • Completing the construction activity by removing all spoils	Contractor/ UPJN
1.10	**Land Acquisition**	• Inadequate compensation	Significant and Permanent	• Advance realistic payments to be made to affected population (estimation for compensation for land and property should be made on the prevailing market rates)	UPJN

	Environmental Issues	Adverse Impact	Nature of Impact	Proposed Mitigation Measures	Implementing Authority
1.11	**Existing Infrastructures**	Site clearance and works: • Damage existing structures, • Affect electricity supply and telecommunication lines, • Clutter road sides with pipes, • Cause general nuisance to public.	Not Significant and temporary	• Minimize damage to existing structures, flora and fauna, avenue trees and other natural vegetation, electricity & telephone lines and other infrastructure services • Cleared earth and debris should be properly disposed off • Storage sites should be identified for stacking pipes so as not to clutter road sides	Contractor
1.12	**Construction Camps**	• Prevalence of unsanitary conditions and practices like open air defecation • Possibilities of public health problems • Piling of garbage from workers	Significant and Temporary	• Adequate measures such as provision of septic tanks/pit latrines around the construction camp sites • Provision of clean drinking water to potable water standards • Collection of garbage in garbage cans in fixed places and disposal of it regularly	Contractor
1.13	**Public and Workers' Health**	• Adverse health of workers due to unsanitary practices and spreading of diseases from vectors	Significant and Temporary	• Workers are the immediately affected people • Proper sanitation and drinking water should be provided • Medical facilities to be provided to prevent communicable diseases	Contractor/ UPJN

	Environmental Issues	Adverse Impact	Nature of Impact	Proposed Mitigation Measures	Implementing Authority
2. OPERATION PHASE					
2.1	**Air Quality**	• Problems of bad odour from the treatment plant	Significant	• Some bad odour from sewage treatment plant is unavoidable; however, steps should be taken to minimise odour by proper maintenance and housekeeping of the treatment plant	UPJN/ AJS
2.2	**Water Quality**	• Overflow of sewers and breakdown of treatment plant leading to failure in meeting the requisite standards • Poor performance will affect the proposed reuse for irrigation, and also the receiving water body	Significant	• Preventive maintenance of all components should be performed regularly • Relevant standby equipment and spare parts should be provided; standby power generation should be provided at pumping stations, if any • Proper response plan must be prepared and all workers must be trained to tackle emergencies	UPJN/ AJS
2.3	**Sludge Treatment & Disposal**	• Improper treatment of sludge could lead to putrefaction and other related problems such as bad odour, health effects, etc.	Significant	• Sludge should be treated properly and dewatered • Dried sludge should be disposed of in a specified landfill site with proper precautions or given for land application to farmers, if it can be handled properly by them	UPJN/ AJS
2.4	**Aesthetic**	• Pumping stations, treatment work site might pose an unattractive sight but it affects only close residents	Not significant	• Sewage plant should be located away from the densely populated residential areas • Plantation of trees in and around the pumping stations/treatment plant would improve the aesthetics	UPJN/ AJS
2.5	**Public Health**	• Mixing of sewage with drinking water • Outbreak of waterborne diseases Unhealthy conditions: mosquito breeding over sludge drying beds, etc.	Significant	• Any such health risk to public should be minimised by proper maintenance and operation of sewers, pumping stations, treatment plant, etc. • In case of failure, inform relevant authorities to alert public at risk so that precautions might be taken	UPJN/ AJS

	Environmental Issues	Adverse Impact	Nature of Impact	Proposed Mitigation Measures	Implementing Authority
2.6	**Workers Health & Safety**	• Workers may be inflicted by endemic & other diseases such as malaria or respiratory ailments • Accidents and loss of lives may occur during sewer cleaning & maintenance • Non availability of emergency medical facilities at all times during day & night	Significant and Permanent	• Proper house keeping of the plant to prevent unsanitary conditions • Regular medical check ups and immediate treatment of affected workers • Maintenance personnel should not perform dangerous tasks when alone, enter the manholes without checking for gas and without proper protective clothing, enter the manholes without ropes and harnesses firmly tied • Manholes should not be left open unattended especially in busy roads, near schools and residential areas	UPJN/ AJS

5.7.7 Risk Analysis & Contingency Plan

The sanitation project comprises sewer laying, construction of pumping stations and sewage treatment plants and their operation. The risk involved in laying the sewers is mainly for pipelines of DN 600 and larger, which require lifting by cranes. The risk of mechanical equipment failure and thereby occurrence of accidents cannot be overlooked.

Contingency measures plans have been prepared for:

1) Sewage treatment works that could reasonably be expected to cause significant environmental impacts as a consequence of operational disruption (i.e. maintenance, etc. or breakdown);
2) Accidents which may occur while laying sewers or during construction of the treatment works;
3) Discharge of sub-standard wastewater into the environment from treatment plant that could cause a significant public health impact, and which therefore requires a continuous system of influent/effluent monitoring to identify potential problems as and when they arise.

In the preparation of the contingency measures:

- The most likely causes of process disruption/breakdown have been identified;
- An attempt has been made to estimate their probability of occurrence;
- The possible resultant environmental adverse impacts are presented;
- The recommended courses of action to minimise the severity of the impacts have been highlighted;
- The responsible agency that will act in case of emergencies has been indicated.

Table 5.44 gives the potential risks due to construction, operation and maintenance and corrective actions. The major risks that can result in breakdowns and disruptions are described below.

(1) Power Supply

One of the main reasons for disruption during the operation phase of the treatment works is very likely to be power cuts, which are routine in Allahabad.

It is recommended that the new treatment plants and pumping stations receive their power supply through dedicated feeders from two different power sources. It is also suggested that standby power generators are provided to ensure at least minimum services in case of prolonged power cuts, and also that cost of diesel be built into the O&M costs.

Also the sewage treatment technology chosen should be able to survive short spells of power cuts.

(2) E&M Equipment Disruptions

Operational disruption due to E&M equipment can be avoided by spare parts and stand-by provision available at site.

O&M instructions and manuals should be provided by the contractor of the treatment plant with training of the operation staff for the new plant.

Table 5.44 Risk Assessment and Contingency Plan

	Works	Risks	Impact	Corrective Action Plan	Responsibility
1. ACCIDENTS RELATED TO CONSTRUCTION					
1.1	**Sewerage**	• Accidents due to pedestrians falling into the open trenches	Significant	• Excavated trenches should be provided with adequate barricades • Signboards in bold letters to be displayed in prominent places • Solid planks with guard rails should be provided across the trenches for crossing	Contractor/ UPJN
		• Accidents due to vehicular traffic and risk to pedestrians, workers, vehicle drivers	Significant	• Traffic diversions and signboards should be displayed prominently • Proper lighting should be provided at night time • Co-ordination with traffic police in managing traffic	Contractor/ UPJN
		• Accidents due to failure of machinery such as cranes	Significant	• Workers to be trained on contingency management • Emergency medical help should be available immediately • The contractor should have a proper safety policy issued to workers and should strictly comply with all the safety regulations	Contractor/ UPJN
		• Accidents due to carelessness of workers	Significant	• Workers should be provided with protective clothing and helmets • Workers should not be allowed to work when alone • Workers should be trained on first aid • Emergency medical help should be available immediately	Contractor/ UPJN
		• Breakage's of water supply pipes and services connections	Significant	• Inform public in advance about works • Make temporary arrangements for not disturbing water supply in case some pipes have to be displaced	Contractor/ UPJN
1.2	**Treatment Plant & Pumping Stations**	• Risk of accidents and loss of limb and life	Significant	• During construction, effective safety and warning measures including all the above mentioned safety precautions should be followed by the contractor and UPJN should insist on compliance by contractor	Contractor/ UPJN

	Works	Risks	Impact	Corrective Action Plan	Responsibility
				• Lighting of construction site and safety signs to be installed	
2. ACCIDENTS RELATED TO OPERATION & MAINTENANCE					
2.1	**Sewers**	• Accidents to operator/UPJN/UPJS personnel	Significant	• Operators should not enter the manholes when alone • Operators should check for gases before entering the manholes • Operators should wear protective clothing, helmets and masks • Operators should enter the manhole by lowering themselves with a rope or a harness tied safely above • Manhole covers should be lifted using proper lifting keys • Emergency medical services should be available round the clock • At least one person of Management level should be on duty at all times	Operator/ UPJN/ AJS
2.2	**Treatment Plant**	• Breakdown of wastewater treatment units (or overall poor condition)	Not Significant	• The treatment plant will require regular maintenance (preventive maintenance rather than reactive maintenance should be insisted upon)	Operator/ UPJN/ AJS
		• Breakdown of mechanical equipment	Not Significant	• Adequate standby for pumps and motors should be provided • Adequate quantities of reliable spare parts should be available on site • Presence of mechanics to take corrective action • All standby equipment should be regularly checked to ensure full working order	Operator/ UPJN/ AJS
		Maintenance of sludge drying beds: • risks of perpetuation of mosquitoes and other vectors • risk of bad odours • risk of groundwater pollution.	Not Significant	• Sludge drying should be maintained properly • Wet sludge should be raked frequently and dry sludge should be removed and stored/disposed off • Ensure proper drainage • Operator should ensure that there is no standing water on the SDB	Operator/ UPJN/ AJS

	Works	Risks	Impact	Corrective Action Plan	Responsibility
2.3	**Treatment Plant (continued)**	• Failure of biological process due to toxicity, poor maintenance, etc. (contamination of the effluent with toxic industrial effluents is the major reason for failure of biological treatment systems)	Significant	• The secondary biological treatment should be by passed and the water should be discharged after primary treatment only • All relevant authorities should be informed on potential health risk to public • The biological process should be revived • Inoculation or addition of nutrients should be carried out, if needed	Operator/ UPJN/ AJS
2.4	**Pumping Stations**	• Breakdown of pumping stations leading to flooding and consequent public health problems as well as general nuisance to public	Significant	• Pumping stations should be avoided as far as possible and in cases where it is not possible, their numbers should be minimised • All pumps should be wear resistant • Standby pumps should be provided and they should be regularly checked to ensure full working condition when needed • Safety overflow should be provided at all pumping stations leading to a ditch or preferable a drain. These emergency overflows should be designed to ensure minimum environmental nuisance, in case of use	Operator/ UPJN/ AJS
		• Power failure leading to flooding of sewage on streets and other problems	Significant	• Power supply to all SPS and STPs should be through two dedicated feeders from two different supply sources • Standby diesel generators should be provided to cater for a minimum of 1.5 times the average dry weather flow so as to avoid flooding • Diesel for DG operation should be available • Emergency overflows as above, should also be provided along with the DG sets as a precaution	Operator/ UPJN/ AJS

5.8 ENVIRONMENTAL MANAGEMENT TRAINING AND MONITORING PLAN

5.8.1 General

The success of the Environmental Mitigation Plan depends on the efficiency of the organisational set up responsible for the implementation of the programme.

For a sanitation project of this magnitude, the Environmental Management Plan needs to be entrusted, in both the construction and the operation phases, to an Environmental Management Group, under and regular monitoring of various environmental parameters is also necessary to evaluate the effectiveness of the management programme so that necessary corrective measures could be taken in case there are some drawbacks in the proposed programme.

Thus, the Environmental Management Plan will consist of:

- ⇒ Setting up an Environmental Management Group to implement the mitigation measures in operation phase;
- ⇒ Ensuring a proper operation and maintenance of the treatment works;
- ⇒ Ensuring a proper maintenance of the sludge drying beds and the disposal of dry chemical sludge in a proper landfill site;
- ⇒ Monitoring the waste and treated water quality;
- ⇒ Monitoring the built in pollution control equipment, for vehicles and equipment;
- ⇒ Maintaining tree plantations around the pumping stations and the periphery of the sewage treatment plant.

Details of the Management Group and the monitoring requirements needed to ensure that construction and operation follow best environmental practices are given in this section.

5.8.2 Environmental Management Group

The Environmental Management Group (EMG) will be a part of Department F -Support of the revamped AJS or any other agency, which would be overall in charge of the O&M of the facilities created under this Project. This staff will be in charge of the overall management of the environmental aspects of the Project.

Under the supervision of an Environmental Engineer of the rank of an Executive Engineer, the EMG will comprise of an Environmental Scientist, a Chemist and a Biologist, plus three assistants, as shown in Figure 5.27.

The main functions of the EMG will be:

1) Collecting water, air, soil and sludge samples;
2) Analysing the collected samples or getting analysis done from outside sources;
3) Preparing and updating a database of environmental parameters;
4) Implementing the environmental control and protective measures;
5) Controlling the sludge treatment, disposal and re-use;
6) Collecting statistics of health of workers and the population of surrounding areas;
7) Ensuring the development and maintenance of the green belts;
8) Monitoring the progress of implementation of Environmental Management Programme;
9) Co-ordinating the environment related activities within the project as well as with outside agencies.

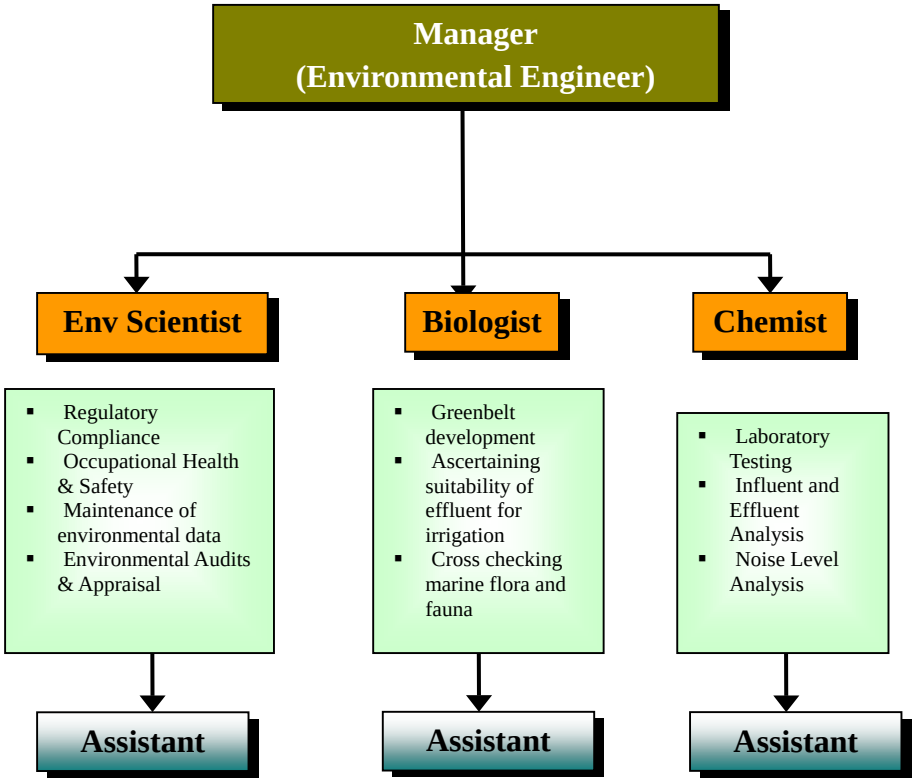

Figure 5.27 Environmental Management

5.8.3 Monitoring Plan

To evaluate the effectiveness of the Environmental Management Plan, regular monitoring of the important environmental parameters, computerisation of data will be taken up by EMG with or without the help of outside agencies. The schedule duration and parameters to be monitored by the environmental team are described below and summarised in Table 5.45.

Water Quality

The sampling of various inlets and outlets will be carried out for analysis of relevant parameters. The analysis will be done once in a month both at the inlet and outlet of the treatment plant and at strategic locations within the treatment plant. Some of the parameters will be tested daily. This practice would help EMG evaluate the performance of individual units of the sewage treatment plant and take corrective measures if the results are not satisfactory.

Air Quality

Ambient air quality should be monitored for SO_2, NO_x, SPM, etc. At the STP, H_2S and CH_4 should be monitored. Instruments like high volume air samplers and other monitoring kits should be used for the purpose of air quality monitoring. For the operation period, monitoring points should be fixed in consultation with the UPPCB.

Noise Monitoring

Noise levels should be monitored in working environment, main noise producing sources such as the DG sets, pumping stations, over the boundary and around the sewage treatment plant.

Green Belt and Compensatory Plantation

Continuous vigil and monitoring of the green belt around the treatment plant and trees planted around the pumping stations as well as the avenue trees planted, should be done for its growth and well being.

5.8.4 Environmental Testing Laboratory

The Existing laboratory at Naini should be upgraded for routine analysis of raw sewage and treated wastewater as well as for ambient air quality and sludge analysis. The biological testing facility should be provided in this laboratory in addition to chemical analysis of water. The record of analyses should be maintained at the plant site for all the parameters mentioned in the Monitoring Plan.

The cost of the installation of the laboratory and carrying out of the various analyses will be included in the investment and operation cost of the sewage treatment plant. This is the normal practice and all major sewage treatment works have such a facility and the same is recommended to be applied for this project as well.

5.8.5 Environmental Training

The environmental monitoring plan will be successful only if it is implemented by trained and skilled staff. The training of the qualified staff should be necessary not only in day-to-day operation and maintenance of the treatment plant, but also in environmental aspects. National Environmental Engineering Research Institute, NEERI, Nagpur, and Central Pollution Control Board conduct training courses for Environmental Management, which will increase the capabilities of the staff in the Environmental Management Group to execute independent plans for environmental management.

It will be essential to involve the staff who will be responsible for the execution of the Environmental Management Plan, in the construction phase, as well as to train the staff in practising the mitigation actions and the day-to-day monitoring programme during the operation phase of the water supply units.

The training should include:

1) Basic concepts of pollution control techniques in the various methods of sewage treatment,
2) Operation and maintenance of the sewage treatment plant,
3) Emergency preparedness to handle adverse situations,
4) Principles of wastewater analysis,
5) Other environmental monitoring techniques,
6) Development of green belt and its maintenance,
7) Sewage farming,
8) Communication with farmers and general public.

This training is different from the mandatory training required for operation and maintenance of the sewage treatment plants.

Table 5.45 Environmental Monitoring Plan

Environmental Quality	Monitoring Parameters	Schedule and Duration of Monitoring
Waste and Treated Water Quality	• All physico-chemical and bacteriological parameters as per UPPCB standards; pH, temperature, TDS, TSS, DO, BOD, COD, heavy metals and *E coli*. etc.	• Once a week • Monitoring point will be the inlet and outlet of the treatment plant • Technical criteria should be based on UPPCB standards/ guidelines
Ambient Groundwater	• pH, TDS, nitrates, fluorides, nitrites, heavy metals and *Faecal Coli*	• Once every three months • At sewage treatment plant location near sludge drying beds • Technical criteria should be based on UPPCB standards/ guidelines
Ambient Water Quality of Receiving Body	• pH, TDS, TSS, BOD, COD, hardness, nitrates, heavy metals	• Once a month • At eventual discharge points of all 4 STPs • Technical criteria should be based on UPPCB standards/ guidelines
Ambient Air Quality	• SPM, NO_x, CO, SO_2, H_2S, CH_4	• Construction period: 3 times a year (January, May and September) Monitoring point will be near construction sites and residential areas • Operation period: 24 hour samples, for one week, once a year; Monitoring points will be fixed in consultation with the UPPCB • Technical criteria should be based on UPPCB standards/ guidelines
Ambient Noise	• Noise level	• Construction period: 12 times a year, every hour each time including day and night; Monitoring points should be near construction sites and sensitive areas • Operation period: 4 times a year ad-hoc monitoring will be undertaken as appropriate; Monitoring points should be at pumping stations, near treatment plants • Technical criteria should be based on UPPCB standards/ guidelines
General Meteorology	• Ambient temperature, relative humidity, wind direction and speed	• Permanent
Soil Quality	• SAR	• Once every six months • From lands where treated effluent is being used for irrigation

5.8.6 Conclusions

(1) General

The Environmental Impact Assessment (EIA) of the priority sewerage projects of Allahabad has considered the potential impacts on the environment of the proposed facilities under the Project.
Possible impacts of construction and operation phases of project engineering activities on various elements of environment including air quality, noise quality, water quality, soil quality, landuse profile, traffic, ecology, socio-economic impacts on residents, health impacts on people and workers, etc. have been considered while carrying out this EIA Study.

In this EIA study, concern is expressed about the pollution of Ganga and Yamuna by domestic wastewater, and the inadequacy of the existing collection and the treatment facility. The rapid increase in population and lack of planned expansion of the city has led to the infrastructure provision always lagging behind and continually trying to catch up with urban development.

(2) Beneficial Impacts

The most obvious and significant environmental impact of the project will be the improvement expected in public health and quality of life with adequate sewerage in the project area and collection and treatment of the sewage before disposal. This would eliminate flows of untreated wastewater in the open drains and prevent accumulation of sewage and sullage along the road side in the unsewered areas, which emanates foul smells and is unsightly.

Also sewerage and proper treatment and disposal of sewage would lower the risk of incidence of waterborne diseases. This would substantially enhance the public health and the visual quality of the city. With the functioning of the sewerage system, the city will be able to tackle the influx of tourists better. The overall aesthetics of the city would improve which will have a positive impact on the economics of the tourism industry.

In addition, treatment of wastewater would improve the quality of the receiving water bodies, especially river Ganga and Yamuna. It will also benefit the population downstream who use river Ganga in various aspects of their life. The impact on river water quality would be positive as presently most of the wastewater is being discharged into rivers without adequate treatment. Further, prevention of untreated wastewater from flowing in the open drains would reduce the groundwater contamination due to seepage. Sewerage and treatment of sewage would reduce the need for on site sanitation with ground soakage, which would also reduce the groundwater pollution.

(3) Adverse Impacts

The impact assessment study has identified adverse impacts, the vast majority of which are temporary, and restricted to the construction phase. It is inevitable that such a large civil engineering project will result in some adverse impacts.

It should be noted that the majority of impacts would occur to the local, indigenous population of the project area. Impacts such as noise and dust generation, traffic disruption will occur to those living in proximity. Conversion of agricultural land for non-productive use will occur for the site acquired for the sewage treatment plant.

The negative impacts expected of the project are temporary disruption of normal activities during the construction phase due to laying sewers and construction of the treatment plants. Activities related to laying of sewers and the construction of treatment plants will result in the conversion of agricultural land. Laying of sewers in the congested and heavy traffic areas within city will result in some severance for the general public. The sewer laying will also affect the traffic flow.

A limited number of long term or permanent impacts that are predicted to be at a rather lower scale and related mitigation measures comprising both the construction and operation phase of the works have been identified.

(4) Overall Impact

The overall impact of the project is environmentally beneficial.

CHAPTER 6

COST ESTIMATION AND IMPLEMENTATION PROGRAMME

CHAPTER 6 COST ESTIMATION AND IMPLEMENTATION PROGRAMME

6.1 CAPITAL COST ESTIMATION OF THE PRIORITY PROJECTS

Cost estimates for various works are worked out on the basis of prevailing Schedule of Rates and market rates. Rates for land acquisition are obtained from Finance and Revenue Department, Govt. of Uttar Pradesh. All the figures are in Rs.

Unit prices for the estimate of capital costs are, in principle, derived from the list of prices provided by UPJN. However, prices not provided by UPJN are calculated using Allahabad rates on the basis of Delhi Schedule of Rates taking localities and deflator into account. Furthermore, prices of items such as sewer pipes, reinforcing steel bars, manhole covers and so on that are not found in UPJN Schedule or DSR are obtained by quotation. The following are cost estimation conditions.

1) The rates assumed for major civil works are based on UPJN Schedule of Rates for Allahabad and market rates.
   - To apply schedule of rates provided by UPJN in principle.
   - For rates of items not provided by UPJN, to use modified rates based on Delhi Schedule of Rates.
   - To use market prices for items not available in (1) and (2).
2) Costing of electrical equipment is based on the price list of standard suppliers.
3) Costing of the pump houses is based on actual quantities worked out from preliminary design.
4) Costing of pumps and motors is based on the price of reputed suppliers, and other facilities like screen, pipe, valves etc. are based on prevailing market rates.
5) Current market rates have been considered for pipes, reinforcement steel, structural steel and specialized items like geo-synthetic etc.
6) For STPs based on UASB technology, costs have been calculated on the basis of preliminary design of process units.
7) Physical contingencies: 5% of capital cost
8) Engineering costs (detailed design (6%) and project management (5%)): 11 % of capital cost
9) Project administration: 5 %, including the cost of "Environment Monitoring Plan", which is discussed in the section on Environmental Impact Assessment.

The capital costs of each component are provided in the relevant Chapters and the abstract of cost estimation is shown in Table 6.1.

6.2 IMPLEMENTATION PROGRAMME

In the F/S, a detailed list of the works identified for implementation of the priority projects has been provided.

The implementation programme for the priority projects in Allahabad (Table 6.2) is prepared considering the following assumptions.

1) Necessary technical and financial sanctions and inter government agreement (between Japanese Government and Indian Government) shall be finalised within 2005.
2) Process of appointment of Project Management Consultant for the project shall start by July 2006 by NRCD, Ministry of Environment and Forests, Government of India.
3) Appointment of consultants for detailed engineering and preparation of detailed project reports and tender documents for project component shall be completed within 2006.
4) Actual execution of various priority project components shall start from 2007.
5) During execution, various project components shall be executed in parallel.
6) UPJN, Lucknow, will acquire 100 % of the land required for construction of proposed sewage

treatment plants and pumping stations before the commencement of tendering.

6.3 OPERATION & MAINTENANCE COST ESTIMATION

The following is the summary of the basis of preliminary estimation of operation & maintenance (O&M) cost for the proposed sewerage system.

(1) Estimation Conditions

i) Trunk sewers and rising mains

- Annual maintenance cost of trunk sewers: @ 0.5% of capital cost (New & Replacement)
- Annual maintenance cost of rising mains: @ 0.25% of capital cost
- Annual maintenance cost of branch sewers: @ 0.5% of capital cost
- Annual operation cost: manpower cost
- Manpower cost - As per actual salaries and proposed staff requirement [*1]
- The capital cost of existing and sanctioned sewers is estimated based on unit cost of proposed facilities or Master Plan (M/P).

ii) Pumping stations

- Power cost (required power) - Rs. 3.25 per unit
- Diesel cost (for power cut) - As per market rate
- Annual power cost is estimated based on average flow
- Maintenance of civil works: @ 1.5% of capital cost of civil works
- Maintenance of mechanical & electrical (M&E) works: @ 3% of capital cost of M&E works
- Manpower cost - As per actual salaries and proposed staff requirement *1
- The capital costs of existing and sanctioned PSs are estimated based on unit cost of proposed facilities or M/P.

iii) Treatment plants

- Power cost (required power) - Rs. 3.25 per unit
- Gas power generator installed in the STP will be used during power cut
- Chemicals – actual cost
- Maintenance of civil works @ 1.5% of capital cost of civil works
- Maintenance of M&E works @ 3% of capital cost of M&E works
- Manpower cost - As per actual salaries and proposed staff requirement *1
- The capital costs of existing and sanctioned STPs are estimated based on unit cost of proposed facilities or M/P.

Note: [*1] The manpower requirement of O&M for sewers, pumping stations and treatment plants for 2015 is proposed in the PART IV of VOLUME IV-3, Institutional Development Programme.

(2) Facilities Considering for O&M Cost Estimation

The O&M costs of all facilities including existing, sanctioned and proposed facilities are estimated.

(3) Power Supply Conditions

The O&M costs in following two cases in terms of power supply conditions are estimated.

- Operation by power from grid (24 hours a day)

- Operation by power from grid (20 hours a day) and diesel (4 hours)

(4) Estimation Results

Table 6.3 presents annual O&M costs of all major facilities including existing, sanctioned and proposed facilities for 2015 and the following table summarises annual O&M costs for 2015.

Summary of Annual O&M Costs in 2015 (Allahabad)

(1,000 Rs./year)

Facility	Case-1 Grid Power Supply only	Case-2 Grid Power Supply supplemented by Diesel
(1) Sewer and Rising Mains	10,374	10,374
(2) Pumping Stations	44,276	49,524
(3) Sewage Treatment Plants	90,014	90,214
Total	144,663	150,111

Note: The O&M cost includes all major existing, sanctioned and proposed facilities.

Table 6.1 Abstract of Project Cost Estimation

	Sewerage District	Capital Cost (Rs.)	Contingencies	Detailed Design	Supervision	Project Administration	Total Cost (Rs.)	Land Acquisition (Rs.)	Total Project Cost (Rs.)
			5%	6%	5%	5%			
SEWERAGE SCHEMES									
Installation / Replacement of Trunk Sewer									
Trunk Sewers in District A	A	88,063,000	4,403,000	5,284,000	4,403,000	4,403,000	106,556,000	0	106,556,000
Trunk Sewers in District B	B	49,976,000	2,499,000	2,999,000	2,499,000	2,499,000	60,472,000	0	60,472,000
Trunk Sewers in District D	D	110,958,000	5,548,000	6,657,000	5,548,000	5,548,000	134,259,000	0	134,259,000
Construction of Sewerage Pumping Station									
Ghaghar Nala PS and rising main	B	117,959,000	5,898,000	7,078,000	5,898,000	5,898,000	142,731,000	963,000	143,694,000
Sasur Khaderi PS and rising main	B	40,676,000	2,034,000	2,441,000	2,034,000	2,034,000	49,219,000	963,000	50,182,000
Construction of Sewerage Treatment Plant									
Numaya Dahi STP	B	327,920,000	16,396,000	19,675,000	16,396,000	16,396,000	396,783,000	78,287,000	475,070,000
Rajapur STP	D	583,680,000	29,184,000	35,021,000	29,184,000	29,184,000	706,253,000	32,752,000	739,005,000
Kodara STP	E	85,520,000	4,276,000	5,131,000	4,276,000	4,276,000	103,479,000	10,115,000	113,594,000
Ponghat STP	E	83,220,000	4,161,000	4,993,000	4,161,000	4,161,000	100,696,000	18,592,000	119,288,000
Desilting of Existing Trunk Sewer									
Trunk Sewers in District A	A	15,950,000	798,000	957,000	798,000	798,000	19,301,000	0	19,301,000
Trunk Sewers in District D	D	21,990,000	1,100,000	1,319,000	1,100,000	1,100,000	26,609,000	0	26,609,000
Rehabilitation of Existing Trunk Sewer									
Trunk Sewers in District A	A	120,410,000	6,021,000	7,225,000	6,021,000	6,021,000	145,698,000	0	145,698,000
Rehabiltation/Upgrading of Existing Pumping Station									
Chachar Nala PS	A	16,820,000	841,000	1,009,000	841,000	841,000	20,352,000	4,800,000	25,152,000
Gaughat PS	A	28,100,000	1,405,000	1,686,000	1,405,000	1,405,000	34,001,000	0	34,001,000
Lukerganj PS	B	16,760,000	838,000	1,006,000	838,000	838,000	20,280,000	0	20,280,000
Daraganj PS	D	10,510,000	526,000	631,000	526,000	526,000	12,719,000	0	12,719,000
Allapur PS	D	13,840,000	692,000	830,000	692,000	692,000	16,746,000	0	16,746,000
Morigate PS and rising main	D	39,910,000	1,996,000	2,395,000	1,996,000	1,996,000	48,293,000	16,800,000	65,093,000
Alopibagh PS and rising main	D	61,050,000	3,053,000	3,663,000	3,053,000	3,053,000	73,872,000	0	73,872,000
Mumfordganj PS and rising main	D	74,870,000	3,744,000	4,492,000	3,744,000	3,744,000	90,594,000	45,500,000	136,094,000
Upgrading of Existing Treatment Plant									
Naini STP (ASP, 20mld)	A	151,630,000	7,582,000	9,098,000	7,582,000	7,582,000	183,474,000	0	183,474,000
Total		2,059,812,000	102,995,000	123,590,000	102,995,000	102,995,000	2,492,387,000	208,772,000	2,701,159,000

Table 6.2 Implementation Schedule of Priority Projects (Allahabad)

(Unit:Rs.)

	Capital Cost	Detailed Design	Total Project Cost	2007	2008	2009	2010	2011	2012
				Capital and Detailed Design Cost Schedule					
Installstion of Trunk Sewer									
Trunk Sewers in District A	88,063,000	5,284,000	106,556,000	5,284,000	17,613,000	17,613,000	17,613,000	26,419,000	8,805,000
Trunk Sewers in District B	49,976,000	2,999,000	60,472,000	2,999,000	9,995,000	9,995,000	9,995,000	14,993,000	4,998,000
Trunk Sewers in District D	110,958,000	6,657,000	134,259,000	6,657,000	22,192,000	22,192,000	22,192,000	33,287,000	11,095,000
Construction of Sewerage Pumping Station									
Ghaghar Nala PS	117,959,000	7,078,000	143,694,000			7,078,000	39,320,000	39,320,000	39,319,000
Sasur Khaderi PS	40,676,000	2,441,000	50,182,000			2,441,000	13,559,000	13,559,000	13,558,000
Construction of Sewerage Treatment Plant									
Numaya Dahi STP	327,920,000	19,675,000	475,070,000	19,675,000	65,584,000	65,584,000	65,584,000	98,376,000	32,792,000
Rajapur STP	583,680,000	35,021,000	739,005,000	35,021,000	116,736,000	134,246,000	116,736,000	175,104,000	40,858,000
Kodara STP	85,520,000	5,131,000	113,594,000	5,131,000	28,507,000	28,507,000	28,506,000		
Ponghat Nala STP	83,220,000	4,993,000	119,288,000	4,993,000	27,740,000	27,740,000	27,740,000		
Desilting of Existing Trunk Sewer									
Trunk Sewers in District A	15,950,000	957,000	19,301,000	957,000	7,975,000	7,975,000			
Trunk Sewers in District D	21,990,000	1,319,000	26,609,000	1,319,000	10,995,000	10,995,000			
Rehabiltation of Existing Trunk Sewer									
Trunk Sewers in District A	120,410,000	7,225,000	145,698,000	7,225,000	60,205,000	60,205,000			
Rehabiltation of Existing Pumping Station									
Chachar Nala PS	16,820,000	1,009,000	25,152,000	1,009,000	8,410,000	8,410,000			
Gaughat PS	28,100,000	1,686,000	34,001,000	1,686,000	14,050,000	14,050,000			
Lukerganj PS	16,760,000	1,006,000	20,280,000	1,006,000	8,380,000	8,380,000			
Daraganj PS	10,510,000	631,000	12,719,000	631,000	5,255,000	5,255,000			
Allapur PS	13,840,000	830,000	16,746,000	830,000	6,920,000	6,920,000			
Morigate Nala PS	39,910,000	2,395,000	65,093,000	2,395,000	19,955,000	19,955,000			
Alopibagh PS	61,050,000	3,663,000	73,872,000				3,663,000	30,525,000	30,525,000
Mumfordganj PS	74,870,000	4,492,000	136,094,000				4,492,000	37,435,000	37,435,000
Upgrading of Existing Treatment Plant									
Upgrading of Existing Treatment Plant	151,630,000	9,098,000	183,474,000	9,098,000	75,815,000	75,815,000			
Total	2,059,812,000	123,590,000	2,701,159,000	105,916,000	506,327,000	533,356,000	349,400,000	469,018,000	219,385,000

(Unit:million Rs.)

Items		Total	2007	2008	2008	2009	2009	2010
Capital Cost		2,059.83	0.00	506.33	523.84	341.25	469.02	219.39
Detailed Design		123.60	105.92	0.00	9.52	8.16	0.00	0.00
Contingencies		102.99	0.00	25.32	26.19	17.06	23.45	10.97
Supervision		102.99	0.00	25.32	26.19	17.06	23.45	10.97
ProjectAdmin		102.99	0.00	25.32	26.19	17.06	23.45	10.97
Total Cost		2,492.40	105.92	582.29	611.93	400.59	539.37	252.30
Land Acquisition		208.77	161.34	0.00	1.93	45.50	0.00	0.00
Total Project Cost		2,701.17	267.26	582.29	613.86	446.09	539.37	252.30

Detaied Design
Construction Cost

Table 6.3 Operation and Maintenance Cost Estimation

									Power condition : Grid power supply (24 hours a day)					Power Condition : Grid power (20 hours a day) and diesel power (4 hours) supply						Assumptions and Conditions for Estimation		
		Status	Sewerage District	Ave. Capacity at 2015 (mld)	Diameter (mm)	Length (m)	Unit Cost (Rs./m)	**Capital Cost (Thousand Rs.)**	Staff Cost (Thousand Rs. /year)[1]			**Maintenance Cost (Thousand Rs.)**	**Total O&M Cost (Thousand Rs. /year)**	Staff Cost (Thousand Rs. /year)				**Maintenance Cost (Thousand Rs.)**	**Total O&M Cost (Thousand Rs. /year)**	Basis of Capital Cost	Basis of Operation Cost	Basis of Maintenance Cost
1	**Trunk Sewer**																					
	Existing (District A)	E	A		600-1400	12,250	see relevant part	143,014				715	715					715	715	M/P Unit cost base		@ 0.5 %
	Existing (District D)	E	D		500-1000	8,000	see relevant part	275,252				1,376	1,376					1,376	1,376	M/P Unit cost base		@ 0.5 %
	Proposed (District A)	P	A		500-700	4,006		39,670				198	198					198	198	F/S estimate		@ 0.5 %
	Proposed (District B)	P	B		450-1000	4,921		49,980				250	250					250	250	F/S estimate		@ 0.5 %
	Proposed (District D)	P	D		450-1200	8,010		86,950				435	435					435	435	F/S estimate		@ 0.5 %
	Sub Total					**37,187**		**594,866**				**2,974**	**2,974**					**2,974**	**2,974**			
2	**Branch Sewer**																	0				
	District A		A	(1,321 ha x 65% x 385 m/ha)		330,580	1,000	330,580				1,653	1,653					1,653	1,653	M/P Unit cost base		@ 0.5 %
	District B (B-1)		B	(384 ha x 60% x 385 m/ha)		88,704	1,000	88,704				444	444					444	444	M/P Unit cost base		@ 0.5 %
	District B (B-2)		B	(416 ha x 40% x 385 m/ha)		64,064	1,000	64,064				320	320					320	320	M/P Unit cost base		@ 0.5 %
	District D (D-1)		D	(886 ha x 55% x 385 m/ha)		187,611	1,000	187,611				938	938					938	938	M/P Unit cost base		@ 0.5 %
	Sub Total					**670,959**		**670,959**				**3,355**	**3,355**					**3,355**	**3,355**			
3	**Rising Main**																					
	From Sasur Khaderi PS	P	B		600	200		1,740				4	4					4	4	F/S estimate		@ 0.25 %
	From Ghaghar Nala PS	P	B		1000	7,700		68,600				172	172					172	172	F/S estimate		@ 0.25 %
	From Daraganj PS	E	D		305	700	8,016	5,611				14	14					14	14	M/P Unit cost base		@ 0.25 %
	From Allahpur	E	D		356	250	8,016	2,004				5	5					5	5	M/P Unit cost base		@ 0.25 %
	From Morigate PS	E	D		500	1,950	8,016	15,631				39	39					39	39	M/P Unit cost base		@ 0.25 %
	From Morigate PS	P	D		800	1,800		11,840				30	30					30	30	F/S estimate		@ 0.25 %
	From Alopibagh PS	P	D		1000	3,100		32,800				82	82					82	82	F/S estimate		@ 0.25 %
	From Mumfordganj PS	P	D		1100	2,650		32,800				82	82					82	82	F/S estimate		@ 0.25 %
	Sub Total					**18,350**		**171,026**				**428**	**428**					**428**	**428**			
Total						**726,496**		**1,436,851**				**6,757**	**6,757**					**6,757**	**6,757**			
									3,617				**10,374**	**3,617**					**10,374**	**See IDP report for staff cost**		

		Status	Sewerage District	**Ave. Capacity at 2015 (mld)**	Civil Cost (Thousand Rs.)	E & M Cost (Thousand Rs.)	Utility Cost (Thousand Rs.)	**Total Capital Cost (Thousand Rs.)**	Staff Cost (Thousand Rs. /year)[1]	Power Cost (Thousand Rs. /year)	Chemical Cost (Thousand Rs. /year)	**Maintenance Cost (Thousand Rs. /year)**	**Total O&M Cost (Thousand Rs. /year)**	Staff Cost (Thousand Rs. /year)	Power Cost (Thousand Rs. /year)	Chemical Cost (Thousand Rs. /year)	Diesel Cost (Thousand Rs. /year)	**Maintenance Cost (Thousand Rs. /year)**	**Total O&M Cost (Thousand Rs. /year)**	Basis of Capital Cost	Basis of Operationl Cost	Basis of Maintenance Cost
4	**Pumping Station**																					
	Chachar Nala PS	E/R	A	26	9,932	14,784	-	24,716		2,496	-	592	3,088		2,080	-	744	592	3,416	M/P Unit cost base	Mumford PS F/S cost base	@1.5% of civil, 3.0% of E&M
	Gaughat PS	E/R	A	80	30,560	45,488	-	76,048		7,680	-	1,823	9,503		6,400	-	2,288	1,823	10,511	M/P Unit cost base	Mumford PS F/S cost base	@1.5% of civil, 3.0% of E&M
	Lukerganj PS	E/R	B	9	3,438	5,117	-	8,555		864	-	205	1,069		720	-	257	205	1,182	M/P Unit cost base	Mumford PS F/S cost base	@1.5% of civil, 3.0% of E&M
	Sasur Khaderi PS	P	B	13	20,410	14,530	-	34,940		1,356	-	742	2,098		1,130	-	660	742	2,532	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Ghaghar Nala PS	P	B	50	19,790	29,570	-	49,360		6,744	-	1,184	7,928		5,620	-	2,840	1,184	9,644	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Daraganj PS	E/R	D	3	1,146	1,706	-	2,852		288	-	68	356		240	-	86	68	394	M/P Unit cost base	Mumford PS F/S cost base	@1.5% of civil, 3.0% of E&M
	Allapur PS	E/R	D	3	1,146	1,706	-	2,852		288	-	68	356		240	-	86	68	394	M/P Unit cost base	Mumford PS F/S cost base	@1.5% of civil, 3.0% of E&M
	Morigate PS	P	D	12	12,100	12,570	-	24,670		1,776	-	559	2,335		1,480	-	660	559	2,699	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Alopibagh PS	E/R	D	46	17,572	26,156	-	43,728		4,416	-	1,048	5,464		3,680	-	1,316	1,048	6,044	M/P Unit cost base	Mumford PS F/S cost base	@1.5% of civil, 3.0% of E&M
	Mumfordganj PS	P	D	50	19,100	28,430	-	47,530		4,800	-	1,139	5,939		4,000	-	1,430	1,139	6,569	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Sub Total				**135,194**	**180,056**	**0**	**315,250**		**30,708**	**0**	**7,430**	**38,138**		**25,590**	**0**	**10,366**	**7,430**	**43,386**			
									6,138				**44,276**	**6,138**					**49,524**	**See IDP report for staff cost**		
5	**Treatment Plant**																					
	Naini STP (ASP)	E	A	60	97,200	64,800	-	162,000	7,207	13,374	900	3,402	24,883	7,207	13,374	900	-	3,402	24,883	M/P Unit cost base	Jajmau (ASP) F/S cost Base	@1.5% of civil, 3.0% of E&M
	Naini STP (ASP) (including rehabilitation)	P	A	20	71,630	80,000	-	151,630	0	4,458	300	3,474	8,233	0	4,458	300	-	3,474	8,233	F/S estimate	Jajmau (ASP) F/S cost Base	@1.5% of civil, 3.0% of E&M
	Numaya Dahi STP (WSP)	P	B	50	295,660	32,260	-	327,920	2,350	300	-	5,403	8,053	2,350	300	-	200	5,403	8,253	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Salori STP (FAB)	S	C	29	53,360	80,040	-	133,400	3,181	17,110	-	3,202	23,493	3,181	17,110	-	-	3,202	23,493	M/P Unit cost base	M/P Unit cost base	@1.5% of civil, 3.0% of E&M
	Rajapur (UASB)	P	D	65	578,780	4,900	-	583,680	5,003	1,600	1,300	8,829	16,732	5,003	1,600	1,300	-	8,829	16,732	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Kodara STP (UASB)	P	E	15	61,570	23,950	-	85,520	3,287	225	186	1,642	5,340	3,287	225	186	-	1,642	5,340	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Ponghat STP (UASB)	P	E	10	67,200	16,020	-	83,220	1,518	150	124	1,489	3,281	1,518	150	124	-	1,489	3,281	F/S estimate	F/S estimate	@1.5% of civil, 3.0% of E&M
	Sub Total				**1,225,400**	**301,970**	**0**	**1,527,370**	**22,546**	**37,218**	**2,810**	**27,440**	**90,014**	**22,546**	**37,218**	**2,810**	**200**	**27,440**	**90,214**			
Total					**1,360,594**	**482,026**	**0**	**1,842,620**	**28,684**	**67,926**	**2,810**	**34,870**	**134,289**	**28,684**	**62,808**	**2,810**	**10,566**	**34,870**	**139,737**			

	Grand total							**3,279,471**	**32,301**	**67,926**	**2,810**	**41,626**	**144,663**	**32,301**	**62,808**	**2,810**	**10,566**	**41,626**	**150,111**			

Note:
(1) See Institutional Development Programme (ID) report for Manpower (Staff) Cost.
E: Existing, S: Sanctioned, P: Proposed, A: Proposed augementation

Appendix A

Appendix A1.1 District Wise Population

	Area (ha)	2003			2015			2030		
		Resident	Floating	Total	Resident	Floating	Total	Resident	Floating	Total
District A	1,321	368,007	5,763	373,770	425,188	7,209	432,397	494,279	9,190	503,469
District B (Including FSA)	875	118,866	1,130	119,996	179,749	1,784	181,533	259,794	2,694	262,488
District C	647	113,184	0	113,184	158,714	0	158,714	225,944	0	225,944
District D	1,709	271,311	3,501	274,812	359,533	4,916	364,449	495,161	7,253	502,414
District E	928	96,858	0	96,858	153,819	0	153,819	258,872	0	258,872
District F	186	21,321	0	21,321	36,913	0	36,913	56,394	0	56,394
District G (Including FSA)	1,382	101,264	0	101,264	162,602	0	162,602	266,989	0	266,989
Total	7,048	1,090,811	10,394	1,101,205	1,476,518	13,909	1,490,427	2,057,433	19,137	2,076,570

Appendix A1.2 District Wise Watewater Generation

(mld)

	2003			2015			2030		
	Resident	Floating	Total	Resident	Floating	Total	Resident	Floating	Total
District A	75.44	1.18	76.62	74.41	1.26	75.67	76.61	1.42	78.03
District B (Including FSA)	24.37	0.23	24.60	31.46	0.31	31.77	40.27	0.42	40.69
District C	23.20	0.00	23.20	27.77	0.00	27.77	35.02	0.00	35.02
District D	55.62	0.72	56.34	62.92	0.86	63.78	76.75	1.12	77.87
District E	19.86	0.00	19.86	26.92	0.00	26.92	40.13	0.00	40.13
District F	4.37	0.00	4.37	6.46	0.00	6.46	8.74	0.00	8.74
District G (Including FSA)	20.76	0.00	20.76	28.46	0.00	28.46	41.38	0.00	41.38
Total	223.62	2.13	225.75	258.40	2.43	260.83	318.90	2.96	321.86

Appendix A2.1 Sewer Data of GT Road (Dist- A)-Node 4-5-7 (1/3)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	500 mm	50	MH-1	MH-2	92.702	92.535	300	158	61.7	1.08	2.77	0.8	3	189	27
P-2	Allahabad Concrete	500 mm	52	MH-2	MH-3	91.852	91.679	300	158	61.8	1.08	2.5	0.8	3	189	27
P-3	Allahabad Concrete	500 mm	52	MH-3	MH-4	91.479	91.306	300	158	61.8	1.08	2.5	0.8	3	189	27
P-4	Allahabad Concrete	500 mm	46	MH-4	MH-5	91.199	91.046	300	158	69.9	1.08	2.5	0.8	3	189	27
P-5	Allahabad Concrete	500 mm	44	MH-5	MH-6	91.046	90.899	300	158	69.9	1.08	2.58	0.8	3	189	27
P-6	Allahabad Concrete	500 mm	46	MH-6	MH-7	90.899	90.746	300	158	69.9	1.08	2.61	0.8	3	189	27
P-7	Allahabad Concrete	500 mm	46	MH-7	MH-8	90.746	90.593	300	158	69.9	1.08	2.67	0.8	3	189	27
P-8	Allahabad Concrete	500 mm	49	MH-8	MH-9	90.593	90.429	300	158	69.9	1.08	2.94	0.8	3	189	27
P-9	Allahabad Concrete	500 mm	12	MH-9	MH-10	90.429	90.389	300	158	69.9	1.08	3.03	0.8	3	189	27
P-10	Allahabad Concrete	500 mm	52	MH-10	MH-11	90.389	90.216	300	158	69.9	1.08	2.93	0.8	3	189	27
P-11	Allahabad Concrete	500 mm	53	MH-11	MH-12	90.216	90.039	300	158	69.9	1.08	3.57	0.8	3	189	27
P-12	Allahabad Concrete	500 mm	27	MH-12	MH-13	90.039	89.949	300	158	69.9	1.08	3.62	0.8	3	189	27
P-13	Allahabad Concrete	500 mm	45	MH-13	MH-14	89.949	89.799	300	158	69.9	1.08	3.88	0.8	3	189	27
P-14	Allahabad Concrete	500 mm	40	MH-14	MH-15	89.799	89.666	300	158	69.9	1.08	4.13	0.8	3	189	27
P-15	Allahabad Concrete	500 mm	40	MH-15	MH-16	89.666	89.533	300	158	69.9	1.08	4.39	0.8	3	189	27
P-16	Allahabad Concrete	500 mm	35	MH-16	MH-17	89.533	89.416	300	158	69.9	1.08	4.54	0.8	3	189	27
P-17	Allahabad Concrete	500 mm	39	MH-17	MH-18	89.416	89.286	300	158	69.9	1.08	4.71	0.8	3	189	27
P-18	Allahabad Concrete	500 mm	55	MH-18	MH-19	89.286	89.103	300	158	69.9	1.08	5.03	0.8	3	189	27
P-19	Allahabad Concrete	500 mm	59	MH-19	MH-20	89.103	88.906	300	158	69.9	1.08	5.39	0.8	3	189	27
P-20	Allahabad Concrete	500 mm	31	MH-20	MH-21	88.906	88.803	300	158	69.9	1.08	5.65	0.8	3	189	27
P-21	Allahabad Concrete	500 mm	35	MH-21	MH-22	88.803	88.686	300	158	69.9	1.08	5.93	0.8	3	189	27

Appendix A2.1 Sewer Data of GT Road (Dist- A)-Node 4-5-7 (2/3)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-22	Allahabad Concrete	500 mm	45	MH-22	MH-23	88.686	88.536	300	158	69.5	1.08	6.28	0.8	3	189	27
P-23	Allahabad Concrete	500 mm	45	MH-23	MH-24	88.536	88.386	300	158	61.9	1.08	6.72	0.8	3	189	27
P-24	Allahabad Concrete	700 mm	46	MH-24	MH-25	88.186	88.033	300	370	67.6	1.34	7.17	0.8	3	463	83
P-25	Allahabad Concrete	700 mm	40	MH-25	MH-26	88.033	87.899	300	370	67.6	1.34	7.41	0.8	3	463	83
P-26	Allahabad Concrete	700 mm	31	MH-26	MH-27	87.899	87.796	300	370	67.6	1.34	7.5	0.8	3	463	83
P-27	Allahabad Concrete	700 mm	45	MH-27	MH-28	87.796	87.646	300	370	67.6	1.34	7.34	0.8	3	463	83
P-28	Allahabad Concrete	700 mm	62	MH-28	MH-29	87.646	87.439	300	370	67.6	1.34	6.41	0.8	3	463	83
P-29	Allahabad Concrete	700 mm	38	MH-29	MH-30	87.439	87.313	300	370	67.6	1.34	5.84	0.8	3	463	83
P-30	Allahabad Concrete	700 mm	39	MH-30	MH-31	87.313	87.183	300	370	67.6	1.34	5.35	0.8	3	463	83
P-31	Allahabad Concrete	700 mm	42	MH-31	MH-32	87.183	87.043	300	370	67.6	1.34	5.02	0.8	3	463	83
P-32	Allahabad Concrete	700 mm	50	MH-32	MH-33	87.043	86.876	300	370	67.6	1.34	4.71	0.8	3	463	83
P-33	Allahabad Concrete	700 mm	56	MH-33	MH-34	86.876	86.689	300	370	67.6	1.34	4.32	0.8	3	463	83
P-34	Allahabad Concrete	700 mm	52	MH-34	MH-35	86.689	86.516	300	370	67.6	1.34	4.09	0.8	3	463	83
P-35	Allahabad Concrete	700 mm	30	MH-35	MH-36	86.516	86.416	300	370	67.5	1.34	4.01	0.8	3	463	83
P-36	Allahabad Concrete	700 mm	44	MH-36	MH-37	86.416	86.269	300	370	67.3	1.34	3.71	0.8	3	463	83
P-37	Allahabad Concrete	700 mm	39	MH-37	MH-38	86.269	86.139	300	370	66.7	1.34	3.27	0.8	3	463	83
P-38	Allahabad Concrete	700 mm	37	MH-38	MH-39	86.139	86.016	300	370	60.2	1.34	2.76	0.8	3	463	83
P-39	Allahabad Concrete	700 mm	43	MH-39	MH-40	85.929	85.786	300	370	60.4	1.34	2.5	0.8	3	463	83
P-40	Allahabad Concrete	700 mm	33	MH-40	MH-41	85.66	85.55	300	370	60.1	1.34	2.5	0.8	3	463	83
P-41	Allahabad Concrete	700 mm	40	MH-41	MH-42	85.452	85.319	300	370	63.3	1.34	2.5	0.8	3	463	83
P-42	Allahabad Concrete	700 mm	55	MH-42	MH-43	85.267	85.084	300	370	67.6	1.34	2.5	0.8	3	463	83

Appendix A2.1 Sewer Data of GT Road (Dist- A)-Node 4-5-7 (3/3)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-43	Allahabad Concrete	700 mm	35	MH-43	MH-44	85.084	84.967	300	370	67.6	1.34	2.51	0.8	3	463	83
P-44	Allahabad Concrete	700 mm	46	MH-44	MH-45	84.967	84.814	300	370	67.6	1.34	2.66	0.8	3	463	83
P-45	Allahabad Concrete	700 mm	45	MH-45	MH-46	84.814	84.664	300	370	67.6	1.34	2.6	0.8	3	463	83
P-46	Allahabad Concrete	700 mm	27	MH-46	MH-47	84.664	84.574	300	370	67.6	1.34	2.58	0.8	3	463	83
P-47	Allahabad Concrete	700 mm	35	MH-47	MH-48	84.574	84.457	300	370	67.6	1.34	2.6	0.8	3	463	83
P-48	Allahabad Concrete	700 mm	44	MH-48	MH-49	84.457	84.311	300	370	67.5	1.34	2.57	0.8	3	463	83
P-49	Allahabad Concrete	700 mm	30	MH-49	MH-50	84.311	84.211	300	370	67.4	1.34	2.65	0.8	3	463	83
P-50	Allahabad Concrete	700 mm	52	MH-50	MH-51	84.211	84.037	300	370	66.8	1.34	2.81	0.8	3	463	83
P-51	Allahabad Concrete	700 mm	25	MH-51	MH-52	84.037	83.954	300	370	65.2	1.34	2.84	0.8	3	463	83
P-52	Allahabad Concrete	700 mm	16	MH-52	(Node 7)	83.954	83.901	300	370	59.2	1.34	2.83	0.8	3	463	83
			2175													

Appendix A2.2 Detailed Description of Sewer of GT Road (Dist- A)-Node 4-5-7

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	500 mm	50	MH-1	MH-2	92.702	92.535	2.77	50	0	0
P-2	Allahabad Concrete	500 mm	52	MH-2	MH-3	91.852	91.679	2.5	52	0	0
P-3	Allahabad Concrete	500 mm	52	MH-3	MH-4	91.479	91.306	2.5	52	0	0
P-4	Allahabad Concrete	500 mm	46	MH-4	MH-5	91.199	91.046	2.5	46	0	0
P-5	Allahabad Concrete	500 mm	44	MH-5	MH-6	91.046	90.899	2.58	44	0	0
P-6	Allahabad Concrete	500 mm	46	MH-6	MH-7	90.899	90.746	2.61	46	0	0
P-7	Allahabad Concrete	500 mm	46	MH-7	MH-8	90.746	90.593	2.67	46	0	0
P-8	Allahabad Concrete	500 mm	49	MH-8	MH-9	90.593	90.429	2.94	49	0	0
P-9	Allahabad Concrete	500 mm	12	MH-9	MH-10	90.429	90.389	3.03	12	0	0
P-10	Allahabad Concrete	500 mm	52	MH-10	MH-11	90.389	90.216	2.93	52	0	0
P-11	Allahabad Concrete	500 mm	53	MH-11	MH-12	90.216	90.039	3.57	53	0	0
P-12	Allahabad Concrete	500 mm	27	MH-12	MH-13	90.039	89.949	3.62	27	0	0
P-13	Allahabad Concrete	500 mm	45	MH-13	MH-14	89.949	89.799	3.88	45	0	0
P-14	Allahabad Concrete	500 mm	40	MH-14	MH-15	89.799	89.666	4.13	0	40	0
P-15	Allahabad Concrete	500 mm	40	MH-15	MH-16	89.666	89.533	4.39	0	40	0
P-16	Allahabad Concrete	500 mm	35	MH-16	MH-17	89.533	89.416	4.54	0	35	0
P-17	Allahabad Concrete	500 mm	39	MH-17	MH-18	89.416	89.286	4.71	0	39	0
P-18	Allahabad Concrete	500 mm	55	MH-18	MH-19	89.286	89.103	5.03	0	55	0
P-19	Allahabad Concrete	500 mm	59	MH-19	MH-20	89.103	88.906	5.39	0	59	0
P-20	Allahabad Concrete	500 mm	31	MH-20	MH-21	88.906	88.803	5.65	0	31	0
P-21	Allahabad Concrete	500 mm	35	MH-21	MH-22	88.803	88.686	5.93	0	35	0
P-22	Allahabad Concrete	500 mm	45	MH-22	MH-23	88.686	88.536	6.28	0	0	45
P-23	Allahabad Concrete	500 mm	45	MH-23	MH-24	88.536	88.386	6.72	0	0	45
Total			**998**						**574**	**334**	**90**
P-24	Allahabad Concrete	700 mm	46	MH-24	MH-25	88.186	88.033	7.17	0	0	46
P-25	Allahabad Concrete	700 mm	40	MH-25	MH-26	88.033	87.899	7.41	0	0	40
P-26	Allahabad Concrete	700 mm	31	MH-26	MH-27	87.899	87.796	7.5	0	0	31
P-27	Allahabad Concrete	700 mm	45	MH-27	MH-28	87.796	87.646	7.34	0	0	45
P-28	Allahabad Concrete	700 mm	62	MH-28	MH-29	87.646	87.439	6.41	0	0	62
P-29	Allahabad Concrete	700 mm	38	MH-29	MH-30	87.439	87.313	5.84	0	38	0
P-30	Allahabad Concrete	700 mm	39	MH-30	MH-31	87.313	87.183	5.35	0	39	0
P-31	Allahabad Concrete	700 mm	42	MH-31	MH-32	87.183	87.043	5.02	0	42	0
P-32	Allahabad Concrete	700 mm	50	MH-32	MH-33	87.043	86.876	4.71	0	50	0
P-33	Allahabad Concrete	700 mm	56	MH-33	MH-34	86.876	86.689	4.32	0	56	0
P-34	Allahabad Concrete	700 mm	52	MH-34	MH-35	86.689	86.516	4.09	0	52	0
P-35	Allahabad Concrete	700 mm	30	MH-35	MH-36	86.516	86.416	4.01	0	30	0
P-36	Allahabad Concrete	700 mm	44	MH-36	MH-37	86.416	86.269	3.71	44	0	0
P-37	Allahabad Concrete	700 mm	39	MH-37	MH-38	86.269	86.139	3.27	39	0	0
P-38	Allahabad Concrete	700 mm	37	MH-38	MH-39	86.139	86.016	2.76	37	0	0
P-39	Allahabad Concrete	700 mm	43	MH-39	MH-40	85.929	85.786	2.5	43	0	0

Appendix A2.2 Detailed Description of Sewer of GT Road (Dist- A)-Node 4-5-7

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-40	Allahabad Concrete	700 mm	33	MH-40	MH-41	85.66	85.55	2.5	33	0	0
P-41	Allahabad Concrete	700 mm	40	MH-41	MH-42	85.452	85.319	2.5	40	0	0
P-42	Allahabad Concrete	700 mm	55	MH-42	MH-43	85.267	85.084	2.5	55	0	0
P-43	Allahabad Concrete	700 mm	35	MH-43	MH-44	85.084	84.967	2.51	35	0	0
P-44	Allahabad Concrete	700 mm	46	MH-44	MH-45	84.967	84.814	2.66	46	0	0
P-45	Allahabad Concrete	700 mm	45	MH-45	MH-46	84.814	84.664	2.6	45	0	0
P-46	Allahabad Concrete	700 mm	27	MH-46	MH-47	84.664	84.574	2.58	27	0	0
P-47	Allahabad Concrete	700 mm	35	MH-47	MH-48	84.574	84.457	2.6	35	0	0
P-48	Allahabad Concrete	700 mm	44	MH-48	MH-49	84.457	84.311	2.57	44	0	0
P-49	Allahabad Concrete	700 mm	30	MH-49	MH-50	84.311	84.211	2.65	30	0	0
P-50	Allahabad Concrete	700 mm	52	MH-50	MH-51	84.211	84.037	2.81	52	0	0
P-51	Allahabad Concrete	700 mm	25	MH-51	MH-52	84.037	83.954	2.84	25	0	0
P-52	Allahabad Concrete	700 mm	16	MH-52	(Node 7)	83.954	83.901	2.83	16	0	0
Total			**1,177**						**646**	**307**	**224**
GRAND TOTAL			**2,175**						**1,220**	**641**	**314**

Appendix A2.3 Detailed Description of Manhole of GT Road (Dist- A)-Node 4-5-7

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	95.702	92.702	1.2	3	1	0
MH-2	95.803	91.852	1.2	3.95	1	0
MH-3	94.679	91.479	1.2	3.2	1	0
MH-4	94.306	91.199	1.2	3.11	1	0
MH-5	94.046	91.046	1.2	3	1	0
MH-6	93.977	90.899	1.2	3.08	1	0
MH-7	93.857	90.746	1.2	3.11	1	0
MH-8	93.765	90.593	1.2	3.17	1	0
MH-9	93.869	90.429	1.2	3.44	1	0
MH-10	93.916	90.389	1.2	3.53	1	0
MH-11	93.642	90.216	1.2	3.43	1	0
MH-12	94.113	90.039	1.2	4.07	1	0
MH-13	94.073	89.949	1.2	4.12	1	0
MH-14	94.183	89.799	1.2	4.38	1	0
MH-15	94.299	89.666	1.2	4.63	1	0
MH-16	94.418	89.533	1.2	4.89	1	0
MH-17	94.455	89.416	1.2	5.04	1	0
MH-18	94.499	89.286	1.2	5.21	1	0
MH-19	94.636	89.103	1.2	5.53	1	0
MH-20	94.797	88.906	1.2	5.89	1	0
MH-21	94.948	88.803	1.2	6.15	1	0
MH-22	95.121	88.686	1.2	6.44	1	0
MH-23	95.315	88.536	1.2	6.78	1	0
MH-24	95.61	88.186	1.2	7.42	0	1
MH-25	95.9	88.033	1.2	7.87	0	1
MH-26	96.011	87.899	1.2	8.11	0	1
MH-27	95.997	87.796	1.2	8.2	0	1
MH-28	95.688	87.646	1.2	8.04	0	1
MH-29	94.552	87.439	1.2	7.11	0	1
MH-30	93.854	87.313	1.2	6.54	1	0
MH-31	93.231	87.183	1.2	6.05	1	0
MH-32	92.758	87.043	1.2	5.72	1	0
MH-33	92.282	86.876	1.2	5.41	1	0
MH-34	91.71	86.689	1.2	5.02	1	0
MH-35	91.311	86.516	1.2	4.79	1	0
MH-36	91.123	86.416	1.2	4.71	1	0
MH-37	90.68	86.269	1.2	4.41	1	0
MH-38	90.11	86.139	1.2	3.97	1	0
MH-39	89.472	85.929	1.2	3.54	1	0
MH-40	88.986	85.66	1.2	3.33	1	0
MH-41	88.75	85.452	1.2	3.3	1	0
MH-42	88.519	85.267	1.2	3.25	1	0
MH-43	88.284	85.084	1.2	3.2	1	0
MH-44	88.174	84.967	1.2	3.21	1	0
MH-45	88.175	84.814	1.2	3.36	1	0
MH-46	87.962	84.664	1.2	3.3	1	0
MH-47	87.859	84.574	1.2	3.28	1	0
MH-48	87.756	84.457	1.2	3.3	1	0
MH-49	87.578	84.311	1.2	3.27	1	0
MH-50	87.557	84.211	1.2	3.35	1	0
MH-51	87.544	84.037	1.2	3.51	1	0
MH-52	87.498	83.954	1.2	3.54	1	0
					46	**6**

Appendix A2.4 Sewer Data of Salik Ganj (Dist- A)- Node 8 to Node 15 (Gaughat PS) (1/2)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Maxi-mum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	600 mm	13	MH-1	MH-2	86.2	86.2	600	148	46.6	0.83	2.5	0.8	3	217	64
P-2	Allahabad Concrete	600 mm	17	MH-2	MH-3	85.7	85.7	600	148	47.2	0.83	2.5	0.8	3	217	64
P-3	Allahabad Concrete	600 mm	32	MH-3	MH-4	84.8	84.8	600	148	48.5	0.83	2.5	0.8	3	217	64
P-4	Allahabad Concrete	600 mm	23	MH-4	MH-5	84.4	84.4	600	148	47.8	0.83	2.5	0.8	3	217	64
P-5	Allahabad Concrete	600 mm	56	MH-5	MH-6	83.3	83.2	600	148	49.5	0.83	2.5	0.8	3	217	64
P-6	Allahabad Concrete	600 mm	32	MH-6	MH-7	83	83	600	148	48.5	0.83	2.5	0.8	3	217	64
P-7	Allahabad Concrete	600 mm	39	MH-7	MH-8	82.8	82.7	600	148	48.9	0.83	2.5	0.8	3	217	64
P-8	Allahabad Concrete	600 mm	34	MH-8	MH-9	82.5	82.5	600	148	60.5	0.83	2.5	0.8	3	217	64
P-9	Allahabad Concrete	600 mm	7	MH-9	MH-10	82.5	82.5	600	148	60.5	0.83	2.52	0.8	3	217	64
P-10	Allahabad Concrete	600 mm	19	MH-10	MH-11	82.5	82.4	600	148	60.5	0.83	2.67	0.8	3	217	64
P-11	Allahabad Concrete	600 mm	65	MH-11	MH-12	82.4	82.3	600	148	60.5	0.83	2.82	0.8	3	217	64
P-12	Allahabad Concrete	600 mm	35	MH-12	MH-13	82.3	82.3	600	148	60.5	0.83	3.29	0.8	3	217	64
P-13	Allahabad Concrete	600 mm	32	MH-13	MH-14	82.3	82.2	600	148	60.5	0.83	3.23	0.8	3	217	64
P-14	Allahabad Concrete	600 mm	16	MH-14	MH-15	82.2	82.2	600	148	60.5	0.83	3.41	0.8	3	217	64
P-15	Allahabad Concrete	600 mm	56	MH-15	MH-16	82.2	82.1	600	148	60.5	0.83	3.76	0.8	3	217	64
P-16	Allahabad Concrete	600 mm	29	MH-16	MH-17	82.1	82.1	600	148	60.5	0.83	3.91	0.8	3	217	64
P-17	Allahabad Concrete	600 mm	34	MH-17	MH-18	82.1	82	600	148	60.5	0.83	4.22	0.8	3	217	64
P-18	Allahabad Concrete	600 mm	27	MH-18	MH-19	82	82	600	148	60.5	0.83	4.56	0.8	3	217	64
P-19	Allahabad Concrete	600 mm	11	MH-19	MH-20	82	81.9	600	148	60.5	0.83	4.79	0.8	3	217	64

Appendix A2.4 Sewer Data of Salik Ganj (Dist- A)- Node 8 to Node 15 (Gaughat PS) (2/2)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Maxi-mum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-20	Allahabad Concrete	600 mm	25	MH-20	MH-21	81.9	81.9	600	148	60.5	0.83	5.05	0.8	3	217	64
P-21	Allahabad Concrete	600 mm	37	MH-21	MH-22	81.9	81.8	600	148	60.5	0.83	5	0.8	3	217	64
P-22	Allahabad Concrete	600 mm	17	MH-22	MH-23	81.8	81.8	600	148	60.5	0.83	4.99	0.8	3	217	64
P-23	Allahabad Concrete	600 mm	50	MH-23	MH-24	81.8	81.7	600	148	60.5	0.83	5	0.8	3	217	64
P-24	Allahabad Concrete	600 mm	36	MH-24	MH-25	81.7	81.7	600	148	60.5	0.83	5.08	0.8	3	217	64
P-25	Allahabad Concrete	600 mm	58	MH-25	MH-26	81.7	81.6	600	148	60.5	0.83	5	0.8	3	217	64
P-26	Allahabad Concrete	600 mm	44	MH-26	MH-27	81.6	81.5	600	148	60.5	0.83	5.01	0.8	3	217	64
P-27	Allahabad Concrete	600 mm	44	MH-27	MH-28	81.5	81.4	600	148	60.5	0.83	5.17	0.8	3	217	64
P-28	Allahabad Concrete	600 mm	21	MH-28	MH-29	81.4	81.4	600	148	60.5	0.83	5.18	0.8	3	217	64
P-29	Allahabad Concrete	600 mm	38	MH-29	MH-30	81.4	81.3	600	148	60.4	0.83	5.18	0.8	3	217	64
P-30	Allahabad Concrete	600 mm	41	MH-30	MH-31	81.3	81.3	600	148	60.2	0.83	5.21	0.8	3	217	64
P-31	Allahabad Concrete	600 mm	36	MH-31	MH-32	81.3	81.2	600	148	59.9	0.83	5.26	0.8	3	217	64
P-32	Allahabad Concrete	600 mm	23	MH-32	MH-33	81.2	81.2	600	148	59.5	0.83	5.29	0.8	3	217	64
P-33	Allahabad Concrete	600 mm	46	MH-33	MH-34	81.2	81.1	600	148	58.3	0.83	5.32	0.8	3	217	64
P-34	Allahabad Concrete	600 mm	46	MH-34	Sump at Gaughat	81.1	81	600	148	49.2	0.83	5.55	0.8	3	217	64
			1139													

Appendix A2.5 Detailed Discription of Sewer of Salik Ganj (Dist- A)- Node 8 to Node 15 (Gaughat PS)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	600 mm	13	MH-1	MH-2	86.2	86.2	2.5	13	0	0
P-2	Allahabad Concrete	600 mm	17	MH-2	MH-3	85.7	85.7	2.5	17	0	0
P-3	Allahabad Concrete	600 mm	32	MH-3	MH-4	84.8	84.8	2.5	32	0	0
P-4	Allahabad Concrete	600 mm	23	MH-4	MH-5	84.4	84.4	2.5	23	0	0
P-5	Allahabad Concrete	600 mm	56	MH-5	MH-6	83.3	83.2	2.5	56	0	0
P-6	Allahabad Concrete	600 mm	32	MH-6	MH-7	83	83	2.5	32	0	0
P-7	Allahabad Concrete	600 mm	39	MH-7	MH-8	82.8	82.7	2.5	39	0	0
P-8	Allahabad Concrete	600 mm	34	MH-8	MH-9	82.5	82.5	2.5	34	0	0
P-9	Allahabad Concrete	600 mm	7	MH-9	MH-10	82.5	82.5	2.52	7	0	0
P-10	Allahabad Concrete	600 mm	19	MH-10	MH-11	82.5	82.4	2.67	19	0	0
P-11	Allahabad Concrete	600 mm	65	MH-11	MH-12	82.4	82.3	2.82	65	0	0
P-12	Allahabad Concrete	600 mm	35	MH-12	MH-13	82.3	82.3	3.29	35	0	0
P-13	Allahabad Concrete	600 mm	32	MH-13	MH-14	82.3	82.2	3.23	32	0	0
P-14	Allahabad Concrete	600 mm	16	MH-14	MH-15	82.2	82.2	3.41	16	0	0
P-15	Allahabad Concrete	600 mm	56	MH-15	MH-16	82.2	82.1	3.76	56	0	0
P-16	Allahabad Concrete	600 mm	29	MH-16	MH-17	82.1	82.1	3.91	29	0	0
P-17	Allahabad Concrete	600 mm	34	MH-17	MH-18	82.1	82	4.22	0	34	0
P-18	Allahabad Concrete	600 mm	27	MH-18	MH-19	82	82	4.56	0	27	0
P-19	Allahabad Concrete	600 mm	11	MH-19	MH-20	82	81.9	4.79	0	11	0
P-20	Allahabad Concrete	600 mm	25	MH-20	MH-21	81.9	81.9	5.05	0	25	0
P-21	Allahabad Concrete	600 mm	37	MH-21	MH-22	81.9	81.8	5	0	37	0
P-22	Allahabad Concrete	600 mm	17	MH-22	MH-23	81.8	81.8	4.99	0	17	0
P-23	Allahabad Concrete	600 mm	50	MH-23	MH-24	81.8	81.7	5	0	50	0
P-24	Allahabad Concrete	600 mm	36	MH-24	MH-25	81.7	81.7	5.08	0	36	0
P-25	Allahabad Concrete	600 mm	58	MH-25	MH-26	81.7	81.6	5	0	58	0
P-26	Allahabad Concrete	600 mm	44	MH-26	MH-27	81.6	81.5	5.01	0	44	0
P-27	Allahabad Concrete	600 mm	44	MH-27	MH-28	81.5	81.4	5.17	0	44	0
P-28	Allahabad Concrete	600 mm	21	MH-28	MH-29	81.4	81.4	5.18	0	21	0
P-29	Allahabad Concrete	600 mm	38	MH-29	MH-30	81.4	81.3	5.18	0	38	0
P-30	Allahabad Concrete	600 mm	41	MH-30	MH-31	81.3	81.3	5.21	0	41	0
P-31	Allahabad Concrete	600 mm	36	MH-31	MH-32	81.3	81.2	5.26	0	36	0
P-32	Allahabad Concrete	600 mm	23	MH-32	MH-33	81.2	81.2	5.29	0	23	0
P-33	Allahabad Concrete	600 mm	46	MH-33	MH-34	81.2	81.1	5.32	0	46	0
P-34	Allahabad Concrete	600 mm	46	MH-34	Sump at Gaughat	81.1	81	5.55	0	46	0
			1139						**505**	**634**	**0**

Appendix A2.6 Detailed Discription of Manhole of Salik Ganj (District-A)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	89.9	86.2	1.2	3.63	1	0
MH-2	89.3	85.7	1.2	3.62	1	0
MH-3	88.8	84.8	1.2	3.95	1	0
MH-4	87.9	84.4	1.2	3.41	1	0
MH-5	87.5	83.3	1.2	4.17	1	0
MH-6	86.3	83	1.2	3.31	1	0
MH-7	86.1	82.8	1.2	3.32	1	0
MH-8	85.8	82.5	1.2	3.24	1	0
MH-9	85.6	82.5	1.2	3.1	1	0
MH-10	85.6	82.5	1.2	3.12	1	0
MH-11	85.7	82.4	1.2	3.27	1	0
MH-12	85.8	82.3	1.2	3.42	1	0
MH-13	86.2	82.3	1.2	3.89	1	0
MH-14	86.1	82.2	1.2	3.83	1	0
MH-15	86.2	82.2	1.2	4.01	1	0
MH-16	86.5	82.1	1.2	4.36	1	0
MH-17	86.6	82.1	1.2	4.51	1	0
MH-18	86.8	82	1.2	4.82	1	0
MH-19	87.1	82	1.2	5.16	1	0
MH-20	87.3	81.9	1.2	5.39	1	0
MH-21	87.5	81.9	1.2	5.65	1	0
MH-22	87.4	81.8	1.2	5.6	1	0
MH-23	87.4	81.8	1.2	5.59	1	0
MH-24	87.3	81.7	1.2	5.6	1	0
MH-25	87.3	81.7	1.2	5.68	1	0
MH-26	87.2	81.6	1.2	5.6	1	0
MH-27	87.1	81.5	1.2	5.61	1	0
MH-28	87.2	81.4	1.2	5.77	1	0
MH-29	87.2	81.4	1.2	5.78	1	0
MH-30	87.1	81.3	1.2	5.78	1	0
MH-31	87.1	81.3	1.2	5.81	1	0
MH-32	87.1	81.2	1.2	5.86	1	0
MH-33	87.1	81.2	1.2	5.89	1	0
MH-34	87	81.1	1.2	5.92	1	0
					34	**0**

Appendix A2.7 Sewer Data of S K Dey (Dist- A)- Node 11 to Node 12 (Saukat Ali marg)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Down-stream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Construc-ted Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	500 mm	12	Node 10/MH-1	MH-2	88.07	88.04	400	143	70.3	0.94	2.9	0.8	3	164	17
P-2	Allahabad Concrete	500 mm	49	MH-2	MH-3	88.04	87.91	400	143	60.6	0.94	2.58	0.8	3	164	17
P-3	Allahabad Concrete	500 mm	49	MH-3	MH-4	87.81	87.68	400	143	60.6	0.94	2.5	0.8	3	164	17
P-4	Allahabad Concrete	500 mm	49	MH-4	MH-5	87.53	87.4	400	143	60.6	0.94	2.5	0.8	3	164	17
P-5	Allahabad Concrete	500 mm	49	MH-5	MH-6	87.01	86.88	400	143	72.4	0.94	2.5	0.8	3	164	17
P-6	Allahabad Concrete	500 mm	62	MH-6	MH-7	86.88	86.73	400	143	72.4	0.94	2.77	0.8	3	164	17
P-7	Allahabad Concrete	500 mm	62	MH-7	MH-8	86.73	86.57	400	143	72.4	0.94	3.33	0.8	3	164	17
P-8	Allahabad Concrete	500 mm	14	MH-8	MH-9	86.57	86.54	400	143	72.4	0.94	3.41	0.8	3	164	17
P-9	Allahabad Concrete	500 mm	31	MH-9	MH-10	86.54	86.46	400	143	72.4	0.94	3.79	0.8	3	164	17
P-10	Allahabad Concrete	500 mm	34	MH-10	MH-11	86.46	86.38	400	143	72.4	0.94	4.18	0.8	3	164	17
P-11	Allahabad Concrete	500 mm	62	MH-11	MH-12	86.38	86.22	400	143	72.4	0.94	4.91	0.8	3	164	17
P-12	Allahabad Concrete	500 mm	47	MH-12	MH-13	86.22	86.1	400	143	72.3	0.94	5.26	0.8	3	164	17
P-13	Allahabad Concrete	500 mm	34	MH-13	MH-14	86.1	86.02	400	143	72.2	0.94	5.5	0.8	3	164	17
P-14	Allahabad Concrete	500 mm	34	MH-14	MH-15	86.02	85.93	400	143	71.9	0.94	5.71	0.8	3	164	17
P-15	Allahabad Concrete	500 mm	42	MH-15	MH-16	85.93	85.83	400	143	71.2	0.94	6.01	0.8	3	164	17
P-16	Allahabad Concrete	500 mm	17	MH-16	MH-17	85.83	85.79	400	143	70.1	0.94	6.17	0.8	3	164	17
P-17	Allahabad Concrete	500 mm	23	MH-17	MH-18	85.79	85.73	400	143	68.1	0.94	6.2	0.8	3	164	17
P-18	Allahabad Concrete	500 mm	22	MH-18	O-1	85.73	85.67	400	143	59	0.94	6.34	0.8	3	164	17
			692													

Appendix A2.8 Detailed Description of Sewer Data of S K Dey (Dist- A)
- Node 11 to Node 12 (Saukat Ali marg)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	500 mm	12	Node 10/MH-1	MH-2	88.07	88.04	2.9	12	0	0
P-2	Allahabad Concrete	500 mm	49	MH-2	MH-3	88.04	87.91	2.58	49	0	0
P-3	Allahabad Concrete	500 mm	49	MH-3	MH-4	87.81	87.68	2.5	49	0	0
P-4	Allahabad Concrete	500 mm	49	MH-4	MH-5	87.53	87.4	2.5	49	0	0
P-5	Allahabad Concrete	500 mm	49	MH-5	MH-6	87.01	86.88	2.5	49	0	0
P-6	Allahabad Concrete	500 mm	62	MH-6	MH-7	86.88	86.73	2.77	62	0	0
P-7	Allahabad Concrete	500 mm	62	MH-7	MH-8	86.73	86.57	3.33	62	0	0
P-8	Allahabad Concrete	500 mm	14	MH-8	MH-9	86.57	86.54	3.41	14	0	0
P-9	Allahabad Concrete	500 mm	31	MH-9	MH-10	86.54	86.46	3.79	31	0	0
P-10	Allahabad Concrete	500 mm	34	MH-10	MH-11	86.46	86.38	4.18	0	34	0
P-11	Allahabad Concrete	500 mm	62	MH-11	MH-12	86.38	86.22	4.91	0	62	0
P-12	Allahabad Concrete	500 mm	47	MH-12	MH-13	86.22	86.1	5.26	0	47	0
P-13	Allahabad Concrete	500 mm	34	MH-13	MH-14	86.1	86.02	5.5	0	34	0
P-14	Allahabad Concrete	500 mm	34	MH-14	MH-15	86.02	85.93	5.71	0	34	0
P-15	Allahabad Concrete	500 mm	42	MH-15	MH-16	85.93	85.83	6.01	0	0	42
P-16	Allahabad Concrete	500 mm	17	MH-16	MH-17	85.83	85.79	6.17	0	0	17
P-17	Allahabad Concrete	500 mm	23	MH-17	MH-18	85.79	85.73	6.2	0	0	23
P-18	Allahabad Concrete	500 mm	22	MH-18	O-1	85.73	85.67	6.34	0	0	22
			692						**377**	**211**	**104**

Appendix A2.9 Detailed Description of Manholes S K Dey (District-A)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
Node 10/MH-1	91.17	88.07	1.2	3.1	1	0
MH-2	91.44	88.04	1.2	3.4	1	0
MH-3	90.99	87.81	1.2	3.19	1	0
MH-4	90.68	87.53	1.2	3.16	1	0
MH-5	90.4	87.01	1.2	3.4	1	0
MH-6	89.89	86.88	1.2	3	1	0
MH-7	90	86.73	1.2	3.27	1	0
MH-8	90.41	86.57	1.2	3.83	1	0
MH-9	90.45	86.54	1.2	3.91	1	0
MH-10	90.75	86.46	1.2	4.29	1	0
MH-11	91.06	86.38	1.2	4.68	1	0
MH-12	91.63	86.22	1.2	5.41	1	0
MH-13	91.87	86.1	1.2	5.77	1	0
MH-14	92.02	86.02	1.2	6	1	0
MH-15	92.15	85.93	1.2	6.21	1	0
MH-16	92.34	85.83	1.2	6.51	1	0
MH-17	92.45	85.79	1.2	6.67	1	0
MH-18	92.44	85.73	1.2	6.71	1	0
					18	**0**

Appendix A3.1 Sewer Data of Thorn Hill Road (Dist- D)- Node 1-2-4-18 (Mumford Ganj PS) (1/4)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	450 mm	60	MH-1	MH-2	92.551	92.431	500	90	68.6	0.77	3.24	0.8	3	111	18
P-2	Allahabad Concrete	450 mm	60	MH-2	MH-3	92.431	92.311	500	90	68.6	0.77	3.62	0.8	3	111	18
P-3	Allahabad Concrete	450 mm	60	MH-3	MH-4	92.311	92.191	500	90	68.6	0.77	3.59	0.8	3	111	18
P-4	Allahabad Concrete	450 mm	60	MH-4	MH-5	92.191	92.071	500	90	68.6	0.77	3.6	0.8	3	111	18
P-5	Allahabad Concrete	450 mm	60	MH-5	MH-6	92.071	91.951	500	90	68.6	0.77	3.58	0.8	3	111	18
P-6	Allahabad Concrete	450 mm	60	MH-6	MH-7	91.951	91.831	500	90	68.6	0.77	3.91	0.8	3	111	18
P-7	Allahabad Concrete	450 mm	55	MH-7	MH-8	91.831	91.721	500	90	68.6	0.77	3.98	0.8	3	111	18
P-8	Allahabad Concrete	450 mm	60	MH-8	MH-9	91.721	91.601	500	90	68.6	0.77	3.87	0.8	3	111	18
P-9	Allahabad Concrete	450 mm	60	MH-9	MH-10	91.601	91.481	500	90	68.6	0.77	4.03	0.8	3	111	18
P-10	Allahabad Concrete	450 mm	60	MH-10	MH-11	91.481	91.361	500	90	68.6	0.77	4.22	0.8	3	111	18
P-11	Allahabad Concrete	450 mm	60	MH-11	MH-12	91.361	91.241	500	90	68.6	0.77	4.05	0.8	3	111	18
P-12	Allahabad Concrete	450 mm	60	MH-12	MH-13	91.241	91.121	500	90	68.6	0.77	3.97	0.8	3	111	18
P-13	Allahabad Concrete	450 mm	60	MH-13	MH-14	91.121	91.001	500	90	68.6	0.77	4.13	0.8	3	111	18
P-14	Allahabad Concrete	450 mm	60	MH-14	MH-15	91.001	90.881	500	90	68.6	0.77	4.18	0.8	3	111	18
P-15	Allahabad Concrete	450 mm	60	MH-15	MH-16	90.881	90.761	500	90	68.6	0.77	4.12	0.8	3	111	18
P-16	Allahabad Concrete	450 mm	60	MH-16	MH-17	90.761	90.641	500	90	68.6	0.77	4.33	0.8	3	111	18
P-17	Allahabad Concrete	450 mm	45	MH-17	MH-18	90.641	90.551	500	90	68.6	0.77	4.06	0.8	3	111	18
P-18	Allahabad Concrete	450 mm	60	MH-18	MH-19	90.551	90.431	500	90	68.6	0.77	4.08	0.8	3	111	18
P-19	Allahabad Concrete	450 mm	60	MH-19	MH-20	90.431	90.311	500	90	68.6	0.77	3.71	0.8	3	111	18
P-20	Allahabad Concrete	450 mm	48	MH-20	MH-21	90.311	90.215	500	90	68.6	0.77	3.56	0.8	3	111	18
P-21	Allahabad Concrete	450 mm	60	MH-21	MH-22	90.215	90.095	500	90	68.6	0.77	3.84	0.8	3	111	18
P-22	Allahabad Concrete	450 mm	60	MH-22	MH-23	90.095	89.975	500	90	68.6	0.77	4.26	0.8	3	111	18

Appendix A3.1 Sewer Data of Thorn Hill Road (Dist- D)- Node 1-2-4-18 (Mumford Ganj PS) (2/4)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-23	Allahabad Concrete	450 mm	60	MH-23	MH-24	89.975	89.855	500	90	68.6	0.77	4.66	0.8	3	111	18
P-24	Allahabad Concrete	450 mm	68	MH-24	MH-25	89.855	89.719	500	90	68.5	0.77	4.93	0.8	3	111	18
P-25	Allahabad Concrete	450 mm	60	MH-25	MH-26	89.719	89.599	500	90	68.2	0.77	4.9	0.8	3	111	18
P-26	Allahabad Concrete	450 mm	39	MH-26	MH-27	89.599	89.521	500	90	67.5	0.77	4.9	0.8	3	111	18
P-27	Allahabad Concrete	450 mm	39	MH-27	MH-28	89.521	89.443	500	90	65.9	0.77	4.91	0.8	3	111	18
P-28	Allahabad Concrete	450 mm	33	MH-28	MH-29	89.443	89.377	500	90	60	0.77	4.94	0.8	3	111	18
P-29	Allahabad Concrete	600 mm	49	MH-29	MH-30	89.227	89.129	500	186	66.5	0.93	4.81	0.8	3	238	47
P-30	Allahabad Concrete	600 mm	60	MH-30	MH-31	89.129	89.009	500	186	66.5	0.93	4.87	0.8	3	238	47
P-31	Allahabad Concrete	600 mm	60	MH-31	MH-32	89.009	88.889	500	186	66.5	0.93	5.3	0.8	3	238	47
P-32	Allahabad Concrete	600 mm	12	MH-32	MH-33	88.889	88.865	500	186	66.5	0.93	5.43	0.8	3	238	47
P-33	Allahabad Concrete	600 mm	40	MH-33	MH-34	88.865	88.785	500	186	66.5	0.93	5.62	0.8	3	238	47
P-34	Allahabad Concrete	600 mm	41	MH-34	MH-35	88.785	88.703	500	186	66.5	0.93	5.8	0.8	3	238	47
P-35	Allahabad Concrete	600 mm	40	MH-35	MH-36	88.703	88.623	500	186	66.5	0.93	6.02	0.8	3	238	47
P-36	Allahabad Concrete	600 mm	37	MH-36	MH-37	88.623	88.549	500	186	66.5	0.93	6.13	0.8	3	238	47
P-37	Allahabad Concrete	600 mm	60	MH-37	MH-38	88.549	88.429	500	186	66.5	0.93	5.97	0.8	3	238	47
P-38	Allahabad Concrete	600 mm	60	MH-38	MH-39	88.429	88.309	500	186	66.5	0.93	5.51	0.8	3	238	47
P-39	Allahabad Concrete	600 mm	60	MH-39	MH-40	88.309	88.189	500	186	66.5	0.93	4.89	0.8	3	238	47
P-40	Allahabad Concrete	600 mm	60	MH-40	MH-41	88.189	88.069	500	186	66.3	0.93	4.33	0.8	3	238	47
P-41	Allahabad Concrete	600 mm	60	MH-41	MH-42	88.069	87.949	500	186	65.9	0.93	4.31	0.8	3	238	47
P-42	Allahabad Concrete	600 mm	15	MH-42	MH-43	87.949	87.919	500	186	65.4	0.93	4.34	0.8	3	238	47
P-43	Allahabad Concrete	600 mm	30	MH-43	MH-44	87.919	87.859	500	186	64.7	0.93	4.17	0.8	3	238	47
P-44	Allahabad Concrete	600 mm	60	MH-44	MH-45	87.859	87.739	500	186	55.2	0.93	3.25	0.8	3	238	47

Appendix A3.1 Sewer Data of Thorn Hill Road (Dist- D)- Node 1-2-4-18 (Mumford Ganj PS)(3/4)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-45	Allahabad Concrete	600 mm	60	MH-45	MH-46	87.471	87.351	500	186	65.6	0.93	3	0.8	3	238	47
P-46	Allahabad Concrete	600 mm	60	MH-46	MH-47	87.351	87.231	500	186	63.1	0.93	3.57	0.8	3	238	47
P-47	Allahabad Concrete	600 mm	28	MH-47	MH-48	87.231	87.175	500	186	53.7	0.93	4.14	0.8	3	238	47
P-48	Allahabad Concrete	700 mm	65	MH-48	MH-49	84.553	84.423	500	296	69.2	1.04	7.13	0.8	3	359	55
P-49	Allahabad Concrete	700 mm	60	MH-49	MH-50	84.423	84.303	500	296	69.2	1.04	7.26	0.8	3	359	55
P-50	Allahabad Concrete	700 mm	55	MH-50	MH-51	84.303	84.193	500	296	69.2	1.04	7.3	0.8	3	359	55
P-51	Allahabad Concrete	700 mm	65	MH-51	MH-52	84.193	84.063	500	296	69.2	1.04	8	0.8	3	359	55
P-52	Allahabad Concrete	700 mm	60	MH-52	MH-53	84.063	83.943	500	296	69.2	1.04	8.86	0.8	3	359	55
P-53	Allahabad Concrete	700 mm	41	MH-53	MH-54	83.943	83.861	500	296	69.2	1.04	8.94	0.8	3	359	55
P-54	Allahabad Concrete	700 mm	41	MH-54	MH-55	83.861	83.779	500	296	69.2	1.04	9.07	0.8	3	359	55
P-55	Allahabad Concrete	700 mm	20	MH-55	MH-56	83.779	83.739	500	296	69.2	1.04	9.23	0.8	3	359	55
P-56	Allahabad Concrete	700 mm	50	MH-56	MH-57	83.739	83.639	500	296	69.2	1.04	8.74	0.8	3	359	55
P-57	Allahabad Concrete	700 mm	60	MH-57	MH-58	83.639	83.519	500	296	69.2	1.04	8.8	0.8	3	359	55
P-58	Allahabad Concrete	700 mm	60	MH-58	MH-59	83.519	83.399	500	296	69.2	1.04	8.63	0.8	3	359	55
P-59	Allahabad Concrete	700 mm	60	MH-59	MH-60	83.399	83.279	500	296	69.2	1.04	8.56	0.8	3	359	55
P-60	Allahabad Concrete	700 mm	60	MH-60	MH-61	83.279	83.159	500	296	69.2	1.04	8.54	0.8	3	359	55
P-61	Allahabad Concrete	700 mm	60	MH-61	MH-62	83.159	83.039	500	296	69.2	1.04	7.67	0.8	3	359	55
P-62	Allahabad Concrete	700 mm	60	MH-62	MH-63	83.039	82.919	500	296	69.1	1.04	6.91	0.8	3	359	55
P-63	Allahabad Concrete	700 mm	60	MH-63	MH-64	82.919	82.799	500	296	69.1	1.04	6.11	0.8	3	359	55
P-64	Allahabad Concrete	700 mm	60	MH-64	MH-65	82.799	82.679	500	296	68.9	1.04	5.39	0.8	3	359	55
P-65	Allahabad Concrete	700 mm	37	MH-65	MH-66	82.679	82.605	500	296	68.6	1.04	5.29	0.8	3	359	55
P-66	Allahabad Concrete	700 mm	30	MH-66	MH-67	82.605	82.545	500	296	68.2	1.04	5.07	0.8	3	359	55

Appendix A3.1 Sewer Data of Thorn Hill Road (Dist- D)- Node 1-2-4-18 (Mumford Ganj PS) (4/4)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-67	Allahabad Concrete	700 mm	60	MH-67	MH-68	82.545	82.425	500	296	67	1.04	4.88	0.8	3	359	55
P-68	Allahabad Concrete	700 mm	62	MH-68	Mumford ganj Sump	82.425	82.301	500	296	57.1	1.04	5	0.8	3	359	55
			3605													

Appendix A3.2 Detailed Description of Sewer of Thorn Hill Road (Dist- D)- Node 1-2-4-18 (Mumford Ganj PS)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9.5m
P-1	Allahabad Concrete	450 mm	60	MH-1	MH-2	92.551	92.431	3.24	60	0	0
P-2	Allahabad Concrete	450 mm	60	MH-2	MH-3	92.431	92.311	3.62	60	0	0
P-3	Allahabad Concrete	450 mm	60	MH-3	MH-4	92.311	92.191	3.59	60	0	0
P-4	Allahabad Concrete	450 mm	60	MH-4	MH-5	92.191	92.071	3.6	60	0	0
P-5	Allahabad Concrete	450 mm	60	MH-5	MH-6	92.071	91.951	3.58	60	0	0
P-6	Allahabad Concrete	450 mm	60	MH-6	MH-7	91.951	91.831	3.91	60	0	0
P-7	Allahabad Concrete	450 mm	55	MH-7	MH-8	91.831	91.721	3.98	55	0	0
P-8	Allahabad Concrete	450 mm	60	MH-8	MH-9	91.721	91.601	3.87	60	0	0
P-9	Allahabad Concrete	450 mm	60	MH-9	MH-10	91.601	91.481	4.03	0	60	0
P-10	Allahabad Concrete	450 mm	60	MH-10	MH-11	91.481	91.361	4.22	0	60	0
P-11	Allahabad Concrete	450 mm	60	MH-11	MH-12	91.361	91.241	4.05	0	60	0
P-12	Allahabad Concrete	450 mm	60	MH-12	MH-13	91.241	91.121	3.97	60	0	0
P-13	Allahabad Concrete	450 mm	60	MH-13	MH-14	91.121	91.001	4.13	0	60	0
P-14	Allahabad Concrete	450 mm	60	MH-14	MH-15	91.001	90.881	4.18	0	60	0
P-15	Allahabad Concrete	450 mm	60	MH-15	MH-16	90.881	90.761	4.12	0	60	0
P-16	Allahabad Concrete	450 mm	60	MH-16	MH-17	90.761	90.641	4.33	0	60	0
P-17	Allahabad Concrete	450 mm	45	MH-17	MH-18	90.641	90.551	4.06	0	45	0
P-18	Allahabad Concrete	450 mm	60	MH-18	MH-19	90.551	90.431	4.08	0	60	0
P-19	Allahabad Concrete	450 mm	60	MH-19	MH-20	90.431	90.311	3.71	60	0	0
P-20	Allahabad Concrete	450 mm	48	MH-20	MH-21	90.311	90.215	3.56	48	0	0
P-21	Allahabad Concrete	450 mm	60	MH-21	MH-22	90.215	90.095	3.84	60	0	0
P-22	Allahabad Concrete	450 mm	60	MH-22	MH-23	90.095	89.975	4.26	0	60	0
P-23	Allahabad Concrete	450 mm	60	MH-23	MH-24	89.975	89.855	4.66	0	60	0
P-24	Allahabad Concrete	450 mm	68	MH-24	MH-25	89.855	89.719	4.93	0	68	0
P-25	Allahabad Concrete	450 mm	60	MH-25	MH-26	89.719	89.599	4.9	0	60	0
P-26	Allahabad Concrete	450 mm	39	MH-26	MH-27	89.599	89.521	4.9	0	39	0
P-27	Allahabad Concrete	450 mm	39	MH-27	MH-28	89.521	89.443	4.91	0	39	0
P-28	Allahabad Concrete	450 mm	33	MH-28	MH-29	89.443	89.377	4.94	0	33	0
Total			**1587**						**703**	**884**	**0**
P-29	Allahabad Concrete	600 mm	49	MH-29	MH-30	89.227	89.129	4.81	0	49	0
P-30	Allahabad Concrete	600 mm	60	MH-30	MH-31	89.129	89.009	4.87	0	60	0
P-31	Allahabad Concrete	600 mm	60	MH-31	MH-32	89.009	88.889	5.3	0	60	0
P-32	Allahabad Concrete	600 mm	12	MH-32	MH-33	88.889	88.865	5.43	0	12	0
P-33	Allahabad Concrete	600 mm	40	MH-33	MH-34	88.865	88.785	5.62	0	40	0
P-34	Allahabad Concrete	600 mm	41	MH-34	MH-35	88.785	88.703	5.8	0	41	0
P-35	Allahabad Concrete	600 mm	40	MH-35	MH-36	88.703	88.623	6.02	0	0	40
P-36	Allahabad Concrete	600 mm	37	MH-36	MH-37	88.623	88.549	6.13	0	0	37
P-37	Allahabad Concrete	600 mm	60	MH-37	MH-38	88.549	88.429	5.97	0	60	0
P-38	Allahabad Concrete	600 mm	60	MH-38	MH-39	88.429	88.309	5.51	0	60	0
P-39	Allahabad Concrete	600 mm	60	MH-39	MH-40	88.309	88.189	4.89	0	60	0
P-40	Allahabad Concrete	600 mm	60	MH-40	MH-41	88.189	88.069	4.33	0	60	0
P-41	Allahabad Concrete	600 mm	60	MH-41	MH-42	88.069	87.949	4.31	0	60	0
P-42	Allahabad Concrete	600 mm	15	MH-42	MH-43	87.949	87.919	4.34	0	15	0
P-43	Allahabad Concrete	600 mm	30	MH-43	MH-44	87.919	87.859	4.17	0	30	0
P-44	Allahabad Concrete	600 mm	60	MH-44	MH-45	87.859	87.739	3.25	60	0	0
P-45	Allahabad Concrete	600 mm	60	MH-45	MH-46	87.471	87.351	3	60	0	0
P-46	Allahabad Concrete	600 mm	60	MH-46	MH-47	87.351	87.231	3.57	60	0	0
P-47	Allahabad Concrete	600 mm	28	MH-47	MH-48	87.231	87.175	4.14	0	28	0
Total			**892**						**180**	**635**	**77**
P-48	Allahabad Concrete	700 mm	65	MH-48	MH-49	84.553	84.423	7.13	0	0	65
P-49	Allahabad Concrete	700 mm	60	MH-49	MH-50	84.423	84.303	7.26	0	0	60
P-50	Allahabad Concrete	700 mm	55	MH-50	MH-51	84.303	84.193	7.3	0	0	55
P-51	Allahabad Concrete	700 mm	65	MH-51	MH-52	84.193	84.063	8	0	0	65
P-52	Allahabad Concrete	700 mm	60	MH-52	MH-53	84.063	83.943	8.86	0	0	60
P-53	Allahabad Concrete	700 mm	41	MH-53	MH-54	83.943	83.861	8.94	0	0	41
P-54	Allahabad Concrete	700 mm	41	MH-54	MH-55	83.861	83.779	9.07	0	0	41
P-55	Allahabad Concrete	700 mm	20	MH-55	MH-56	83.779	83.739	9.23	0	0	20
P-56	Allahabad Concrete	700 mm	50	MH-56	MH-57	83.739	83.639	8.74	0	0	50
P-57	Allahabad Concrete	700 mm	60	MH-57	MH-58	83.639	83.519	8.8	0	0	60
P-58	Allahabad Concrete	700 mm	60	MH-58	MH-59	83.519	83.399	8.63	0	0	60
P-59	Allahabad Concrete	700 mm	60	MH-59	MH-60	83.399	83.279	8.56	0	0	60
P-60	Allahabad Concrete	700 mm	60	MH-60	MH-61	83.279	83.159	8.54	0	0	60
P-61	Allahabad Concrete	700 mm	60	MH-61	MH-62	83.159	83.039	7.67	0	0	60
P-62	Allahabad Concrete	700 mm	60	MH-62	MH-63	83.039	82.919	6.91	0	0	60
P-63	Allahabad Concrete	700 mm	60	MH-63	MH-64	82.919	82.799	6.11	0	0	60
P-64	Allahabad Concrete	700 mm	60	MH-64	MH-65	82.799	82.679	5.39	0	60	0
P-65	Allahabad Concrete	700 mm	37	MH-65	MH-66	82.679	82.605	5.29	0	37	0
P-66	Allahabad Concrete	700 mm	30	MH-66	MH-67	82.605	82.545	5.07	0	30	0
P-67	Allahabad Concrete	700 mm	60	MH-67	MH-68	82.545	82.425	4.88	0	60	0
P-68	Allahabad Concrete	700 mm	62	MH-68	Mumford ganj Sump	82.425	82.301	5	0	62	0
Total			**1126**						**0**	**249**	**877**
GRAND TOTAL			**3605**						**883**	**1768**	**954**

Appendix A3.3 Detailed Description of Manhole of Thornhill Road (District-D)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	96.001	92.551	1.2	3.45	1	0
MH-2	96.125	92.431	1.2	3.69	1	0
MH-3	96.381	92.311	1.2	4.07	1	0
MH-4	96.23	92.191	1.2	4.04	1	0
MH-5	96.125	92.071	1.2	4.05	1	0
MH-6	95.976	91.951	1.2	4.02	1	0
MH-7	96.187	91.831	1.2	4.36	1	0
MH-8	96.153	91.721	1.2	4.43	1	0
MH-9	95.922	91.601	1.2	4.32	1	0
MH-10	95.965	91.481	1.2	4.48	1	0
MH-11	96.026	91.361	1.2	4.66	1	0
MH-12	95.744	91.241	1.2	4.5	1	0
MH-13	95.544	91.121	1.2	4.42	1	0
MH-14	95.577	91.001	1.2	4.58	1	0
MH-15	95.51	90.881	1.2	4.63	1	0
MH-16	95.329	90.761	1.2	4.57	1	0
MH-17	95.419	90.641	1.2	4.78	1	0
MH-18	95.065	90.551	1.2	4.51	1	0
MH-19	94.961	90.431	1.2	4.53	1	0
MH-20	94.466	90.311	1.2	4.15	1	0
MH-21	94.229	90.215	1.2	4.01	1	0
MH-22	94.385	90.095	1.2	4.29	1	0
MH-23	94.681	89.975	1.2	4.71	1	0
MH-24	94.966	89.855	1.2	5.11	1	0
MH-25	95.101	89.719	1.2	5.38	1	0
MH-26	94.946	89.599	1.2	5.35	1	0
MH-27	94.867	89.521	1.2	5.35	1	0
MH-28	94.806	89.443	1.2	5.36	1	0
MH-29	94.764	89.227	1.2	5.54	1	0
MH-30	94.542	89.129	1.2	5.41	1	0
MH-31	94.48	89.009	1.2	5.47	1	0
MH-32	94.785	88.889	1.2	5.9	1	0
MH-33	94.893	88.865	1.2	6.03	1	0
MH-34	95	88.785	1.2	6.21	1	0
MH-35	95.107	88.703	1.2	6.4	1	0
MH-36	95.243	88.623	1.2	6.62	1	0
MH-37	95.281	88.549	1.2	6.73	1	0
MH-38	94.995	88.429	1.2	6.57	1	0
MH-39	94.415	88.309	1.2	6.11	1	0
MH-40	93.683	88.189	1.2	5.49	1	0
MH-41	93.002	88.069	1.2	4.93	1	0
MH-42	92.855	87.949	1.2	4.91	1	0
MH-43	92.86	87.919	1.2	4.94	1	0
MH-44	92.625	87.859	1.2	4.77	1	0
MH-45	91.593	87.471	1.2	4.12	1	0
MH-46	90.951	87.351	1.2	3.6	1	0
MH-47	91.396	87.231	1.2	4.16	1	0
MH-48	91.913	84.553	1.2	7.36	0	1
MH-49	92.253	84.423	1.2	7.83	0	1
MH-50	92.264	84.303	1.2	7.96	0	1
MH-51	92.191	84.193	1.2	8	0	1
MH-52	92.758	84.063	1.2	8.7	0	1
MH-53	93.504	83.943	1.2	9.56	0	1
MH-54	93.505	83.861	1.2	9.64	0	1
MH-55	93.55	83.779	1.2	9.77	0	1
MH-56	93.664	83.739	1.2	9.93	0	1
MH-57	93.078	83.639	1.2	9.44	0	1
MH-58	93.017	83.519	1.2	9.5	0	1
MH-59	92.729	83.399	1.2	9.33	0	1
MH-60	92.541	83.279	1.2	9.26	0	1
MH-61	92.4	83.159	1.2	9.24	0	1
MH-62	91.41	83.039	1.2	8.37	0	1
MH-63	90.527	82.919	1.2	7.61	0	1
MH-64	89.609	82.799	1.2	6.81	1	0
MH-65	88.77	82.679	1.2	6.09	1	0
MH-66	88.594	82.605	1.2	5.99	1	0
MH-67	88.314	82.545	1.2	5.77	1	0
MH-68	88	82.425	1.2	5.58	1	0
					52	**16**

Appendix A3.4 Sewer Data of Muir Road (Dist- D) -Node 3-4 (1/3)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	500 mm	47	MH-1	MH-2	90.844	90.777	700	110	61.6	0.71	3.31	0.8	3	124	11
P-2	Allahabad Concrete	500 mm	46	MH-2	MH-3	90.725	90.659	700	110	61.5	0.71	3.1	0.8	3	124	11
P-3	Allahabad Concrete	500 mm	45	MH-3	MH-4	90.608	90.543	700	110	61.1	0.71	2.81	0.8	3	124	11
P-4	Allahabad Concrete	500 mm	45	MH-4	MH-5	90.492	90.428	700	110	55.3	0.71	2.61	0.8	3	124	11
P-5	Allahabad Concrete	500 mm	42	MH-5	MH-6	90.233	90.173	700	110	55.1	0.71	2.52	0.8	3	124	11
P-6	Allahabad Concrete	500 mm	56	MH-6	MH-7	89.766	89.686	700	110	56	0.71	2.53	0.8	3	124	11
P-7	Allahabad Concrete	500 mm	56	MH-7	MH-8	89.311	89.231	700	110	56	0.71	2.53	0.8	3	124	11
P-8	Allahabad Concrete	500 mm	43	MH-8	MH-9	88.937	88.875	700	110	63.6	0.71	2.52	0.8	3	124	11
P-9	Allahabad Concrete	500 mm	13	MH-9	MH-10	88.861	88.842	700	110	61.1	0.71	2.56	0.8	3	124	11
P-10	Allahabad Concrete	500 mm	9	MH-10	MH-11	88.832	88.819	700	110	60	0.71	2.59	0.8	3	124	11
P-11	Allahabad Concrete	500 mm	4	MH-11	MH-12	88.814	88.809	700	110	58.7	0.71	2.6	0.8	3	124	11
P-12	Allahabad Concrete	500 mm	34	MH-12	MH-13	88.77	88.721	700	110	61.7	0.71	3.25	0.8	3	124	11
P-13	Allahabad Concrete	500 mm	35	MH-13	MH-14	88.681	88.631	700	110	61.7	0.71	3.62	0.8	3	124	11
P-14	Allahabad Concrete	500 mm	35	MH-14	MH-15	88.591	88.541	700	110	61.6	0.71	3.92	0.8	3	124	11
P-15	Allahabad Concrete	500 mm	32	MH-15	MH-16	88.505	88.459	700	110	60.3	0.71	4.11	0.8	3	124	11
P-16	Allahabad Concrete	500 mm	50	MH-16	MH-17	88.402	88.33	700	110	61.5	0.71	4.35	0.8	3	124	11
P-17	Allahabad Concrete	500 mm	49	MH-17	MH-18	88.274	88.204	700	110	61.8	0.71	4.25	0.8	3	124	11
P-18	Allahabad Concrete	500 mm	49	MH-18	MH-19	88.148	88.078	700	110	63.2	0.71	4.13	0.8	3	124	11
P-19	Allahabad Concrete	500 mm	10	MH-19	MH-20	88.067	88.053	700	110	59.4	0.71	4.06	0.8	3	124	11
P-20	Allahabad Concrete	500 mm	31	MH-20	MH-21	88.017	87.973	700	110	60.2	0.71	3.74	0.8	3	124	11
P-21	Allahabad Concrete	500 mm	50	MH-21	MH-22	87.916	87.844	700	110	61.4	0.71	3.53	0.8	3	124	11
P-22	Allahabad Concrete	500 mm	50	MH-22	MH-23	87.787	87.716	700	110	61.6	0.71	3.69	0.8	3	124	11

Appendix A3.4 Sewer Data of Muir Road (Dist- D) -Node 3-4 (2/3)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-23	Allahabad Concrete	500 mm	50	MH-23	MH-24	87.659	87.587	700	110	62.9	0.71	4.03	0.8	3	124	11
P-24	Allahabad Concrete	500 mm	25	MH-24	MH-25	87.559	87.523	700	110	60.1	0.71	4.15	0.8	3	124	11
P-25	Allahabad Concrete	500 mm	46	MH-25	MH-26	87.47	87.405	700	110	61.6	0.71	3.89	0.8	3	124	11
P-26	Allahabad Concrete	500 mm	45	MH-26	MH-27	87.353	87.289	700	110	61.5	0.71	3.58	0.8	3	124	11
P-27	Allahabad Concrete	500 mm	48	MH-27	MH-28	87.234	87.165	700	110	62.6	0.71	3.39	0.8	3	124	11
P-28	Allahabad Concrete	500 mm	29	MH-28	MH-29	87.132	87.091	700	110	60.4	0.71	3.55	0.8	3	124	11
P-29	Allahabad Concrete	500 mm	43	MH-29	MH-30	87.042	86.98	700	110	60.2	0.71	3.83	0.8	3	124	11
P-30	Allahabad Concrete	500 mm	61	MH-30	MH-31	86.911	86.823	700	110	62.6	0.71	4.12	0.8	3	124	11
P-31	Allahabad Concrete	500 mm	42	MH-31	MH-32	86.775	86.715	700	110	62	0.71	3.84	0.8	3	124	11
P-32	Allahabad Concrete	500 mm	38	MH-32	MH-33	86.672	86.618	700	110	61.8	0.71	3.75	0.8	3	124	11
P-33	Allahabad Concrete	500 mm	37	MH-33	MH-34	86.575	86.523	700	110	61.7	0.71	3.5	0.8	3	124	11
P-34	Allahabad Concrete	500 mm	35	MH-34	MH-35	86.483	86.433	700	110	60.7	0.71	3.57	0.8	3	124	11
P-35	Allahabad Concrete	500 mm	45	MH-35	MH-36	86.381	86.317	700	110	60.2	0.71	3.75	0.8	3	124	11
P-36	Allahabad Concrete	500 mm	62	MH-36	MH-37	86.246	86.157	700	110	62.4	0.71	3.01	0.8	3	124	11
P-37	Allahabad Concrete	500 mm	33	MH-37	MH-38	86.12	86.073	700	110	54.4	0.71	2.54	0.8	3	124	11
P-38	Allahabad Concrete	500 mm	51	MH-38	MH-39	85.77	85.697	700	110	61	0.71	2.53	0.8	3	124	11
P-39	Allahabad Concrete	500 mm	51	MH-39	MH-40	85.637	85.564	700	110	60.6	0.71	2.53	0.8	3	124	11
P-40	Allahabad Concrete	500 mm	60	MH-40	MH-41	85.495	85.41	700	110	61.6	0.71	3.19	0.8	3	124	11
P-41	Allahabad Concrete	500 mm	49	MH-41	MH-42	85.354	85.284	700	110	59	0.71	4.16	0.8	3	124	11
P-42	Allahabad Concrete	500 mm	78	MH-42	MH-43	85.194	85.083	700	110	63.1	0.71	5.98	0.8	3	124	11
P-43	Allahabad Concrete	500 mm	42	MH-43	MH-44	85.035	84.975	700	110	61.6	0.71	6.47	0.8	3	124	11
P-44	Allahabad Concrete	500 mm	41	MH-44	MH-45	84.928	84.87	700	110	60.8	0.71	6.71	0.8	3	124	11

Appendix A3.4 Sewer Data of Muir Road (Dist- D) -Node 3-4 (3/3)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-45	Allahabad Concrete	500 mm	51	MH-45	MH-46	84.811	84.738	700	110	61.3	0.71	6.68	0.8	3	124	11
P-46	Allahabad Concrete	500 mm	52	MH-46	MH-47	84.679	84.605	700	110	62	0.71	6.64	0.8	3	124	11
P-47	Allahabad Concrete	500 mm	20	MH-47	Node 4	84.582	84.553	700	110	53	0.71	6.82	0.8	3	124	11
			1965													

Appendix A3.5 Detailed Description of Sewer of Muir Road (Dist- D) -Node 3-4 (1/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	500 mm	47	MH-1	MH-2	90.844	90.777	3.31	47	0	0
P-2	Allahabad Concrete	500 mm	46	MH-2	MH-3	90.725	90.659	3.1	46	0	0
P-3	Allahabad Concrete	500 mm	45	MH-3	MH-4	90.608	90.543	2.81	45	0	0
P-4	Allahabad Concrete	500 mm	45	MH-4	MH-5	90.492	90.428	2.61	45	0	0
P-5	Allahabad Concrete	500 mm	42	MH-5	MH-6	90.233	90.173	2.52	42	0	0
P-6	Allahabad Concrete	500 mm	56	MH-6	MH-7	89.766	89.686	2.53	56	0	0
P-7	Allahabad Concrete	500 mm	56	MH-7	MH-8	89.311	89.231	2.53	56	0	0
P-8	Allahabad Concrete	500 mm	43	MH-8	MH-9	88.937	88.875	2.52	43	0	0
P-9	Allahabad Concrete	500 mm	13	MH-9	MH-10	88.861	88.842	2.56	13	0	0
P-10	Allahabad Concrete	500 mm	9	MH-10	MH-11	88.832	88.819	2.59	9	0	0
P-11	Allahabad Concrete	500 mm	4	MH-11	MH-12	88.814	88.809	2.6	4	0	0
P-12	Allahabad Concrete	500 mm	34	MH-12	MH-13	88.77	88.721	3.25	34	0	0
P-13	Allahabad Concrete	500 mm	35	MH-13	MH-14	88.681	88.631	3.62	35	0	0
P-14	Allahabad Concrete	500 mm	35	MH-14	MH-15	88.591	88.541	3.92	35	0	0
P-15	Allahabad Concrete	500 mm	32	MH-15	MH-16	88.505	88.459	4.11	0	32	0
P-16	Allahabad Concrete	500 mm	50	MH-16	MH-17	88.402	88.33	4.35	0	50	0
P-17	Allahabad Concrete	500 mm	49	MH-17	MH-18	88.274	88.204	4.25	0	49	0
P-18	Allahabad Concrete	500 mm	49	MH-18	MH-19	88.148	88.078	4.13	0	49	0
P-19	Allahabad Concrete	500 mm	10	MH-19	MH-20	88.067	88.053	4.06	0	10	0
P-20	Allahabad Concrete	500 mm	31	MH-20	MH-21	88.017	87.973	3.74	31	0	0
P-21	Allahabad Concrete	500 mm	50	MH-21	MH-22	87.916	87.844	3.53	50	0	0
P-22	Allahabad Concrete	500 mm	50	MH-22	MH-23	87.787	87.716	3.69	50	0	0
P-23	Allahabad Concrete	500 mm	50	MH-23	MH-24	87.659	87.587	4.03	0	50	0
P-24	Allahabad Concrete	500 mm	25	MH-24	MH-25	87.559	87.523	4.15	0	25	0
P-25	Allahabad Concrete	500 mm	46	MH-25	MH-26	87.47	87.405	3.89	46	0	0
P-26	Allahabad Concrete	500 mm	45	MH-26	MH-27	87.353	87.289	3.58	45	0	0
P-27	Allahabad Concrete	500 mm	48	MH-27	MH-28	87.234	87.165	3.39	48	0	0
P-28	Allahabad Concrete	500 mm	29	MH-28	MH-29	87.132	87.091	3.55	29	0	0
P-29	Allahabad Concrete	500 mm	43	MH-29	MH-30	87.042	86.98	3.83	43	0	0
P-30	Allahabad Concrete	500 mm	61	MH-30	MH-31	86.911	86.823	4.12	0	61	0
P-31	Allahabad Concrete	500 mm	42	MH-31	MH-32	86.775	86.715	3.84	42	0	0
P-32	Allahabad Concrete	500 mm	38	MH-32	MH-33	86.672	86.618	3.75	38	0	0
P-33	Allahabad Concrete	500 mm	37	MH-33	MH-34	86.575	86.523	3.5	37	0	0
P-34	Allahabad Concrete	500 mm	35	MH-34	MH-35	86.483	86.433	3.57	35	0	0
P-35	Allahabad Concrete	500 mm	45	MH-35	MH-36	86.381	86.317	3.75	45	0	0
P-36	Allahabad Concrete	500 mm	62	MH-36	MH-37	86.246	86.157	3.01	62	0	0
P-37	Allahabad Concrete	500 mm	33	MH-37	MH-38	86.12	86.073	2.54	33	0	0
P-38	Allahabad Concrete	500 mm	51	MH-38	MH-39	85.77	85.697	2.53	51	0	0
P-39	Allahabad Concrete	500 mm	51	MH-39	MH-40	85.637	85.564	2.53	51	0	0

Appendix A3.5 Detailed Description of Sewer of Muir Road (Dist- D) -Node 3-4 (2/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-40	Allahabad Concrete	500 mm	60	MH-40	MH-41	85.495	85.41	3.19	60	0	0
P-41	Allahabad Concrete	500 mm	49	MH-41	MH-42	85.354	85.284	4.16	0	49	0
P-42	Allahabad Concrete	500 mm	78	MH-42	MH-43	85.194	85.083	5.98	0	78	0
P-43	Allahabad Concrete	500 mm	42	MH-43	MH-44	85.035	84.975	6.47	0	0	42
P-44	Allahabad Concrete	500 mm	41	MH-44	MH-45	84.928	84.87	6.71	0	0	41
P-45	Allahabad Concrete	500 mm	51	MH-45	MH-46	84.811	84.738	6.68	0	0	51
P-46	Allahabad Concrete	500 mm	52	MH-46	MH-47	84.679	84.605	6.64	0	0	52
P-47	Allahabad Concrete	500 mm	20	MH-47	Node 4	84.582	84.553	6.82	0	0	20
			1965						**1306**	**453**	**206**

Appendix A3.6 Detailed Description of Manhole of Muir Road to Stanley Road (Disctrict-D)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	93.925	90.844	1.2	3.08	1	0
MH-2	94.588	90.725	1.2	3.86	1	0
MH-3	94.257	90.608	1.2	3.65	1	0
MH-4	93.856	90.492	1.2	3.36	1	0
MH-5	93.535	90.233	1.2	3.3	1	0
MH-6	93.197	89.766	1.2	3.43	1	0
MH-7	92.718	89.311	1.2	3.41	1	0
MH-8	92.263	88.937	1.2	3.33	1	0
MH-9	91.9	88.861	1.2	3.04	1	0
MH-10	91.907	88.832	1.2	3.08	1	0
MH-11	91.91	88.814	1.2	3.1	1	0
MH-12	91.912	88.77	1.2	3.14	1	0
MH-13	92.469	88.681	1.2	3.79	1	0
MH-14	92.752	88.591	1.2	4.16	1	0
MH-15	92.958	88.505	1.2	4.45	1	0
MH-16	93.07	88.402	1.2	4.67	1	0
MH-17	93.184	88.274	1.2	4.91	1	0
MH-18	92.957	88.148	1.2	4.81	1	0
MH-19	92.704	88.067	1.2	4.64	1	0
MH-20	92.615	88.017	1.2	4.6	1	0
MH-21	92.21	87.916	1.2	4.29	1	0
MH-22	91.877	87.787	1.2	4.09	1	0
MH-23	91.903	87.659	1.2	4.24	1	0
MH-24	92.122	87.559	1.2	4.56	1	0
MH-25	92.17	87.47	1.2	4.7	1	0
MH-26	91.798	87.353	1.2	4.44	1	0
MH-27	91.373	87.234	1.2	4.14	1	0
MH-28	91.057	87.132	1.2	3.92	1	0
MH-29	91.138	87.042	1.2	4.1	1	0
MH-30	91.311	86.911	1.2	4.4	1	0
MH-31	91.441	86.775	1.2	4.67	1	0
MH-32	91.051	86.672	1.2	4.38	1	0
MH-33	90.87	86.575	1.2	4.29	1	0
MH-34	90.518	86.483	1.2	4.04	1	0
MH-35	90.501	86.381	1.2	4.12	1	0
MH-36	90.571	86.246	1.2	4.33	1	0
MH-37	89.665	86.12	1.2	3.55	1	0
MH-38	89.108	85.77	1.2	3.34	1	0
MH-39	88.726	85.637	1.2	3.09	1	0
MH-40	88.593	85.495	1.2	3.1	1	0
MH-41	89.101	85.354	1.2	3.75	1	0
MH-42	89.94	85.194	1.2	4.75	1	0
MH-43	91.566	85.035	1.2	6.53	1	0
MH-44	91.947	84.928	1.2	7.02	0	1
MH-45	92.078	84.811	1.2	7.27	0	1
MH-46	91.92	84.679	1.2	7.24	0	1
MH-47	91.741	84.582	1.2	7.16	0	1
					43	**4**

Appendix A3.7 Sewer Data of Sewer Line from Alopi Bagh- Mumford Ganj (District - D)-Start Ch. 3100 m- Node 18-18(Mumford ganj PS) (1/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	1200 mm	32	MH-1	MH-2	90.573	90.527	700	1,206	67.8	1.28	3.2	0.8	3	1,277	42
P-2	Allahabad Concrete	1200 mm	60	MH-2	MH-3	90.527	90.441	700	1,206	61.9	1.28	3.05	0.8	3	1,277	42
P-3	Allahabad Concrete	1200 mm	34	MH-3	MH-4	90.365	90.316	700	1,206	59.5	1.28	3	0.8	3	1,277	42
P-4	Allahabad Concrete	1200 mm	21	MH-4	MH-5	90.076	90.046	700	1,206	75.3	1.28	3	0.8	3	1,277	42
P-5	Allahabad Concrete	1200 mm	29	MH-5	MH-6	90.046	90.005	700	1,206	75	1.28	3.01	0.8	3	1,277	42
P-6	Allahabad Concrete	1200 mm	35	MH-6	MH-7	90.005	89.955	700	1,206	74.6	1.28	3.05	0.8	3	1,277	42
P-7	Allahabad Concrete	1200 mm	64	MH-7	MH-8	89.933	89.842	700	1,206	76	1.28	3	0.8	3	1,277	42
P-8	Allahabad Concrete	1200 mm	58	MH-8	MH-9	89.842	89.759	700	1,206	75.6	1.28	3.18	0.8	3	1,277	42
P-9	Allahabad Concrete	1200 mm	43	MH-9	MH-10	89.759	89.698	700	1,206	75.1	1.28	3.04	0.8	3	1,277	42
P-10	Allahabad Concrete	1200 mm	33	MH-10	MH-11	89.698	89.651	700	1,206	74.7	1.28	3.39	0.8	3	1,277	42
P-11	Allahabad Concrete	1200 mm	45	MH-11	MH-12	89.651	89.586	700	1,206	74.2	1.28	3.34	0.8	3	1,277	42
P-12	Allahabad Concrete	1200 mm	55	MH-12	MH-13	89.586	89.508	700	1,206	73.2	1.28	3.64	0.8	3	1,277	42
P-13	Allahabad Concrete	1200 mm	30	MH-13	MH-14	89.508	89.465	700	1,206	72.3	1.28	3.7	0.8	3	1,277	42
P-14	Allahabad Concrete	1200 mm	68	MH-14	MH-15	89.465	89.368	700	1,206	70.5	1.28	3.99	0.8	3	1,277	42
P-15	Allahabad Concrete	1200 mm	37	MH-15	MH-16	89.368	89.315	700	1,206	68	1.28	3.82	0.8	3	1,277	42
P-16	Allahabad Concrete	1200 mm	38	MH-16	MH-17	89.315	89.261	700	1,206	64.8	1.28	3.79	0.8	3	1,277	42
P-17	Allahabad Concrete	1200 mm	32	MH-17	MH-18	89.261	89.215	700	1,206	56.3	1.28	3.02	0.8	3	1,277	42
P-18	Allahabad Concrete	1200 mm	63	MH-18	MH-19	88.806	88.716	700	1,206	58.1	1.28	3	0.8	3	1,277	42
P-19	Allahabad Concrete	1200 mm	63	MH-19	MH-20	88.178	88.088	700	1,206	72.5	1.28	3	0.8	3	1,277	42
P-20	Allahabad Concrete	1200 mm	47	MH-20	MH-21	88.088	88.021	700	1,206	70.8	1.28	3.35	0.8	3	1,277	42
P-21	Allahabad Concrete	1200 mm	12	MH-21	MH-22	88.021	88.004	700	1,206	69.6	1.28	3.45	0.8	3	1,277	42
P-22	Allahabad Concrete	1200 mm	45	MH-22	MH-23	88.004	87.939	700	1,206	67.8	1.28	4.06	0.8	3	1,277	42

Appendix A3.7 Sewer Data of Sewer Line from Alopi Bagh- Mumford Ganj (District - D)-Start Ch. 3100 m- Node 18-18(Mumford ganj PS) (2/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-23	Allahabad Concrete	1200 mm	21	MH-23	MH-24	87.939	87.909	700	1,206	65.3	1.28	4.04	0.8	3	1,277	42
P-24	Allahabad Concrete	1200 mm	43	MH-24	MH-25	87.909	87.848	700	1,206	57.5	1.28	3.68	0.8	3	1,277	42
P-25	Allahabad Concrete	1200 mm	60	MH-25	MH-26	87.664	87.578	700	1,206	58	1.28	3	0.8	3	1,277	42
P-26	Allahabad Concrete	1200 mm	24	MH-26	MH-27	87.281	87.247	700	1,206	55.6	1.28	3	0.8	3	1,277	42
P-27	Allahabad Concrete	1200 mm	14	MH-27	MH-28	85.961	85.941	700	1,206	67.8	1.28	3	0.8	3	1,277	42
P-28	Allahabad Concrete	1200 mm	46	MH-28	MH-29	85.848	85.782	700	1,206	74.8	1.28	3	0.8	3	1,277	42
P-29	Allahabad Concrete	1200 mm	53	MH-29	MH-30	85.782	85.706	700	1,206	74.1	1.28	3.27	0.8	3	1,277	42
P-30	Allahabad Concrete	1200 mm	64	MH-30	MH-31	85.706	85.615	700	1,206	73	1.28	4.4	0.8	3	1,277	42
P-31	Allahabad Concrete	1200 mm	56	MH-31	MH-32	85.615	85.535	700	1,206	71.3	1.28	4.89	0.8	3	1,277	42
P-32	Allahabad Concrete	1200 mm	39	MH-32	MH-33	85.535	85.479	700	1,206	69.4	1.28	4.95	0.8	3	1,277	42
P-33	Allahabad Concrete	1200 mm	39	MH-33	MH-34	85.479	85.423	700	1,206	66.9	1.28	4.55	0.8	3	1,277	42
P-34	Allahabad Concrete	1200 mm	40	MH-34	MH-35	85.423	85.366	700	1,206	62.3	1.28	3.65	0.8	3	1,277	42
P-35	Allahabad Concrete	1200 mm	41	MH-35	MH-36	85.309	85.25	700	1,206	56.9	1.28	3	0.8	3	1,277	42
P-36	Allahabad Concrete	1200 mm	20	MH-36	MH-37	85.029	85	700	1,206	62.9	1.28	3	0.8	3	1,277	42
P-37	Allahabad Concrete	1200 mm	48	MH-37	MH-38	84.959	84.89	700	1,206	57.3	1.28	3	0.8	3	1,277	42
P-38	Allahabad Concrete	1200 mm	48	MH-38	MH-39	84.387	84.318	700	1,206	57.3	1.28	3	0.8	3	1,277	42
P-39	Allahabad Concrete	1200 mm	56	MH-39	O-1	83.88	83.8	700	1,206	57.8	1.28	3	0.8	3	1,277	42
			1656													

Appendix A3.8 Detailed Description of Sewer Line from Alopi Bagh- Mumford Ganj (District - D)- Start Ch. 3100 m- Node 18-18(Mumford ganj PS) (1/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	1200 mm	32	MH-1	MH-2	90.573	90.527	3.2	32	0	0
P-2	Allahabad Concrete	1200 mm	60	MH-2	MH-3	90.527	90.441	3.05	60	0	0
P-3	Allahabad Concrete	1200 mm	34	MH-3	MH-4	90.365	90.316	3	34	0	0
P-4	Allahabad Concrete	1200 mm	21	MH-4	MH-5	90.076	90.046	3	21	0	0
P-5	Allahabad Concrete	1200 mm	29	MH-5	MH-6	90.046	90.005	3.01	29	0	0
P-6	Allahabad Concrete	1200 mm	35	MH-6	MH-7	90.005	89.955	3.05	35	0	0
P-7	Allahabad Concrete	1200 mm	64	MH-7	MH-8	89.933	89.842	3	64	0	0
P-8	Allahabad Concrete	1200 mm	58	MH-8	MH-9	89.842	89.759	3.18	58	0	0
P-9	Allahabad Concrete	1200 mm	43	MH-9	MH-10	89.759	89.698	3.04	43	0	0
P-10	Allahabad Concrete	1200 mm	33	MH-10	MH-11	89.698	89.651	3.39	33	0	0
P-11	Allahabad Concrete	1200 mm	45	MH-11	MH-12	89.651	89.586	3.34	45	0	0
P-12	Allahabad Concrete	1200 mm	55	MH-12	MH-13	89.586	89.508	3.64	55	0	0
P-13	Allahabad Concrete	1200 mm	30	MH-13	MH-14	89.508	89.465	3.7	30	0	0
P-14	Allahabad Concrete	1200 mm	68	MH-14	MH-15	89.465	89.368	3.99	68	0	0
P-15	Allahabad Concrete	1200 mm	37	MH-15	MH-16	89.368	89.315	3.82	37	0	0
P-16	Allahabad Concrete	1200 mm	38	MH-16	MH-17	89.315	89.261	3.79	38	0	0
P-17	Allahabad Concrete	1200 mm	32	MH-17	MH-18	89.261	89.215	3.02	32	0	0
P-18	Allahabad Concrete	1200 mm	63	MH-18	MH-19	88.806	88.716	3	63	0	0
P-19	Allahabad Concrete	1200 mm	63	MH-19	MH-20	88.178	88.088	3	63	0	0
P-20	Allahabad Concrete	1200 mm	47	MH-20	MH-21	88.088	88.021	3.35	47	0	0
P-21	Allahabad Concrete	1200 mm	12	MH-21	MH-22	88.021	88.004	3.45	12	0	0
P-22	Allahabad Concrete	1200 mm	45	MH-22	MH-23	88.004	87.939	4.06	0	45	0
P-23	Allahabad Concrete	1200 mm	21	MH-23	MH-24	87.939	87.909	4.04	0	21	0
P-24	Allahabad Concrete	1200 mm	43	MH-24	MH-25	87.909	87.848	3.68	43	0	0
P-25	Allahabad Concrete	1200 mm	60	MH-25	MH-26	87.664	87.578	3	60	0	0
P-26	Allahabad Concrete	1200 mm	24	MH-26	MH-27	87.281	87.247	3	24	0	0
P-27	Allahabad Concrete	1200 mm	14	MH-27	MH-28	85.961	85.941	3	14	0	0
P-28	Allahabad Concrete	1200 mm	46	MH-28	MH-29	85.848	85.782	3	46	0	0
P-29	Allahabad Concrete	1200 mm	53	MH-29	MH-30	85.782	85.706	3.27	53	0	0
P-30	Allahabad Concrete	1200 mm	64	MH-30	MH-31	85.706	85.615	4.4	0	64	0
P-31	Allahabad Concrete	1200 mm	56	MH-31	MH-32	85.615	85.535	4.89	0	56	0
P-32	Allahabad Concrete	1200 mm	39	MH-32	MH-33	85.535	85.479	4.95	0	39	0
P-33	Allahabad Concrete	1200 mm	39	MH-33	MH-34	85.479	85.423	4.55	0	39	0
P-34	Allahabad Concrete	1200 mm	40	MH-34	MH-35	85.423	85.366	3.65	40	0	0
P-35	Allahabad Concrete	1200 mm	41	MH-35	MH-36	85.309	85.25	3	41	0	0
P-36	Allahabad Concrete	1200 mm	20	MH-36	MH-37	85.029	85	3	20	0	0

Appendix A3.8 Detailed Description of Sewer Line from Alopi Bagh- Mumford Ganj (District - D)- Start Ch. 3100 m- Node 18-18(Mumford ganj PS) (2/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-37	Allahabad Concrete	1200 mm	48	MH-37	MH-38	84.959	84.89	3	48	0	0
P-38	Allahabad Concrete	1200 mm	48	MH-38	MH-39	84.387	84.318	3	48	0	0
P-39	Allahabad Concrete	1200 mm	56	MH-39	O-1	83.88	83.8	3	56	0	0
			1656						**1392**	**264**	**0**

Appendix A3.9 Detailed Description of Manhole of Alopi Bagh to Mumford ganj (District-D)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	94.987	90.573	1.2	4.2	1	0
MH-2	94.927	90.527	1.2	4.2	1	0
MH-3	94.688	90.365	1.2	4.2	1	0
MH-4	94.516	90.076	1.2	4.2	1	0
MH-5	94.246	90.046	1.2	4.21	1	0
MH-6	94.214	90.005	1.2	4.24	1	0
MH-7	94.204	89.933	1.2	4.24	1	0
MH-8	94.042	89.842	1.2	4.27	1	0
MH-9	94.138	89.759	1.2	4.29	1	0
MH-10	93.94	89.698	1.2	4.32	1	0
MH-11	94.242	89.651	1.2	4.38	1	0
MH-12	94.122	89.586	1.2	4.4	1	0
MH-13	94.349	89.508	1.2	4.41	1	0
MH-14	94.362	89.465	1.2	4.42	1	0
MH-15	94.56	89.368	1.2	4.44	1	0
MH-16	94.334	89.315	1.2	4.47	1	0
MH-17	94.25	89.261	1.2	4.5	1	0
MH-18	93.439	88.806	1.2	4.54	1	0
MH-19	92.916	88.178	1.2	4.55	1	0
MH-20	92.288	88.088	1.2	4.59	1	0
MH-21	92.574	88.021	1.2	4.63	1	0
MH-22	92.655	88.004	1.2	4.64	1	0
MH-23	93.196	87.939	1.2	4.65	1	0
MH-24	93.152	87.909	1.2	4.7	1	0
MH-25	92.728	87.664	1.2	4.74	1	0
MH-26	91.778	87.281	1.2	4.84	1	0
MH-27	91.447	85.961	1.2	4.9	1	0
MH-28	90.141	85.848	1.2	4.91	1	0
MH-29	89.982	85.782	1.2	4.99	1	0
MH-30	90.177	85.706	1.2	5.02	1	0
MH-31	91.212	85.615	1.2	5.06	1	0
MH-32	91.627	85.535	1.2	5.19	1	0
MH-33	91.634	85.479	1.2	5.24	1	0
MH-34	91.178	85.423	1.2	5.26	1	0
MH-35	90.217	85.309	1.2	5.49	1	0
MH-36	89.45	85.029	1.2	5.6	1	0
MH-37	89.2	84.959	1.2	5.75	1	0
MH-38	89.09	84.387	1.2	6.09	1	0
MH-39	88.518	83.88	1.2	6.15	1	0
					39	**0**

Appendix A3.10 Sewer Data of Intercepting Sewer at Rajapur (District-D) (1/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)
P-1	Allahabad Concrete	150 mm	18	MH-1	MH-2	81.55	81.51	500	3	44.4	0.32	0.84	0.6	3	6
P-2	Allahabad Concrete	150 mm	15	MH-2	MH-3	81.51	81.48	500	3	44.4	0.32	0.87	0.6	3	6
P-3	Allahabad Concrete	150 mm	15	MH-3	MH-4	81.48	81.45	500	3	44.4	0.32	0.5	0.6	3	6
P-4	Allahabad Concrete	150 mm	35	MH-4	MH-5	81.45	81.38	500	3	44.4	0.32	0.47	0.6	3	6
P-5	Allahabad Concrete	150 mm	25	MH-5	MH-6	81.38	81.33	500	3	36.8	0.32	0.42	0.6	3	6
P-6	Allahabad Concrete	200 mm	37	MH-6	MH-7	81.07	81	500	13	65.4	0.47	0.3	0.6	3	13
P-7	Allahabad Concrete	200 mm	29	MH-7	MH-8	80.95	80.9	500	13	77	0.47	0.3	0.6	3	13
P-8	Allahabad Concrete	200 mm	28	MH-8	MH-9	80.9	80.84	500	13	76.7	0.47	0.36	0.6	3	13
P-9	Allahabad Concrete	200 mm	37	MH-9	MH-10	80.84	80.77	500	13	75.4	0.47	0.38	0.6	3	13
P-10	Allahabad Concrete	200 mm	37	MH-10	MH-11	80.77	80.69	500	13	60.4	0.47	0.3	0.6	3	13
P-11	Allahabad Concrete	200 mm	53	MH-11	MH-12	80.6	80.5	500	13	77.2	0.47	0.3	0.6	3	13
P-12	Allahabad Concrete	200 mm	57	MH-12	MH-13	80.5	80.38	500	13	77.2	0.47	0.56	0.6	3	13
P-13	Allahabad Concrete	200 mm	88	MH-13	MH-14	80.38	80.21	500	13	77.2	0.47	0.79	0.6	3	13
P-14	Allahabad Concrete	200 mm	90	MH-14	MH-15	80.21	80.03	500	13	77.2	0.47	1.07	0.6	3	13
P-15	Allahabad Concrete	200 mm	62	MH-15	MH-16	80.03	79.9	500	13	77.2	0.47	1.09	0.6	3	13
P-16	Allahabad Concrete	200 mm	94	MH-16	MH-17	79.9	79.71	500	13	75.5	0.47	0.88	0.6	3	13
P-17	Allahabad Concrete	200 mm	34	MH-17	MH-18	79.71	79.65	500	13	60.2	0.47	0.95	0.6	3	13
P-18	Allahabad Concrete	500 mm	110	MH-18	MH-19	79.35	79.13	500	125	71.3	0.84	1.67	0.6	3	146
P-19	Allahabad Concrete	500 mm	52	MH-19	MH-20	79.13	79.03	500	125	71.6	0.84	1.67	0.6	3	146
P-20	Allahabad Concrete	500 mm	39	MH-20	MH-21	79.03	78.95	500	125	72.3	0.84	1.55	0.6	3	146

Appendix A3.10 Sewer Data of Intercepting Sewer at Rajapur (District-D) (2/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Constructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Downstream Cover (m)	Minimum Velocity (m/s)	Maximum Velocity (m/s)	Full Capacity (l/s)
P-21	Allahabad Concrete	500 mm	27	MH-21	MH-22	78.95	78.89	500	129	72.7	0.84	1.71	0.6	3	146
P-22	Allahabad Concrete	500 mm	107	MH-22	MH-23	78.89	78.68	500	129	72.2	0.84	1.82	0.6	3	146
P-23	Allahabad Concrete	500 mm	17	MH-23	MH-24	78.68	78.65	500	129	71.6	0.84	1.65	0.6	3	146
P-24	Allahabad Concrete	500 mm	53	MH-24	MH-25	78.65	78.54	500	132	68.3	0.84	1.26	0.6	3	146
P-25	Allahabad Concrete	600 mm	31	MH-25	MH-26	78.44	78.38	500	205	70.8	0.95	1.32	0.6	3	238
P-26	Allahabad Concrete	600 mm	109	MH-26	MH-27	78.38	78.16	500	205	68.1	0.95	1.64	0.6	3	238
P-27	Allahabad Concrete	600 mm	31	MH-27	MH-28	78.16	78.1	500	205	61.2	0.95	1.4	0.6	3	238
P-28	Allahabad Concrete	600 mm	4	MH-28	O-1	78.1	78.09	500	208	53	0.95	1.31	0.6	3	238

Appendix A3.11 Detailed Description of Sewer of Intercepting Sewer at Rajapur (District-D)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert	Downstream Invert	Downstream Cover (m)	Length of Pipe for Depth range		
									0m - 4m	4m - 6m	6m - 9.5m
P-1	Allahabad Concrete	150 mm	18	MH-1	MH-2	81.55	81.51	0.84	18	0	0
P-2	Allahabad Concrete	150 mm	15	MH-2	MH-3	81.51	81.48	0.87	15	0	0
P-3	Allahabad Concrete	150 mm	15	MH-3	MH-4	81.48	81.45	0.5	15	0	0
P-4	Allahabad Concrete	150 mm	35	MH-4	MH-5	81.45	81.38	0.47	35	0	0
P-5	Allahabad Concrete	150 mm	25	MH-5	MH-6	81.38	81.33	0.42	25	0	0
	Total		**108**						**108**	**0**	**0**
P-6	Allahabad Concrete	200 mm	37	MH-6	MH-7	81.07	81	0.3	37	0	0
P-7	Allahabad Concrete	200 mm	29	MH-7	MH-8	80.95	80.9	0.3	29	0	0
P-8	Allahabad Concrete	200 mm	28	MH-8	MH-9	80.9	80.84	0.36	28	0	0
P-9	Allahabad Concrete	200 mm	37	MH-9	MH-10	80.84	80.77	0.38	37	0	0
P-10	Allahabad Concrete	200 mm	37	MH-10	MH-11	80.77	80.69	0.3	37	0	0
P-11	Allahabad Concrete	200 mm	53	MH-11	MH-12	80.6	80.5	0.3	53	0	0
P-12	Allahabad Concrete	200 mm	57	MH-12	MH-13	80.5	80.38	0.56	57	0	0
P-13	Allahabad Concrete	200 mm	88	MH-13	MH-14	80.38	80.21	0.79	88	0	0
P-14	Allahabad Concrete	200 mm	90	MH-14	MH-15	80.21	80.03	1.07	90	0	0
P-15	Allahabad Concrete	200 mm	62	MH-15	MH-16	80.03	79.9	1.09	62	0	0
P-16	Allahabad Concrete	200 mm	94	MH-16	MH-17	79.9	79.71	0.88	94	0	0
P-17	Allahabad Concrete	200 mm	34	MH-17	MH-18	79.71	79.65	0.95	34	0	0
	Total		**646**						**646**	**0**	**0**
P-18	Allahabad Concrete	500 mm	110	MH-18	MH-19	79.35	79.13	1.67	110	0	0
P-19	Allahabad Concrete	500 mm	52	MH-19	MH-20	79.13	79.03	1.67	52	0	0
P-20	Allahabad Concrete	500 mm	39	MH-20	MH-21	79.03	78.95	1.55	39	0	0
P-21	Allahabad Concrete	500 mm	27	MH-21	MH-22	78.95	78.89	1.71	27	0	0
P-22	Allahabad Concrete	500 mm	107	MH-22	MH-23	78.89	78.68	1.82	107	0	0
P-23	Allahabad Concrete	500 mm	17	MH-23	MH-24	78.68	78.65	1.65	17	0	0
P-24	Allahabad Concrete	500 mm	53	MH-24	MH-25	78.65	78.54	1.26	53	0	0
	Total		**405**						**405**	**0**	**0**
P-25	Allahabad Concrete	600 mm	31	MH-25	MH-26	78.44	78.38	1.32	31	0	0
P-26	Allahabad Concrete	600 mm	109	MH-26	MH-27	78.38	78.16	1.64	109	0	0
P-27	Allahabad Concrete	600 mm	31	MH-27	MH-28	78.16	78.1	1.4	31	0	0
P-28	Allahabad Concrete	600 mm	4	MH-28	O-1	78.1	78.09	1.31	4	0	0
	Total		**175**						**175**	**0**	**0**
Grand Total			**1334**						**1334**	**0**	**0**

Appendix A3.12 Detailed Description of Manhole of Intercepting Sewer at Rajapur (District-D)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					0m - 2.5m	2.5m - 7m
MH-1	82	81.55	1.2	0.45	1	0
MH-2	82.5	81.51	1.2	0.99	1	0
MH-3	82.5	81.48	1.2	1.02	1	0
MH-4	82.1	81.45	1.2	0.65	1	0
MH-5	82	81.38	1.2	0.62	1	0
MH-6	81.9	81.07	1.2	0.83	1	0
MH-7	81.5	80.95	1.2	0.55	1	0
MH-8	81.4	80.9	1.2	0.5	1	0
MH-9	81.4	80.84	1.2	0.56	1	0
MH-10	81.35	80.77	1.2	0.58	1	0
MH-11	81.2	80.6	1.2	0.6	1	0
MH-12	81	80.5	1.2	0.5	1	0
MH-13	81.15	80.38	1.2	0.77	1	0
MH-14	81.2	80.21	1.2	0.99	1	0
MH-15	81.3	80.03	1.2	1.27	1	0
MH-16	81.2	79.9	1.2	1.3	1	0
MH-17	80.8	79.71	1.2	1.09	1	0
MH-18	80.8	79.35	1.2	1.45	1	0
MH-19	81.3	79.13	1.2	2.17	1	0
MH-20	81.2	79.03	1.2	2.17	1	0
MH-21	81	78.95	1.2	2.05	1	0
MH-22	81.1	78.89	1.2	2.21	1	0
MH-23	81	78.68	1.2	2.32	1	0
MH-24	80.8	78.65	1.2	2.15	1	0
MH-25	80.3	78.44	1.2	1.86	1	0
MH-26	80.3	78.38	1.2	1.92	1	0
MH-27	80.4	78.16	1.2	2.24	1	0
MH-28	80.1	78.1	1.2	2	1	0
					28	**0**

Appendix A4.1 Sewer Data of Lukerganj PS to Ghaghar Nala PS (Dist- B) - Node 1-Ghaghar PS (1/3)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Down-stream Invert Elevation	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Maxi-mum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	450 mm	12	MH-1	MH-2	91.202	91.178	500	102	56.5	0.79	2.5	0.8	3	111	6
P-2	Allahabad Concrete	450 mm	12	MH-2	MH-3	90.973	90.949	500	102	56.5	0.79	2.5	0.8	3	111	6
P-3	Allahabad Concrete	450 mm	22	MH-3	MH-4	90.572	90.528	500	102	58.2	0.79	2.5	0.8	3	111	6
P-4	Allahabad Concrete	450 mm	12	MH-4	MH-5	90.401	90.377	500	102	56.5	0.79	2.5	0.8	3	111	6
P-5	Allahabad Concrete	450 mm	19	MH-5	MH-6	90.236	90.198	500	102	57.8	0.79	2.5	0.8	3	111	6
P-6	Allahabad Concrete	450 mm	39	MH-6	MH-7	90.034	89.956	500	102	74.4	0.79	2.5	0.8	3	111	6
P-7	Allahabad Concrete	450 mm	39	MH-7	MH-8	89.956	89.878	500	102	73	0.79	2.54	0.8	3	111	6
P-8	Allahabad Concrete	450 mm	18	MH-8	MH-9	89.869	89.833	500	102	73.6	0.79	2.5	0.8	3	111	6
P-9	Allahabad Concrete	450 mm	44	MH-9	MH-10	89.833	89.745	500	102	71.3	0.79	2.55	0.8	3	111	6
P-10	Allahabad Concrete	450 mm	34	MH-10	MH-11	89.745	89.677	500	102	59.4	0.79	2.73	0.8	3	111	6
P-11	Allahabad Concrete	450 mm	47	MH-11	MH-12	89.535	89.441	500	102	72	0.79	2.5	0.8	3	111	6
P-12	Allahabad Concrete	450 mm	22	MH-12	MH-13	89.436	89.392	500	102	70.1	0.79	2.5	0.8	3	111	6
P-13	Allahabad Concrete	450 mm	24	MH-13	MH-14	89.392	89.344	500	102	64.9	0.79	2.52	0.8	3	111	6
P-14	Allahabad Concrete	450 mm	7	MH-14	MH-15	89.344	89.33	500	102	55.2	0.79	2.53	0.8	3	111	6
P-15	Allahabad Concrete	450 mm	37	MH-15	MH-16	89.225	89.151	500	102	69.2	0.79	2.5	0.8	3	111	6
P-16	Allahabad Concrete	450 mm	15	MH-16	MH-17	89.109	89.079	500	102	75.8	0.79	2.5	0.8	3	111	6
P-17	Allahabad Concrete	450 mm	26	MH-17	MH-18	89.079	89.027	500	102	75.8	0.79	2.56	0.8	3	111	6
P-18	Allahabad Concrete	450 mm	10	MH-18	MH-19	89.027	89.007	500	102	75.8	0.79	2.59	0.8	3	111	6
P-19	Allahabad Concrete	450 mm	26	MH-19	MH-20	89.007	88.955	500	102	75.8	0.79	2.7	0.8	3	111	6
P-20	Allahabad Concrete	450 mm	25	MH-20	MH-21	88.955	88.905	500	102	75.8	0.79	2.85	0.8	3	111	6
P-21	Allahabad Concrete	450 mm	49	MH-21	MH-22	88.905	88.807	500	102	75.8	0.79	2.89	0.8	3	111	6
P-22	Allahabad Concrete	450 mm	27	MH-22	MH-23	88.807	88.753	500	102	75.8	0.79	2.89	0.8	3	111	6
P-23	Allahabad Concrete	450 mm	17	MH-23	MH-24	88.753	88.719	500	102	75.8	0.79	2.9	0.8	3	111	6
P-24	Allahabad Concrete	450 mm	8	MH-24	MH-25	88.719	88.703	500	102	75.8	0.79	2.9	0.8	3	111	6
P-25	Allahabad Concrete	450 mm	43	MH-25	MH-26	88.703	88.617	500	102	75.8	0.79	3.08	0.8	3	111	6
P-26	Allahabad Concrete	450 mm	67	MH-26	MH-27	88.617	88.483	500	102	75.8	0.79	3.46	0.8	3	111	6
P-27	Allahabad Concrete	450 mm	35	MH-27	MH-28	88.483	88.413	500	102	75.8	0.79	3.35	0.8	3	111	6
P-28	Allahabad Concrete	450 mm	11	MH-28	MH-29	88.413	88.391	500	102	75.8	0.79	3.31	0.8	3	111	6
P-29	Allahabad Concrete	450 mm	51	MH-29	MH-30	88.391	88.289	500	102	75.8	0.79	3.98	0.8	3	111	6
P-30	Allahabad Concrete	450 mm	52	MH-30	MH-31	88.289	88.185	500	102	75.8	0.79	3.71	0.8	3	111	6
P-31	Allahabad Concrete	450 mm	30	MH-31	MH-32	88.185	88.125	500	102	75.8	0.79	3.56	0.8	3	111	6
P-32	Allahabad Concrete	450 mm	44	MH-32	MH-33	88.125	88.037	500	102	75.8	0.79	3.41	0.8	3	111	6
P-33	Allahabad Concrete	450 mm	44	MH-33	MH-34	88.037	87.949	500	102	75.8	0.79	3.32	0.8	3	111	6
P-34	Allahabad Concrete	450 mm	16	MH-34	MH-35	87.949	87.917	500	102	75.8	0.79	3.29	0.8	3	111	6
P-35	Allahabad Concrete	450 mm	39	MH-35	MH-36	87.917	87.839	500	102	75.8	0.79	3.21	0.8	3	111	6

Appendix A4.1 Sewer Data of Lukerganj PS to Ghaghar Nala PS (Dist- B) - Node 1-Ghaghar PS (2/3)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Down-stream Invert Elevation	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Maxi-mum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-36	Allahabad Concrete	450 mm	43	MH-36	MH-37	87.839	87.753	500	102	75.8	0.79	3.17	0.8	3	111	6
P-37	Allahabad Concrete	450 mm	43	MH-37	MH-38	87.753	87.667	500	102	75.8	0.79	3.19	0.8	3	111	6
P-38	Allahabad Concrete	450 mm	42	MH-38	MH-39	87.667	87.583	500	102	75.8	0.79	3.29	0.8	3	111	6
P-39	Allahabad Concrete	450 mm	34	MH-39	MH-40	87.583	87.515	500	102	75.8	0.79	3.28	0.8	3	111	6
P-40	Allahabad Concrete	450 mm	18	MH-40	MH-41	87.515	87.479	500	102	75.8	0.79	3.29	0.8	3	111	6
P-41	Allahabad Concrete	450 mm	42	MH-41	MH-42	87.479	87.395	500	102	75.8	0.79	3.44	0.8	3	111	6
P-42	Allahabad Concrete	450 mm	35	MH-42	MH-43	87.395	87.325	500	102	75.8	0.79	3.49	0.8	3	111	6
P-43	Allahabad Concrete	450 mm	15	MH-43	MH-44	87.325	87.295	500	102	75.8	0.79	3.5	0.8	3	111	6
P-44	Allahabad Concrete	450 mm	31	MH-44	MH-45	87.295	87.233	500	102	75.8	0.79	3.61	0.8	3	111	6
P-45	Allahabad Concrete	450 mm	38	MH-45	MH-46	87.233	87.157	500	102	75.8	0.79	3.74	0.8	3	111	6
P-46	Allahabad Concrete	450 mm	25	MH-46	MH-47	87.157	87.107	500	102	75.8	0.79	3.79	0.8	3	111	6
P-47	Allahabad Concrete	450 mm	37	MH-47	MH-48	87.107	87.033	500	102	75.8	0.79	3.77	0.8	3	111	6
P-48	Allahabad Concrete	450 mm	37	MH-48	MH-49	87.033	86.959	500	102	75.8	0.79	3.79	0.8	3	111	6
P-49	Allahabad Concrete	450 mm	33	MH-49	MH-50	86.959	86.893	500	102	75.8	0.79	3.93	0.8	3	111	6
P-50	Allahabad Concrete	450 mm	31	MH-50	MH-51	86.893	86.831	500	102	75.8	0.79	4.21	0.8	3	111	6
P-51	Allahabad Concrete	450 mm	53	MH-51	MH-52	86.831	86.725	500	102	75.8	0.79	4.68	0.8	3	111	6
P-52	Allahabad Concrete	450 mm	53	MH-52	MH-53	86.725	86.619	500	102	75.7	0.79	5.07	0.8	3	111	6
P-53	Allahabad Concrete	450 mm	48	MH-53	MH-54	86.619	86.523	500	102	75.6	0.79	5.36	0.8	3	111	6
P-54	Allahabad Concrete	450 mm	54	MH-54	MH-55	86.523	86.415	500	102	75.2	0.79	5.66	0.8	3	111	6
P-55	Allahabad Concrete	450 mm	50	MH-55	MH-56	86.415	86.315	500	102	74.3	0.79	5.68	0.8	3	111	6
P-56	Allahabad Concrete	450 mm	44	MH-56	MH-57	86.315	86.227	500	102	72.3	0.79	5.48	0.8	3	111	6
P-57	Allahabad Concrete	450 mm	44	MH-57	MH-58	86.227	86.139	500	102	60.1	0.79	5.28	0.8	3	111	6
P-58	Allahabad Concrete	1000 mm	49	MH-58	MH-59	84.352	84.254	500	762	68.9	1.32	6.46	0.8	3	929	146
P-59	Allahabad Concrete	1000 mm	49	MH-59	MH-60	84.254	84.156	500	762	68.9	1.32	6.58	0.8	3	929	146
P-60	Allahabad Concrete	1000 mm	23	MH-60	MH-61	84.156	84.11	500	762	68.9	1.32	6.69	0.8	3	929	146
P-61	Allahabad Concrete	1000 mm	19	MH-61	MH-62	84.11	84.072	500	762	68.9	1.32	6.74	0.8	3	929	146
P-62	Allahabad Concrete	1000 mm	45	MH-62	MH-63	84.072	83.982	500	762	68.9	1.32	6.89	0.8	3	929	146
P-63	Allahabad Concrete	1000 mm	45	MH-63	MH-64	83.982	83.892	500	762	68.9	1.32	7.22	0.8	3	929	146
P-64	Allahabad Concrete	1000 mm	54	MH-64	MH-65	83.892	83.784	500	762	68.9	1.32	7.42	0.8	3	929	146
P-65	Allahabad Concrete	1000 mm	62	MH-65	MH-66	83.784	83.66	500	762	68.9	1.32	7.6	0.8	3	929	146
P-66	Allahabad Concrete	1000 mm	62	MH-66	MH-67	83.66	83.536	500	762	68.9	1.32	7.15	0.8	3	929	146
P-67	Allahabad Concrete	1000 mm	57	MH-67	MH-68	83.536	83.422	500	762	68.9	1.32	6.76	0.8	3	929	146
P-68	Allahabad Concrete	1000 mm	61	MH-68	MH-69	83.422	83.3	500	762	68.9	1.32	6.21	0.8	3	929	146
P-69	Allahabad Concrete	1000 mm	66	MH-69	MH-70	83.3	83.168	500	762	68.9	1.32	5.5	0.8	3	929	146
P-70	Allahabad Concrete	1000 mm	66	MH-70	MH-71	83.168	83.036	500	762	68.9	1.32	4.69	0.8	3	929	146

Appendix A4.1 Sewer Data of Lukerganj PS to Ghaghar Nala PS (Dist- B) - Node 1-Ghaghar PS (3/3)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Down-stream Invert Elevation	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Maxi-mum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-71	Allahabad Concrete	1000 mm	42	MH-71	MH-72	83.036	82.952	500	762	68.9	1.32	4.88	0.8	3	929	146
P-72	Allahabad Concrete	1000 mm	51	MH-72	MH-73	82.952	82.85	500	762	68.8	1.32	5.27	0.8	3	929	146
P-73	Allahabad Concrete	1000 mm	48	MH-73	MH-74	82.85	82.754	500	762	68.8	1.32	5.54	0.8	3	929	146
P-74	Allahabad Concrete	1000 mm	48	MH-74	MH-75	82.754	82.658	500	762	68.7	1.32	5.78	0.8	3	929	146
P-75	Allahabad Concrete	1000 mm	46	MH-75	MH-76	82.658	82.566	500	762	68.6	1.32	5.83	0.8	3	929	146
P-76	Allahabad Concrete	1000 mm	51	MH-76	MH-77	82.566	82.464	500	762	68.4	1.32	5.51	0.8	3	929	146
P-77	Allahabad Concrete	1000 mm	42	MH-77	MH-78	82.464	82.38	500	762	68.1	1.32	5.17	0.8	3	929	146
P-78	Allahabad Concrete	1000 mm	43	MH-78	MH-79	82.38	82.294	500	762	67.5	1.32	4.57	0.8	3	929	146
P-79	Allahabad Concrete	1000 mm	78	MH-79	MH-80	82.294	82.138	500	762	65.6	1.32	2.78	0.8	3	929	146
P-80	Allahabad Concrete	1000 mm	52	MH-80	O-1 (Ghaghar Sump)	82.138	82.034	500	762	56.9	1.32	4.97	0.8	3	929	146
			3032													

Appendix A4.2 Detailed Description of Lukerganj PS to Ghaghar Nala PS (Dist- B) - Node 1-Ghaghar PS (1/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	450 mm	12	MH-1	MH-2	91.202	91.178	2.5	12	0	0
P-2	Allahabad Concrete	450 mm	12	MH-2	MH-3	90.973	90.949	2.5	12	0	0
P-3	Allahabad Concrete	450 mm	22	MH-3	MH-4	90.572	90.528	2.5	22	0	0
P-4	Allahabad Concrete	450 mm	12	MH-4	MH-5	90.401	90.377	2.5	12	0	0
P-5	Allahabad Concrete	450 mm	19	MH-5	MH-6	90.236	90.198	2.5	19	0	0
P-6	Allahabad Concrete	450 mm	39	MH-6	MH-7	90.034	89.956	2.5	39	0	0
P-7	Allahabad Concrete	450 mm	39	MH-7	MH-8	89.956	89.878	2.54	39	0	0
P-8	Allahabad Concrete	450 mm	18	MH-8	MH-9	89.869	89.833	2.5	18	0	0
P-9	Allahabad Concrete	450 mm	44	MH-9	MH-10	89.833	89.745	2.55	44	0	0
P-10	Allahabad Concrete	450 mm	34	MH-10	MH-11	89.745	89.677	2.73	34	0	0
P-11	Allahabad Concrete	450 mm	47	MH-11	MH-12	89.535	89.441	2.5	47	0	0
P-12	Allahabad Concrete	450 mm	22	MH-12	MH-13	89.436	89.392	2.5	22	0	0
P-13	Allahabad Concrete	450 mm	24	MH-13	MH-14	89.392	89.344	2.52	24	0	0
P-14	Allahabad Concrete	450 mm	7	MH-14	MH-15	89.344	89.33	2.53	7	0	0
P-15	Allahabad Concrete	450 mm	37	MH-15	MH-16	89.225	89.151	2.5	37	0	0
P-16	Allahabad Concrete	450 mm	15	MH-16	MH-17	89.109	89.079	2.5	15	0	0
P-17	Allahabad Concrete	450 mm	26	MH-17	MH-18	89.079	89.027	2.56	26	0	0
P-18	Allahabad Concrete	450 mm	10	MH-18	MH-19	89.027	89.007	2.59	10	0	0
P-19	Allahabad Concrete	450 mm	26	MH-19	MH-20	89.007	88.955	2.7	26	0	0
P-20	Allahabad Concrete	450 mm	25	MH-20	MH-21	88.955	88.905	2.85	25	0	0
P-21	Allahabad Concrete	450 mm	49	MH-21	MH-22	88.905	88.807	2.89	49	0	0
P-22	Allahabad Concrete	450 mm	27	MH-22	MH-23	88.807	88.753	2.89	27	0	0
P-23	Allahabad Concrete	450 mm	17	MH-23	MH-24	88.753	88.719	2.9	17	0	0
P-24	Allahabad Concrete	450 mm	8	MH-24	MH-25	88.719	88.703	2.9	8	0	0
P-25	Allahabad Concrete	450 mm	43	MH-25	MH-26	88.703	88.617	3.08	43	0	0
P-26	Allahabad Concrete	450 mm	67	MH-26	MH-27	88.617	88.483	3.46	67	0	0
P-27	Allahabad Concrete	450 mm	35	MH-27	MH-28	88.483	88.413	3.35	35	0	0
P-28	Allahabad Concrete	450 mm	11	MH-28	MH-29	88.413	88.391	3.31	11	0	0
P-29	Allahabad Concrete	450 mm	51	MH-29	MH-30	88.391	88.289	3.98	51	0	0
P-30	Allahabad Concrete	450 mm	52	MH-30	MH-31	88.289	88.185	3.71	52	0	0
P-31	Allahabad Concrete	450 mm	30	MH-31	MH-32	88.185	88.125	3.56	30	0	0
P-32	Allahabad Concrete	450 mm	44	MH-32	MH-33	88.125	88.037	3.41	44	0	0
P-33	Allahabad Concrete	450 mm	44	MH-33	MH-34	88.037	87.949	3.32	44	0	0
P-34	Allahabad Concrete	450 mm	16	MH-34	MH-35	87.949	87.917	3.29	16	0	0
P-35	Allahabad Concrete	450 mm	39	MH-35	MH-36	87.917	87.839	3.21	39	0	0
P-36	Allahabad Concrete	450 mm	43	MH-36	MH-37	87.839	87.753	3.17	43	0	0
P-37	Allahabad Concrete	450 mm	43	MH-37	MH-38	87.753	87.667	3.19	43	0	0
P-38	Allahabad Concrete	450 mm	42	MH-38	MH-39	87.667	87.583	3.29	42	0	0
P-39	Allahabad Concrete	450 mm	34	MH-39	MH-40	87.583	87.515	3.28	34	0	0
P-40	Allahabad Concrete	450 mm	18	MH-40	MH-41	87.515	87.479	3.29	18	0	0
P-41	Allahabad Concrete	450 mm	42	MH-41	MH-42	87.479	87.395	3.44	42	0	0
P-42	Allahabad Concrete	450 mm	35	MH-42	MH-43	87.395	87.325	3.49	35	0	0
P-43	Allahabad Concrete	450 mm	15	MH-43	MH-44	87.325	87.295	3.5	15	0	0
P-44	Allahabad Concrete	450 mm	31	MH-44	MH-45	87.295	87.233	3.61	31	0	0
P-45	Allahabad Concrete	450 mm	38	MH-45	MH-46	87.233	87.157	3.74	38	0	0
P-46	Allahabad Concrete	450 mm	25	MH-46	MH-47	87.157	87.107	3.79	25	0	0
P-47	Allahabad Concrete	450 mm	37	MH-47	MH-48	87.107	87.033	3.77	37	0	0
P-48	Allahabad Concrete	450 mm	37	MH-48	MH-49	87.033	86.959	3.79	37	0	0
P-49	Allahabad Concrete	450 mm	33	MH-49	MH-50	86.959	86.893	3.93	33	0	0
P-50	Allahabad Concrete	450 mm	31	MH-50	MH-51	86.893	86.831	4.21	0	31	0
P-51	Allahabad Concrete	450 mm	53	MH-51	MH-52	86.831	86.725	4.68	0	53	0
P-52	Allahabad Concrete	450 mm	53	MH-52	MH-53	86.725	86.619	5.07	0	53	0
P-53	Allahabad Concrete	450 mm	48	MH-53	MH-54	86.619	86.523	5.36	0	48	0
P-54	Allahabad Concrete	450 mm	54	MH-54	MH-55	86.523	86.415	5.66	0	54	0
P-55	Allahabad Concrete	450 mm	50	MH-55	MH-56	86.415	86.315	5.68	0	50	0
P-56	Allahabad Concrete	450 mm	44	MH-56	MH-57	86.315	86.227	5.48	0	44	0
P-57	Allahabad Concrete	450 mm	44	MH-57	MH-58	86.227	86.139	5.28	0	44	0
Total			**1873**						**1496**	**377**	**0**

Appendix A4.2 Detailed Description of Lukerganj PS to Ghaghar Nala PS (Dist- B) - Node 1-Ghaghar PS (2/2)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-58	Allahabad Concrete	1000 mm	49	MH-58	MH-59	84.352	84.254	6.46	0	0	49
P-59	Allahabad Concrete	1000 mm	49	MH-59	MH-60	84.254	84.156	6.58	0	0	49
P-60	Allahabad Concrete	1000 mm	23	MH-60	MH-61	84.156	84.11	6.69	0	0	23
P-61	Allahabad Concrete	1000 mm	19	MH-61	MH-62	84.11	84.072	6.74	0	0	19
P-62	Allahabad Concrete	1000 mm	45	MH-62	MH-63	84.072	83.982	6.89	0	0	45
P-63	Allahabad Concrete	1000 mm	45	MH-63	MH-64	83.982	83.892	7.22	0	0	45
P-64	Allahabad Concrete	1000 mm	54	MH-64	MH-65	83.892	83.784	7.42	0	0	54
P-65	Allahabad Concrete	1000 mm	62	MH-65	MH-66	83.784	83.66	7.6	0	0	62
P-66	Allahabad Concrete	1000 mm	62	MH-66	MH-67	83.66	83.536	7.15	0	0	62
P-67	Allahabad Concrete	1000 mm	57	MH-67	MH-68	83.536	83.422	6.76	0	0	57
P-68	Allahabad Concrete	1000 mm	61	MH-68	MH-69	83.422	83.3	6.21	0	0	61
P-69	Allahabad Concrete	1000 mm	66	MH-69	MH-70	83.3	83.168	5.5	0	66	0
P-70	Allahabad Concrete	1000 mm	66	MH-70	MH-71	83.168	83.036	4.69	0	66	0
P-71	Allahabad Concrete	1000 mm	42	MH-71	MH-72	83.036	82.952	4.88	0	42	0
P-72	Allahabad Concrete	1000 mm	51	MH-72	MH-73	82.952	82.85	5.27	0	51	0
P-73	Allahabad Concrete	1000 mm	48	MH-73	MH-74	82.85	82.754	5.54	0	48	0
P-74	Allahabad Concrete	1000 mm	48	MH-74	MH-75	82.754	82.658	5.78	0	48	0
P-75	Allahabad Concrete	1000 mm	46	MH-75	MH-76	82.658	82.566	5.83	0	46	0
P-76	Allahabad Concrete	1000 mm	51	MH-76	MH-77	82.566	82.464	5.51	0	51	0
P-77	Allahabad Concrete	1000 mm	42	MH-77	MH-78	82.464	82.38	5.17	0	42	0
P-78	Allahabad Concrete	1000 mm	43	MH-78	MH-79	82.38	82.294	4.57	0	43	0
P-79	Allahabad Concrete	1000 mm	78	MH-79	MH-80	82.294	82.138	2.78	78	0	0
P-80	Allahabad Concrete	1000 mm	52	MH-80	O-1 (Ghaghar Sump)	82.138	82.034	4.97	0	52	0
Total			**1159**						**78**	**555**	**526**
			3032						**1574**	**932**	**526**

Appendix A4.3 Detailed Description of Manhole of Lukerganj to Ghaghar Nala (District-B)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	94.358	91.202	1.2	3.16	1	0
MH-2	94.128	90.973	1.2	3.15	1	0
MH-3	93.899	90.572	1.2	3.33	1	0
MH-4	93.478	90.401	1.2	3.08	1	0
MH-5	93.327	90.236	1.2	3.09	1	0
MH-6	93.148	90.034	1.2	3.11	1	0
MH-7	92.906	89.956	1.2	2.95	1	0
MH-8	92.864	89.869	1.2	2.99	1	0
MH-9	92.783	89.833	1.2	2.95	1	0
MH-10	92.746	89.745	1.2	3	1	0
MH-11	92.853	89.535	1.2	3.32	1	0
MH-12	92.391	89.436	1.2	2.95	1	0
MH-13	92.342	89.392	1.2	2.95	1	0
MH-14	92.317	89.344	1.2	2.97	1	0
MH-15	92.31	89.225	1.2	3.08	1	0
MH-16	92.101	89.109	1.2	2.99	1	0
MH-17	92.029	89.079	1.2	2.95	1	0
MH-18	92.041	89.027	1.2	3.01	1	0
MH-19	92.045	89.007	1.2	3.04	1	0
MH-20	92.107	88.955	1.2	3.15	1	0
MH-21	92.206	88.905	1.2	3.3	1	0
MH-22	92.149	88.807	1.2	3.34	1	0
MH-23	92.093	88.753	1.2	3.34	1	0
MH-24	92.066	88.719	1.2	3.35	1	0
MH-25	92.054	88.703	1.2	3.35	1	0
MH-26	92.144	88.617	1.2	3.53	1	0
MH-27	92.392	88.483	1.2	3.91	1	0
MH-28	92.209	88.413	1.2	3.8	1	0
MH-29	92.152	88.391	1.2	3.76	1	0
MH-30	92.719	88.289	1.2	4.43	1	0
MH-31	92.34	88.185	1.2	4.15	1	0
MH-32	92.134	88.125	1.2	4.01	1	0
MH-33	91.894	88.037	1.2	3.86	1	0
MH-34	91.72	87.949	1.2	3.77	1	0
MH-35	91.655	87.917	1.2	3.74	1	0
MH-36	91.503	87.839	1.2	3.66	1	0
MH-37	91.368	87.753	1.2	3.61	1	0
MH-38	91.307	87.667	1.2	3.64	1	0
MH-39	91.319	87.583	1.2	3.74	1	0
MH-40	91.247	87.515	1.2	3.73	1	0
MH-41	91.216	87.479	1.2	3.74	1	0
MH-42	91.286	87.395	1.2	3.89	1	0
MH-43	91.261	87.325	1.2	3.94	1	0
MH-44	91.243	87.295	1.2	3.95	1	0
MH-45	91.294	87.233	1.2	4.06	1	0
MH-46	91.351	87.157	1.2	4.19	1	0
MH-47	91.346	87.107	1.2	4.24	1	0
MH-48	91.255	87.033	1.2	4.22	1	0
MH-49	91.2	86.959	1.2	4.24	1	0
MH-50	91.277	86.893	1.2	4.38	1	0
MH-51	91.495	86.831	1.2	4.66	1	0
MH-52	91.859	86.725	1.2	5.13	1	0
MH-53	92.138	86.619	1.2	5.52	1	0
MH-54	92.331	86.523	1.2	5.81	1	0
MH-55	92.526	86.415	1.2	6.11	1	0
MH-56	92.44	86.315	1.2	6.12	1	0
MH-57	92.154	86.227	1.2	5.93	1	0
MH-58	91.869	84.352	1.2	7.52	0	1
MH-59	91.71	84.254	1.2	7.46	0	1
MH-60	91.735	84.156	1.2	7.58	0	1
MH-61	91.796	84.11	1.2	7.69	0	1
MH-62	91.809	84.072	1.2	7.74	0	1
MH-63	91.873	83.982	1.2	7.89	0	1
MH-64	92.112	83.892	1.2	8.22	0	1
MH-65	92.204	83.784	1.2	8.42	0	1
MH-66	92.256	83.66	1.2	8.6	0	1
MH-67	91.686	83.536	1.2	8.15	0	1
MH-68	91.177	83.422	1.2	7.75	0	1
MH-69	90.509	83.3	1.2	7.21	0	1
MH-70	89.669	83.168	1.2	6.5	1	0
MH-71	88.721	83.036	1.2	5.68	1	0
MH-72	88.835	82.952	1.2	5.88	1	0
MH-73	89.124	82.85	1.2	6.27	1	0
MH-74	89.297	82.754	1.2	6.54	1	0
MH-75	89.441	82.658	1.2	6.78	1	0
MH-76	89.392	82.566	1.2	6.83	1	0
MH-77	88.972	82.464	1.2	6.51	1	0
MH-78	88.545	82.38	1.2	6.16	1	0
MH-79	87.867	82.294	1.2	5.57	1	0
MH-80	85.915	82.138	1.2	3.78	1	0
					68	**12**

Appendix A4.4 Sewer Data of Sewer Line from Sasur Khaderi PS - Luker Sewer towards Ghaghar PS (District - B)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Down-stream Invert Elevation (m)	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Maxi-mum Velocity (m/s)	Full Capacity (l/s)	Excess Design Capacity (l/s)
P-1	Allahabad Concrete	900 mm	60	MH-1	MH-2	85.778	85.658	500	660	74.3	1.26	4.21	0.8	3	732	55
P-2	Allahabad Concrete	900 mm	60	MH-2	MH-3	85.658	85.538	500	660	74.3	1.26	4.45	0.8	3	732	55
P-3	Allahabad Concrete	900 mm	40	MH-3	MH-4	85.538	85.458	500	660	74.2	1.26	3.75	0.8	3	732	55
P-4	Allahabad Concrete	900 mm	40	MH-4	MH-5	85.458	85.378	500	660	74.2	1.26	3.24	0.8	3	732	55
P-5	Allahabad Concrete	900 mm	69	MH-5	MH-6	85.378	85.24	500	660	74.2	1.26	2.62	0.8	3	732	55
P-6	Allahabad Concrete	900 mm	41	MH-6	MH-7	85.24	85.158	500	660	74.1	1.26	2.6	0.8	3	732	55
P-7	Allahabad Concrete	900 mm	40	MH-7	MH-8	85.158	85.078	500	660	74.1	1.26	2.77	0.8	3	732	55
P-8	Allahabad Concrete	900 mm	48	MH-8	MH-9	85.078	84.982	500	660	73.9	1.26	3.25	0.8	3	732	55
P-9	Allahabad Concrete	900 mm	47	MH-9	MH-10	84.982	84.888	500	660	73.8	1.26	3.87	0.8	3	732	55
P-10	Allahabad Concrete	900 mm	66	MH-10	MH-11	84.888	84.756	500	660	73.4	1.26	4.68	0.8	3	732	55
P-11	Allahabad Concrete	900 mm	29	MH-11	MH-12	84.756	84.698	500	660	72.9	1.26	4.82	0.8	3	732	55
P-12	Allahabad Concrete	900 mm	16	MH-12	MH-13	84.698	84.666	500	660	72.5	1.26	4.94	0.8	3	732	55
P-13	Allahabad Concrete	900 mm	47	MH-13	MH-14	84.666	84.572	500	660	71.8	1.26	5.62	0.8	3	732	55
P-14	Allahabad Concrete	900 mm	57	MH-14	MH-15	84.572	84.458	500	660	69.6	1.26	6.21	0.8	3	732	55
P-15	Allahabad Concrete	900 mm	37	MH-15	MH-16	84.458	84.384	500	660	65.3	1.26	6.31	0.8	3	732	55
P-16	Allahabad Concrete	900 mm	16	MH-16	O-1 (MH-58 Lukar-Ghaggar)	84.384	84.352	500	660	57.2	1.26	6.6	0.8	3	732	55
			713													

Appendix A4.5 Detailed Description of Sewer Line from Sasur Khaderi PS - Luker Sewer towards Ghaghar PS (District - B)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									1m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	900 mm	60	MH-1	MH-2	85.778	85.658	4.21	0	60	0
P-2	Allahabad Concrete	900 mm	60	MH-2	MH-3	85.658	85.538	4.45	0	60	0
P-3	Allahabad Concrete	900 mm	40	MH-3	MH-4	85.538	85.458	3.75	40	0	0
P-4	Allahabad Concrete	900 mm	40	MH-4	MH-5	85.458	85.378	3.24	40	0	0
P-5	Allahabad Concrete	900 mm	69	MH-5	MH-6	85.378	85.24	2.62	69	0	0
P-6	Allahabad Concrete	900 mm	41	MH-6	MH-7	85.24	85.158	2.6	41	0	0
P-7	Allahabad Concrete	900 mm	40	MH-7	MH-8	85.158	85.078	2.77	40	0	0
P-8	Allahabad Concrete	900 mm	48	MH-8	MH-9	85.078	84.982	3.25	48	0	0
P-9	Allahabad Concrete	900 mm	47	MH-9	MH-10	84.982	84.888	3.87	47	0	0
P-10	Allahabad Concrete	900 mm	66	MH-10	MH-11	84.888	84.756	4.68	0	66	0
P-11	Allahabad Concrete	900 mm	29	MH-11	MH-12	84.756	84.698	4.82	0	29	0
P-12	Allahabad Concrete	900 mm	16	MH-12	MH-13	84.698	84.666	4.94	0	16	0
P-13	Allahabad Concrete	900 mm	47	MH-13	MH-14	84.666	84.572	5.62	0	47	0
P-14	Allahabad Concrete	900 mm	57	MH-14	MH-15	84.572	84.458	6.21	0	0	57
P-15	Allahabad Concrete	900 mm	37	MH-15	MH-16	84.458	84.384	6.31	0	0	37
P-16	Allahabad Concrete	900 mm	16	MH-16	O-1 (MH-58 Lukar-Ghaghar)	84.384	84.352	6.6	0	0	16
			713						**325**	**278**	**110**

Appendix A4.6 Detailed Description of Sewer Line from Sasur Khaderi PS - Luker Sewer towards Ghaghar PS (District - B)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					2.5m - 7m	7m - 10m
MH-1	89.192	85.778	1.2	3.41	1	0
MH-2	90.784	85.658	1.2	5.13	1	0
MH-3	90.899	85.538	1.2	5.36	1	0
MH-4	90.123	85.458	1.2	4.67	1	0
MH-5	89.535	85.378	1.2	4.16	1	0
MH-6	88.778	85.24	1.2	3.54	1	0
MH-7	88.675	85.158	1.2	3.52	1	0
MH-8	88.76	85.078	1.2	3.68	1	0
MH-9	89.148	84.982	1.2	4.17	1	0
MH-10	89.668	84.888	1.2	4.78	1	0
MH-11	90.354	84.756	1.2	5.6	1	0
MH-12	90.428	84.698	1.2	5.73	1	0
MH-13	90.52	84.666	1.2	5.85	1	0
MH-14	91.101	84.572	1.2	6.53	1	0
MH-15	91.582	84.458	1.2	7.12	0	1
MH-16	91.605	84.384	1.2	7.22	0	1
					14	**2**

Appendix A4.7 Sewer Data of Intercepter at Ghaghar Nala from Nala 1 C -1B -1A - Ghaghar Nala PS (District - B) (1/2)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Down-stream Invert Elevation	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Max-imum Velocity (m/s)	Full Capacity (l/s)
P-1	Allahabad Concrete	350 mm	35	MH-1	MH-2	85	84.94	629	21	45	0.5	3.66	0.5	3	50
P-2	Allahabad Concrete	350 mm	24	MH-2	MH-3	84.94	84.91	629	21	45	0.5	3.28	0.5	3	50
P-3	Allahabad Concrete	350 mm	28	MH-3	MH-4	84.91	84.86	629	21	45	0.5	3.07	0.5	3	50
P-4	Allahabad Concrete	350 mm	40	MH-4	MH-5	84.86	84.8	629	21	45	0.5	2.97	0.5	3	50
P-5	Allahabad Concrete	350 mm	40	MH-5	MH-6	84.8	84.73	629	21	45	0.5	3.36	0.5	3	50
P-6	Allahabad Concrete	350 mm	42	MH-6	MH-7	84.73	84.67	629	21	45	0.5	3.71	0.5	3	50
P-7	Allahabad Concrete	350 mm	37	MH-7	MH-8	84.67	84.61	629	21	45	0.5	2.65	0.5	3	50
P-8	Allahabad Concrete	350 mm	56	MH-8	MH-9	84.61	84.52	629	21	45	0.5	1.84	0.5	3	50
P-9	Allahabad Concrete	350 mm	47	MH-9	MH-10	84.52	84.45	629	21	45	0.5	1.62	0.5	3	50
P-10	Allahabad Concrete	350 mm	46	MH-10	MH-11	84.45	84.37	629	21	45	0.5	1.85	0.5	3	50
P-11	Allahabad Concrete	350 mm	14	MH-11	MH-12	84.37	84.35	629	21	45	0.5	1.71	0.5	3	50
P-12	Allahabad Concrete	350 mm	11	MH-12	MH-13	84.35	84.33	629	21	45	0.5	2.01	0.5	3	50
P-13	Allahabad Concrete	350 mm	62	MH-13	MH-14	84.33	84.23	629	21	44.8	0.5	1.47	0.5	3	50
P-14	Allahabad Concrete	375 mm	45	MH-14	MH-15	84.2	84.14	764	28	48.9	0.5	1.18	0.5	3	57
P-15	Allahabad Concrete	375 mm	20	MH-15	MH-16	84.14	84.12	764	28	48.5	0.5	1.1	0.5	3	57
P-16	Allahabad Concrete	375 mm	21	MH-16	MH-17	84.12	84.09	764	28	47.7	0.5	0.23	0.5	3	57
P-17	Allahabad Concrete	375 mm	7	MH-17	MH-18	84.09	84.08	764	28	46.8	0.5	0.55	0.5	3	57
P-18	Allahabad Concrete	375 mm	28	MH-18	MH-19	84.08	84.04	764	28	42.9	0.5	0.27	0.5	3	57
P-19	Allahabad Concrete	375 mm	10	MH-19	MH-20	84.04	84.02	392	28	35.3	0.64	0.2	0.5	3	80
P-20	Allahabad Concrete	375 mm	15	MH-20	MH-21	83.97	83.92	300	28	34.6	0.71	0.2	0.5	3	92
P-21	Allahabad Concrete	375 mm	35	MH-22	MH-23	84.12	84.02	350	75	62.3	0.84	0.2	0.5	3	85
P-22	Allahabad Concrete	450 mm	13	MH-23	MH-24	83.95	83.93	700	75	59.5	0.65	0.22	0.5	3	93
P-23	Allahabad Concrete	450 mm	7	MH-24	MH-25	83.93	83.92	700	75	57.1	0.65	0.23	0.5	3	93
P-24	Allahabad Concrete	450 mm	25	MH-25	MH-26	83.92	83.85	350	75	58.4	0.86	0.2	0.5	3	132
P-25	Allahabad Concrete	450 mm	9	MH-26	MH-27	83.85	83.84	700	75	59.8	0.65	0.21	0.5	3	93
P-26	Allahabad Concrete	450 mm	8	MH-27	MH-28	83.84	83.83	700	75	57.9	0.65	0.22	0.5	3	93
P-27	Allahabad Concrete	450 mm	15	MH-28	MH-21	83.83	83.8	700	75	49.4	0.65	0.25	0.5	3	93
P-28	Allahabad Concrete	800 mm	12	MH-21	MH-29	83.45	83.44	681	178	54	0.83	0.26	0.5	3	439
P-29	Allahabad Concrete	800 mm	11	MH-29	MH-30	83.44	83.4	300	178	56.7	1.12	0.2	0.5	3	662
P-30	Allahabad Concrete	800 mm	27	MH-30	MH-31	83.4	83.39	2,000	178	58.6	0.55	0.21	0.5	3	256
P-31	Allahabad Concrete	800 mm	30	MH-31	MH-32	83.39	83.37	2,000	178	58.3	0.55	0.33	0.5	3	256
P-32	Allahabad Concrete	800 mm	71	MH-32	MH-33	83.37	83.34	2,000	178	57.6	0.55	1.52	0.5	3	256
P-33	Allahabad Concrete	800 mm	58	MH-33	MH-34	83.34	83.31	2,000	178	56.4	0.55	3.28	0.5	3	256
P-34	Allahabad Concrete	800 mm	46	MH-34	MH-35	83.31	83.28	2,000	178	55.2	0.55	3.17	0.5	3	256

Appendix A4.7 Sewer Data of Intercepter at Ghaghar Nala from Nala 1 C -1B -1A - Ghaghar Nala PS (District - B) (2/2)

Pipe ID	Material	Section Size	Length (m)	Up-stream Node	Down-stream Node	Upstream Invert Elevation (m)	Down-stream Invert Elevation	Cons-tructed Slope (1/S)	Total Sanitary Flow (l/s)	Avg End Depth / Rise (d/D) (%)	Average Velocity (m/s)	Down-stream Cover (m)	Mini-mum Velocity (m/s)	Max-imum Velocity (m/s)	Full Capacity (l/s)
P-35	Allahabad Concrete	800 mm	47	MH-35	MH-36	83.28	83.26	2,000	178	53.7	0.55	3.54	0.5	3	256
P-36	Allahabad Concrete	800 mm	16	MH-36	MH-37	83.26	83.25	2,000	178	52.5	0.55	2.78	0.5	3	256
P-37	Allahabad Concrete	800 mm	53	MH-37	MH-38	83.25	83.23	2,000	178	50.4	0.55	2.84	0.5	3	256
P-38	Allahabad Concrete	800 mm	51	MH-38	MH-39	83.23	83.2	2,000	178	45	0.55	1	0.5	3	256
P-39	Allahabad Concrete	800 mm	14	MH-39	O-1	83.2	83.19	2,000	178	36.2	0.55	1.01	0.5	3	256
			1176												

Appendix A4.8 Detailed Description of Intercepter at Ghghar nala from Nala 1 C -1B -1A - Ghaghar nala PS (District - B)

Pipe ID	Material	Section Size	Length (m)	Upstream Node	Downstream Node	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Downstream Cover (m)	Length of Pipe for Depth range		
									0m - 4m	4m - 6m	6m - 9m
P-1	Allahabad Concrete	350 mm	35	MH-1	MH-2	85	84.94	3.66	35	0	0
P-2	Allahabad Concrete	350 mm	24	MH-2	MH-3	84.94	84.91	3.28	24	0	0
P-3	Allahabad Concrete	350 mm	28	MH-3	MH-4	84.91	84.86	3.07	28	0	0
P-4	Allahabad Concrete	350 mm	40	MH-4	MH-5	84.86	84.8	2.97	40	0	0
P-5	Allahabad Concrete	350 mm	40	MH-5	MH-6	84.8	84.73	3.36	40	0	0
P-6	Allahabad Concrete	350 mm	42	MH-6	MH-7	84.73	84.67	3.71	42	0	0
P-7	Allahabad Concrete	350 mm	37	MH-7	MH-8	84.67	84.61	2.65	37	0	0
P-8	Allahabad Concrete	350 mm	56	MH-8	MH-9	84.61	84.52	1.84	56	0	0
P-9	Allahabad Concrete	350 mm	47	MH-9	MH-10	84.52	84.45	1.62	47	0	0
P-10	Allahabad Concrete	350 mm	46	MH-10	MH-11	84.45	84.37	1.85	46	0	0
P-11	Allahabad Concrete	350 mm	14	MH-11	MH-12	84.37	84.35	1.71	14	0	0
P-12	Allahabad Concrete	350 mm	11	MH-12	MH-13	84.35	84.33	2.01	11	0	0
P-13	Allahabad Concrete	350 mm	62	MH-13	MH-14	84.33	84.23	1.47	62	0	0
Total			**482**						**482**	**0**	**0**
P-14	Allahabad Concrete	375 mm	45	MH-14	MH-15	84.2	84.14	1.18	45	0	0
P-15	Allahabad Concrete	375 mm	20	MH-15	MH-16	84.14	84.12	1.1	20	0	0
P-16	Allahabad Concrete	375 mm	21	MH-16	MH-17	84.12	84.09	0.23	21	0	0
P-17	Allahabad Concrete	375 mm	7	MH-17	MH-18	84.09	84.08	0.55	7	0	0
P-18	Allahabad Concrete	375 mm	28	MH-18	MH-19	84.08	84.04	0.27	28	0	0
P-19	Allahabad Concrete	375 mm	10	MH-19	MH-20	84.04	84.02	0.2	10	0	0
P-20	Allahabad Concrete	375 mm	15	MH-20	MH-21	83.97	83.92	0.2	15	0	0
P-21	Allahabad Concrete	375 mm	35	MH-22	MH-23	84.12	84.02	0.2	35	0	0
Total			**181**						**181**	**0**	**0**
P-22	Allahabad Concrete	450 mm	13	MH-23	MH-24	83.95	83.93	0.22	13	0	0
P-23	Allahabad Concrete	450 mm	7	MH-24	MH-25	83.93	83.92	0.23	7	0	0
P-24	Allahabad Concrete	450 mm	25	MH-25	MH-26	83.92	83.85	0.2	25	0	0
P-25	Allahabad Concrete	450 mm	9	MH-26	MH-27	83.85	83.84	0.21	9	0	0
P-26	Allahabad Concrete	450 mm	8	MH-27	MH-28	83.84	83.83	0.22	8	0	0
P-27	Allahabad Concrete	450 mm	15	MH-28	MH-21	83.83	83.8	0.25	15	0	0
Total			**77**						**77**	**0**	**0**
P-28	Allahabad Concrete	800 mm	12	MH-21	MH-29	83.45	83.44	0.26	12	0	0
P-29	Allahabad Concrete	800 mm	11	MH-29	MH-30	83.44	83.4	0.2	11	0	0
P-30	Allahabad Concrete	800 mm	27	MH-30	MH-31	83.4	83.39	0.21	27	0	0
P-31	Allahabad Concrete	800 mm	30	MH-31	MH-32	83.39	83.37	0.33	30	0	0
P-32	Allahabad Concrete	800 mm	71	MH-32	MH-33	83.37	83.34	1.52	71	0	0
P-33	Allahabad Concrete	800 mm	58	MH-33	MH-34	83.34	83.31	3.28	58	0	0
P-34	Allahabad Concrete	800 mm	46	MH-34	MH-35	83.31	83.28	3.17	46	0	0
P-35	Allahabad Concrete	800 mm	47	MH-35	MH-36	83.28	83.26	3.54	47	0	0
P-36	Allahabad Concrete	800 mm	16	MH-36	MH-37	83.26	83.25	2.78	16	0	0
P-37	Allahabad Concrete	800 mm	53	MH-37	MH-38	83.25	83.23	2.84	53	0	0
P-38	Allahabad Concrete	800 mm	51	MH-38	MH-39	83.23	83.2	1	51	0	0
P-39	Allahabad Concrete	800 mm	14	MH-39	O-1	83.2	83.19	1.01	14	0	0
Total			**436**						**436**	**0**	**0**
GRAND TOTAL			**1176**						**1176**	**0**	**0**

Appendix A4.9 Detailed Description of Intercept at Ghghar nala from Nala 1 C -1B -1A - Ghaghar nala PS (District - B)

Manhole ID	Top of Manhole (m)	Invert Level of MH (m)	Structure Diameter (m)	Structure Depth (m)	Manhole depth range (yes-1, no-0)	
					0m - 2.5m	2.5m - 7m
MH-1	89.1	85	1.2	4.1	1	0
MH-2	88.95	84.94	1.2	4.01	1	0
MH-3	88.54	84.91	1.2	3.63	1	0
MH-4	88.28	84.86	1.2	3.42	1	0
MH-5	88.12	84.8	1.2	3.32	1	0
MH-6	88.44	84.73	1.2	3.71	1	0
MH-7	88.73	84.67	1.2	4.06	1	0
MH-8	87.61	84.61	1.2	3	1	0
MH-9	86.71	84.52	1.2	2.19	1	0
MH-10	86.42	84.45	1.2	1.97	1	0
MH-11	86.57	84.37	1.2	2.2	1	0
MH-12	86.41	84.35	1.2	2.06	1	0
MH-13	86.69	84.33	1.2	2.36	1	0
MH-14	86.05	84.2	1.2	1.85	1	0
MH-15	85.7	84.14	1.2	1.56	1	0
MH-22	84.7	84.12	1.2	0.58	1	0
MH-16	85.6	84.12	1.2	1.48	1	0
MH-17	84.7	84.09	1.2	0.61	1	0
MH-18	85.01	84.08	1.2	0.93	1	0
MH-19	84.7	84.04	1.2	0.66	1	0
MH-20	84.6	83.97	1.2	0.63	1	0
MH-23	84.6	83.95	1.2	0.65	1	0
MH-24	84.6	83.93	1.2	0.67	1	0
MH-25	84.6	83.92	1.2	0.68	1	0
MH-26	84.5	83.85	1.2	0.65	1	0
MH-27	84.5	83.84	1.2	0.66	1	0
MH-28	84.5	83.83	1.2	0.67	1	0
MH-21	84.5	83.45	1.2	1.05	1	0
MH-29	84.5	83.44	1.2	1.06	1	0
MH-30	84.4	83.4	1.2	1	1	0
MH-31	84.4	83.39	1.2	1.01	1	0
MH-32	84.5	83.37	1.2	1.13	1	0
MH-33	85.66	83.34	1.2	2.32	1	0
MH-34	87.39	83.31	1.2	4.08	1	0
MH-35	87.25	83.28	1.2	3.97	1	0
MH-36	87.6	83.26	1.2	4.34	1	0
MH-37	86.83	83.25	1.2	3.58	1	0
MH-38	86.87	83.23	1.2	3.64	1	0
MH-39	85	83.2	1.2	1.8	1	0
					39	**0**

Appendix A5.1

SCHEDULE-I

(See paras 1 and 2)

LIST OF PROJECTS REQUIRING ENVIRONMENTAL CLEARANCE FROM THE CENTRAL GOVERNMENT

1 Nuclear Power and related projects such as Heavy Water Plants, nuclear fuel complex, Rare Earths.
2 River Valley projects including hydel power, major Irrigation and their combination including flood control.
3 Ports, Harbours, Airports (except minor ports and harbours).
4 Petroleum Refineries including crude and product pipelines.
5 Chemical Fertilizers (Nitrogenous and Phosphatic other than single superphosphate).
6 Pesticides (Technical).
7 Petrochemical complexes (Both Olefinic and Aromatic) and Petro-chemical intermediates such as DMT, Caprolactam, LAB etc. and production of basic plastics such as LLDPE, HDPE, PP, PVC.
8 Bulk drugs and pharmaceuticals.
9 Exploration for oil and gas and their production, transportation and storage.
10 Synthetic Rubber.
11 Asbestos and Asbestos products.
12 Hydrocyanic acid and its derivatives.
13 (a) Primary metallurgical industries (such as production of Iron and Steel, Aluminium, Copper, Zinc, Lead and Ferro Alloys). Electric arc furnaces (Mini Steel Plants).
14 Chlor alkali industry.
15 Integrated paint complex including manufacture of resins and basic raw materials required in the manufacture of paints.
16 Viscose Staple fibre and filament yarn.
17 Storage batteries integrated with manufacture of oxides of lead and lead antimony alloys.
18 All tourism projects between 200m—500 metres of High Water Line and at locations with an elevation of more than 1000 metres with investment of more than Rs.5 crores.
19 Thermal Power Plants.
20 Mining projects *(major minerals)* with leases more than 5 hectares.
21 Highway Projects **except projects relating to improvement work including widening and strengthening of roads with marginal land acquisition along the existing alignments provided it does not pass through ecologically sensitive areas such as National Parks, Sanctuaries, Tiger Reserves, Reserve Forests**
22 Tarred Roads in the Himalayas and or Forest areas.
23 Distilleries.
24 Raw Skins and Hides
25 Pulp, paper and newsprint.
26 Dyes.
27 Cement.
28 Foundries (individual)
29 Electroplating
30 Meta amino phenol

Source : EIA Notification dated New Delhi, the 27th January, 1994
(As amended on 04/05/1994, 10/04/1997, 27/1/2000 and 13/12/2000)

Appendix A5.2

PROCEDURE FOR ENVIRONMENTAL CLEARANCE IN INDIA

1.1 Indian Policies Requiring EIA

The environmental impact assessment in India was started in 1976-77 when the Planning Commission asked the then Department of Science and Technology to examine the river-valley projects from environmental angle. This was subsequently extended to cover those projects, which required approval of the Public Investment Board. These were administrative decisions, and lacked the legislative support. The Government of India enacted the Environment (Protection) Act on 23rd May 1986. To achieve the objectives of the Act, one of the decisions that were taken is to make environmental impact assessment statutory. After following the legal procedure, a notification was issued on 27th January 1994 and subsequently amended on 4th May 1994, 10th April 1997 and 27th January 2000 making environmental impact assessment statutory for 30 activities. This is the principal piece of legislation governing environmental impact assessment.

Besides this the Government of India under Environment (Protection) Act 1986 issued a number of other notifications, which are related to environmental impact assessment. These are limited to specific geographical areas. These are listed below:

Prohibiting location of industries except those related to Tourism in a belt of 1 km from high tide mark from the Revdanda Creek up to Devgarh Point (near Shrivardhan) as well as in 1 km belt along the banks of Rajpuri Creek in Murud Janjira area in the Raigarh district of Maharashtra (6th January 1989)

Restricting location of industries, mining operations and regulating other activities in Doon Valley (1st February 1989)

Regulating activities in the coastal stretches of the country by classifying them as coastal regulation zone and prohibiting certain activities (19th February 1991)

Restricting location of industries and regulating other activities in Dahanu Taluka in Maharashtra (6th June 91)

Restricting certain activities in specified areas of Aravalli Range in the Gurgaon district of Haryana and Alwar district of Rajasthan (7th May 1992)

Regulating industrial and other activities, which could lead to pollution and congestion in an area north west of Numaligarh in Assam (5th July 1996)

1.2 The EIA Cycle and Procedures

The EIA process in India is made up of the following phases:

Screening
Scoping and consideration of alternatives
Baseline data collection
Impact prediction
Assessment of alternatives, delineation of mitigation measures and environmental impact statement
Public hearing
Environment Management Plan
Decision making
Monitoring the clearance conditions

1.2.1 Screening

Screening is done to see whether a project requires environmental clearance as per the statutory notifications. Screening Criteria are based upon:

Scales of investment;
Type of development; and,
Location of development.

A Project requires statutory environmental clearance only if the provisions of EIA notification and/or one or more statutory notification mentioned in Para 1.1 cover it

1.2.2 Scoping

Scoping is a process of detailing the terms of reference of EIA. It has to be done by the consultant in consultation with the project proponent and guidance, if need be, from Impact Assessment Agency.

The Ministry of Environment and Forests has published guidelines for different sectors, which outline the significant issues to be addressed in the EIA studies. Quantifiable impacts are to be assessed on the basis of magnitude, prevalence, frequency and duration and non-quantifiable impacts (such as aesthetic or recreational value), significance is commonly determined through the socio-economic criteria. After the areas, where the project could have significant impact, are identified, the baseline status of these should be monitored and then the likely changes in these on account of the construction and operation of the proposed project should be predicted.

1.2.3 Baseline Data

Baseline data describes the existing environmental status of the identified study area. The site-specific primary data should be monitored for the identified parameters and supplemented by secondary data if available.

1.2.4 Impact Prediction

Impact prediction is a way of 'mapping' the environmental consequences of the significant aspects of the project and its alternatives. Environmental impact can never be predicted with absolute certainty and this is all the more reason to consider all possible factors and take all possible precautions for reducing the degree of uncertainty.

The following impacts of the project should be assessed:

Air
- changes in ambient levels and ground level concentrations due to total emissions from point, line and area sources
- effects on soils, materials, vegetation, and human health

Noise
- changes in ambient levels due to noise generated from equipment and movement of vehicles
- effect on fauna and human health

Water
- availability to competing users

- changes in quality
- sediment transport
- ingress of saline water

Land

- changes in land use and drainage pattern
- changes in land quality including effects of waste disposal
- changes in shoreline/riverbank and their stability

Biological

- deforestation/tree-cutting and shrinkage of animal habitat.
- impact on fauna and flora (including aquatic species if any) due to contaminants/pollutants
- impact on rare and endangered species, endemic species, and migratory path/route of animals.
- Impact on breeding and nesting grounds

Socio-Economic

- impact on the local community including demographic changes.
- Impact on economic status
- impact on human health.
- impact of increased traffic

1.2.5 Assessment of Alternatives, Delineation of Mitigation Measures and Environmental Impact Assessment Report

For every project, possible alternatives should be identified and environmental attributes compared. Alternatives should cover both project location and process technologies. Alternatives should consider 'no project' option also. Alternatives should then be ranked for selection of the best environmental option for optimum economic benefits to the community at large.

Once alternatives have been reviewed, a mitigation plan should be drawn up for the selected option and is supplemented with an Environmental Management Plan (EMP) to guide the proponent towards environmental improvements. The EMP is a crucial input to monitoring the clearance conditions and therefore details of monitoring should be included in the EMP.

An EIA report should provide clear information to the decision-maker on the different environmental scenarios without the project, with the project and with project alternatives. Uncertainties should be clearly reflected in the EIA report.

1.2.6 Public Hearing

Law requires that the public must be informed and consulted on a proposed development after the completion of EIA report.

Any one likely to be affected by the proposed project is entitled to have access to the Executive Summary of the EIA. The affected persons may include:

bonafide local residents;
local associations;
environmental groups: active in the area
any other person located at the project site / sites of displacement

They are to be given an opportunity to make oral/written suggestions to the State Pollution Control

Board as per Schedule IV of EIA Notification.

1.2.7 Decision Making

Decision making process involve consultation between the project proponent (assisted by a consultant) and the impact assessment authority (assisted by an expert group if necessary)

The decision on environmental clearance is arrived at through a number of steps including evaluation of EIA and EMP.

1.2.8 Monitoring the Clearance Conditions

Monitoring should be done during both construction and operation phases of a project. This is not only to ensure that the commitments made are complied with but also to observe whether the predictions made in the EIA reports were correct or not. Where the impacts exceed the predicted levels, corrective action should be taken. Monitoring will enable the regulatory agency to review the validity of predictions and the conditions of implementation of the Environmental Management Plan (EMP).

Appendix A5.3

PROCESS OF LAND ACQUISITION

LAND ACQUISITION ACT

Land is normally acquired under the provisions of the Land Acquisition Act, 1894 which is general and basic law in the country for the acquisition of land for public purposes and companies. This Act was comprehensively amended in the year 1984, taking into consideration the recommendations of the Law Commission, the Land Acquisition Review Committee, headed by Justice A. N. Mulla, as well as suggestions from the state governments and other quarters.

The Conference of the Revenue Secretaries of States (July 1989) have also made recommendations that all land should be acquired under the provisions of the Land Acquisition Act, 1894 and other laws repugnant thereto should be brought in line with it or repealed altogether. However, these efforts have not met with success and a large number of laws, having different procedures and norms of compensation, continue to operate.

In view of the acknowledged superiority of the Land Acquisition Act, 1894 land is acquired under the provisions of this Act. The underlying principle governing the acquisition of land under the Land Acquisition Act, 1894 is that compensation alone is payable in lieu of deprivation. However, there is a provision under Section 31 (3) in the Land Acquisition Act for grant of land in lieu of money compensation.

LAND ACQUISITION PROCESS

In the table below, relevant sections of the LA Act, 1894 and the relevance of such sections in the land acquisition process has been given.

SUMMARY OF LAND ACQUISITION ACT, 1894

Relevant sections	Description	Relation with the Project
3	Definition	
4	Publication of preliminary notification and powers of officers thereupon	-
5	Payment for damage	Compensation for the damage done to the property during the course of surveying will be paid by the Project
5A	Hearing of Objections	Will be followed by the Project
6	Declaration that land is required for a public purpose	Declaration will be published in the Official Gazette and in two daily newspapers circulating in the locality where the land is situated of which at least one shall be in the regional language. Project Authority through concerned Collector/District Magistrate (DM) will cause public notice of the substance of the declaration at convenient places in the locality.
7	After declaration, Collector/ (DM) to take order for acquisition	Will be followed by the Project
8	Land to be marked out, measured and planned	Will be followed by the Project
9	Notice to persons interested	Will be followed by the Project

..

Relevant sections	Description	Relation with the Project
10	Powers to require and enforce the making of statements as to names and interests	Will be followed by the Project
11	Enquiry into measurements, value and claims and award by Collector	Project to make use of "The Uttar Pradesh Land Acquisition (Determination of Compensation and Declaration of Award by Agreement) Rules, 1997"
12	Award of Collector when to be final	Will be guided by provision made in "The Uttar Pradesh Land Acquisition (Determination of Compensation and Declaration of Award by Agreement) Rules, 1997"
13A	Correction of Clerical Errors, etc.	Will be followed by the Project
16	Power to take possession	Will be followed by the Project
17	Special powers in cases of urgency	May not be required in the Project
18	Reference to court	May not be required, as Project, will follow "The Uttar Pradesh Land Acquisition (Determination of Compensation and Declaration of Award by Agreement) Rules, 1997".
23	Matters to be considered in determining compensation	May not be required, as Project, will follow "The Uttar Pradesh Land Acquisition (Determination of Compensation and Declaration of Award by Agreement) Rules, 1997".
24	Matters to be neglected in determining compensation	May not be required, as Project, will follow "The Uttar Pradesh Land Acquisition (Determination of Compensation and Declaration of Award by Agreement) Rules, 1997".

In private transaction the buyer and the seller negotiate the "price" of land between themselves. ' The seller is willing to sell. The buyer is willing to buy. The price offered and accepted is decided mutually and finally agreed upon. The level at which the price is fixed is determined based on the "market conditions".

Contrarily, in the acquisition of private lands by the state the landowner's consent and willingness is not necessarily (section 24) of the LA Act. The person will lose land even if he/she does not want to part with it. Secondly, while fixing the compensation amount the land owners' objections and opinions are heard (under section 9 and I I of the LA Act), but it is not necessary that the amount quoted by him/her must be agreed to. The landowner thus has no control over his/her right of ownership or on the level of compensation. It may be said therefore that compensation is not a price.

Market Value

The Land Acquisition Act (u/s 23) stipulates that while determining compensation the "market value*' prevailing on the date of preliminary notification (u/s 4(1)) should be taken into consideration. However, the Act or the Rules neither define "market value" not specify the mechanisms to fix the same.

Solatium

Acquisition of lands by the state is compulsory in nature. Such compulsion injures the feelings and causes inconvenience to the owners. The law therefore provide for the payment of mandatory "solatium". The percentage of solatium has varied from time to time. With effect from September 1984 when LA Act was amended, it is **30 percent** of the market value.

Additional Market Value

..

The reckoning date for ascertaining the market value is the date on which preliminary notification (u/s 4(l)) is published. Between this notification and actually taking possession of the land, ordinarily there will be a **time gap varying between three months to three years.** Retrofitting the market value as on the date of 4(1) notification would cause a great loss to the owner. The law therefore, provides for an **additional market value at the rate of 12 percent per annum** of the market value from the date of 4(1) notification till the date of award or taking possession which ever is earlier.

Interest

In case of delay, the law provides for payment of interest on the compensation. For the first 12 months, the interest at the rate of 9 percent is payable from the date of the award. For delays beyond 12 months from the date of declaration of the award, 15 percent is the rate of interest.

METHODS OF CALCULATING COMPENSATION

As said earlier, there is no fixed method of calculating compensation in the Act. However, the basic element in deciding the amount of compensation is the **market value (u/s 23)**. Within the framework of law, the courts have interpreted market value as the price that a willing purchaser would pay to a willing seller for a property giving due regard to its existing condition, with all its advantages, and potential possibilities. It is however, not easy to precisely determine what should be the most accurate market value of a given property. The market conditions are never constant. The demand and supply factors vary enormously over a period of time and from place to place. The uniqueness of each property, its location, size, quality and possible potentialities need to be considered. With these constraints, different methods determining compensation are in vogue. Some of the methods are discussed here:

(1) Sale Statistics Method

Land being an immovable property, all its sales and purchases have to be registered. The registered sale prices can be taken as adequate indicator of market value of a given piece of land. Sale prices of those lands, which are comparable in time and quality, are only to be considered. Following steps are involved in calculating compensation according to sales statistics method.

Step 1 : Collect statistics of sales of land/buildings adjacent to ones being acquired in three to four years preceding 4(l) notification from Registration Department.

Step 2 : Workout average of 3 to 4 years per acre/hectare.

Step 3 : Average Price(AP) + 0.3 AP+0.12AP per annum from the date of 4(l) notification to date of award to arrive at compensation.

Step 4 : Add damages, if any or incidental, if any.

Step 5 : Calculate interest from date of award at 9 % for first 12 months and 15 % for the period thereafter.

(2) Capitalisation Method

Where reliable information is not available about the prevailing market value of the land, capitalisation method is used to decide compensation. Following steps are involved in calculating compensation according to capitalisation method.

Step 1 : Gross Income - Cost=Net Income

..

Step 2 : Net Income x Multiplier* = Market Value

Step 3 : Market Value (MV) +30% of MV as solatium + 12% of MV per annum as Additional Market Value =Compensation

Step 4 : Compensation + Damages / incidental + interest

*There are no fixed limits on the choice of the multiplier. It is based on conjectures or precedents. Generally, a multiplier of 10 to 12 is used for valuing non-irrigated land whereas 8 to 10 is deemed sufficient for irrigated lands. For buildings based on net rental income, a multiplier of 15 or 20 is used.' In assessing the value of plantation or horticultural crops, generally a multiplier of 10 is acceptable.

(3) Expert Assessment

Assessment of value of certain horticultural crops, plantation crops, buildings, waterways, bunds, etc require special expertise. Professional valuers are used for valuing such immovable properties. Valuers take into account the longevity, health and expected yield levels while assessing income and standard practices along with the age. Experts use certain multipliers to arrive at a capitalized value of the assets. The multiplier generally used relates to the remaining period in the longevity of the structures or remaining age of the crops or rental expected.

(4) Consent Award

Negotiated settlement of compensation stands on a footing different from those of other methods of deciding the market value of the acquired asset. The essential elements are:

that the landowners and the collector reach an agreement on the matter to be included in the compensation.

that the terms of such agreement form the basis of the award and no further enquiry is necessary

that other provisions of the Act do not apply to such awards.

The consent of landowner is essential to finalise such awards. Once consent is obtained it cannot be questioned at a later stage. This process comes very close to market mechanism, where in buyers and sellers negotiate the price. It also provides an opportunity to the landowners to participate in the process of determining compensation.

(5) Replacement Value

It is argued that the compensation awarded for the acquired land and other amenities, buildings, etc. should be adequate to enable purchase of comparable assets elsewhere by the affected people. In this direction, the proponents of rehabilitation emphasise that wherever compensation is not adequate enough to buy replacement land/buildings, the project authorities must provide other topping up devices to overcome the shortfall.

A COMPARATIVE ANALYSIS OF ALL THE METHODS

All the five methods of assessing market value of acquired lands may be compared as shown in the table below under following heads:

Proximity to market value

..

Time taken

Who uses?

Degree of participation of PAPs

Equity

Frequency of use

COMPARISON OF DIFFERENT METHODS OF ASSESSING MARKET VALUE

Sl. No.	Criteria	Sale Statistics	Capitalisation	Expert Assessment	Consent Award	Replacement Value
1	Proximity to Market value	Remote	Closer	Closer	Closest	Equal to or more
2	Time Taken	Shorter	Average	Average	Shortest	Longer
3	Who uses?	Government	Courts Govt. rarely	Courts Govt.	Govt.	Govt./Bank Financed
4	Degree of Participation	None	Some	None	Maximum	Maximum
5	Equity	Somewhat reasonable	Reasonable	Reasonable	Highly reasonable	Highly reasonable
6	Frequency of use	Most common	More	Less	Less	Least common

On all these counts the replacement value method emerges as the best way of compensating landowners. Though it is the least used by the government and takes long time, it is highly equitable as it provides maximum opportunity to the affected people to participate in the acquisition process. The compensation thus offered is equal to or greater than the real market value. Consent award could be rated second, while expert assessment and capitalization method stand close to each other in the third place.

Appendix A5.4

TOLERANCE LIMITS FOR INLAND SURFACE WATERS (AS PER IS : 2296)

Sl. No.	Parameter and Unit	Class-A	Class-B	Class-C	Class-D	Class-E
1.	Colour (Hazen Units)	10	300	300	-	-
2.	Odour	Unobject	-	-	-	-
3.	Taste	Tasteless	-	-	-	-
4.	pH (max) (niin:6.5)	8.5	8.5	8.5	8.5	8.5
5.	Conductivity (25°C) (pmhos/cm)	-	-	-	1000	2250
6.	DO (mg/L) (min)	6	5	4	4	-
7.	BOD (3 days at 27'C) (mg/L)	2	3	3	-	
8.	Total Coliforms (MPN/100 mL)	50	500	5000	-	-
9.	TDS (mg/L)	500	-	1500	-	2100
10.	Oil and Grease (mg/L)	-		0.1	0.1	-
11.	Mineral Oil (mg/L)	0.01		-	-	-
12.	Free Carbon Dioxide (mg/L CO_2)	-	-	-	6	-
13.	Free Ammonia (mg/L as N)	-	-	-	1.2	-
14.	Cyanide (mg/L as CN)	0.05	0.05	0.05	-	-
15.	Phenol (mg/L C_6H_5OH)	0.002	0.005	0.005		
16.	Total Hardness (mg/L as $CaCO_3$)	300	-	-	-	-
17.	Chloride (mg/L as Cl)	250	-	600	-	600
18.	Sulphate (mg/L as SO_4)	400	-	400	-	1000
19.	Nitrate (mg/L as NO_3)	20	-	50	-	-
20.	Fluoride (mg/L as F)	1.5	1.5	1.5	-	
21.	Calcium (mg/L as Ca)	80	-	-	-	
22.	Magnesium (mg/L as Mg)	24.4	-	-	-	
23.	Copper (mg/L as Cu)	1.5	-	1.5	-	
24.	Iron (mg/L as Fe)	0.3	-	50	-	
25.	Manganese (mg/L as Mn)	0.5	-	-		
26.	Zinc (mg/L as Zn)	15	-	15	-	-
27.	Boron (mg/L as B)	-		-	-	2
28.	Barium (mg/L as Ba)	1				-
29.	Silver (mg/L as Ag)	0.05	-	-		
30.	Arsenic (mg/L as As)	0.05	0.2	0.2		
31.	Mercury (mg/L as Hg)	0.001	-	-	-	-
32.	Lead (mg/L as Pb)	0.1		0.1	-	-
33.	Cadmium (mg/L as Cd)	0.01	-	0.01	-	-
34.	Chromium (VI) (mg/L as Cr)	0.05	0.05	0.05	-	-
35.	Selenium (mg/L as Se)	0.01	-	0.05	-	-
36.	Anionic Detergents (mg/L MBAS)	0.2	1	1	-	-
37.	PAH (mg/L)	0.2	-	-	-	-
38.	Pesticides (pg/L)	Absent				
39.	Insecticides (nig/L)	-	-	Absent	-	-
40.	Alpha Emitters (10^{-6}µc/mL)	0.001	0.001	0.001	0.001	0.001
41.	Beta En-fitters (10^{-6} µc/mL)	0.01	0.01	0.01	0.01	0.01
42.	Percent Sodium (%)	-	-	-	-	60
43.	Sodium Absorption Ratio	-	-	-	-	26

Class-A : Drinking water source without conventional treatment but after disinfection.
Class-B : Outdoor bathing.
Class-C : Drinking water source with conventional treatment followed by disinfection.
Class-D : Fish culture and wild life propagation,
Class-E : Irrigation, industrial cooling and controlled waste disposal.

Appendix A5.5

IS 10500 : 1991

Table 1 Test Characteristics For Drinking Water

(*Clause* 3.1)

Sl No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref to IS)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Essential Characteristics						
i)	Colour, Hazen units, *Max*	5	Above 5, consumer acceptance decreases	25	3025 (Part 4) : 1983	Extended to 25 only if toxic substances are not suspected, in absence of alternate sources
ii)	Odour	Unobjectionable	—	—	3025 (Part 5) : 1983	a) Test cold and when heated b) Test at several dilutions
iii)	Taste	Agreeable	—	—	3025 (Parts 7 and 8) : 1984	Test to be conducted only after safety has been established
iv)	Turbidity, NTU, *Max*	5	Above 5, consumer acceptance decreases	10	3025 (Part 10) : 1984	—
v)	*p*H value	6·5 to 8·5	Beyond this range the water will affect the mucous membrane and/ or water supply system	No relaxation	3025 (Part 11) : 1984	—
vi)	Total hardness (as $CaCO_3$) mg/l, *Max*	300	Encrustation in water supply structure ane adverse effects on domestic use	600	3025 (Part 21) : 1983	—
vii)	Iron (as Fe) mg/l, *Max*	0·3	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria	1·0	32 of 3025 : 1964	—
viii)	Chlorides (as Cl) mg/l, *Max*	250	Beyond this limit, taste, corrosion and palatibility are affected	1 000	3025 (Part 32) : 1988	—
ix)	Residual, free chlorine, mg/l, *Max*	0·2	—	—	3025 (Part 26) : 1986	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be *Min* 0·5 mg/l.
Desirable Characteristics						
x)	Dissolved solids mg/l, *Max*	500	Beyond this palatability decreases and may cause gastro intestinal irritation	2 000	3025 (Part 16) : 1984	—
xi)	Calcium (as Ca) mg/l, *Max*	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40) : 1991	—

Table 1 Test Characteristics for Drinking Water (*Contd*)

Sl No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref to IS)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
xii)	Copper (as Cu) mg/l, *Max*	0·05	Astringent taste, discoloration and corrosion of pipes, fitting and utensils will be caused beyond this	1·5	**36** of 3025 : 1964	—
xiii)	Manganese (as Mn) mg/l, *Max*	0·1	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures	0·3	**35** of 3025 : 1964	—
xiv)	Sulphate (as SO_4) mg/l, *Max*	200	Beyond this causes gastro intenstinal irritation when magnesium or sodium are persent	400 (*see* col 7)	3025 (Part 24) : 1986	May be extended up to 400 provided (as Mg) does not exceed 30
xv)	Nitrate (as NO_3) mg/l, *Max*	45	Beyond this methaemoglobinemia takes place	100	3025 (Part 34) : 1988	—
xvi)	Fluoride (as F) mg/l, *Max*	1·0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1·5	**23** of 3025 : 1964	—
xvii)	Phenolic compounds (as C_6H_5OH) mg/l, *Max*	0·001	Beyond this, it may cause objectionable taste and odour	0·002	**54** of 3025 : 1964	—
xviii)	Mercury (as Hg) mg/l, *Max*	0·001	Beyond this, the water becomes toxic	No relaxation	(*see* Note) Mercury ion analyser	To be tested when pollution is suspected
xix)	Cadmium (as Cd), mg/l, *Max*	0·01	Beyond this, the water becomes toxic	No relaxation	(*ses* Note)	To be tested when pollution is suspected
xx)	Selenium (as Se), mg/l, *Max*	0·01	Beyond this, the water becomes toxic	No relaxation	**28** of 3025 : 1964	To be tested when pollution is suspected
xxi)	Arsenic (as As), mg/l, *Max*	0·05	Beyond this, the water becomes toxic	No relaxation	3025 (Part 37) : 1988	To be tested when pollution is suspected
xxii)	Cyanide (as CN), mg/l, *Max*	0·05	Beyond this limit, the water becomes toxic	No relaxation	3025 (Part 27) : 1986	To be tested when pollution is suspected
xxiii)	Lead (as Pb), mg/l, *Max*	0·05	Beyond this limit, the water becomes toxic	No relaxation	(*see* Note)	To be tested when pollution/plumbosolvency is suspected
xxiv)	Zinc (as Zn). mg/l, *Max*	5	Beyond this limit it can cause astringent taste and an opalescence in water	15	**39** of 3025 : 1964	To be tested when pollution is suspected
xxv)	Anionic detergents (as MBAS) mg/l, *Max*	0·2	Beyond this limit it can cause a light froth in water	1·0	Methylene-blue extraction method	To be tested when pollution is suspected
xxvi)	Chromium (as Cr^{6+}) mg/l, *Max*	0·05	May be carcinogenic above this limit	No relaxation	**38** of 3025 : 1964	To be tested when pollution is suspected

(*continued*)

Table 1 Test Characteristics for Drinking Water (*concluded*)

Sl No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref to IS)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
xxvii)	Polynuclear aromatic hydrocarbons (as PAH) g/l, *Max*	—	May be carcinogenic	—	—	—
xxviii)	Mineral oil mg/l, *Max*	0·01	Beyond this limit undesirable taste and odour after chlorination take place	0·03	Gas chromatographic method	To be tested when pollution is suspected
xxix)	Pesticides mg/l, *Max*	Absent	Toxic	0·001	—	—
xxx)	Radioactive materials:				58 of 3025 : 1964	
	a) Alpha emitters Bq/l, *Max*	—	—	0·1	—	—
	b) Beta emitters pci/l, *Max*	—	—	1	—	—
xxxi)	Alkalinity mg/l, *Max*	200	Beyond this limit taste becomes unpleasant	600	13 of 3025 : 1964	—
xxxii)	Aluminium (as Al), mg/l, *Max*	0·03	Cumulative effect is reported to cause dementia	0·2	31 of 3025 : 1964	—
xxxiii)	Boron, mg/l, *Max*	1	—	5	29 of 3025 : 1964	—

NOTE — Atomic absorption spectrophotometric method may be used.

Appendix A5.6

[1]SCHEDULE VII

(See Rule 3B)

National Ambient Air Quality Standards (NAAQS)

Pollutants	Time-weighted average	Concentration of ambient air (All concentrations are g/m^3 except for CO in mg/m^3)			Method of measurement
		Industrial area	Residential, Rural & other areas	Sensitive area	
1	2	3	4	5	6
Sulphur Dioxide (SO_2)	Annual Avg*	80	60	15	- Improved West and Gacke Method
	24 hours**	120	80	30	- Ultraviolet Fluorescence
Oxides of Nitrogen as NO_x	Annual Avg*	80	60	15	- Jacob & Hochheister Modified (Na-Arsentire) Method
	24 hours**	120	80	30	- Gas Phase Chemiluminescence
Suspended Particulate Matter (SPM)	Annual Avg*	360	140	70	High Volume Sampling, (Average flow rate not less than 1.1 m^3/ minute)
	24 hours**	500	200	100	
Respirable Particulate Matter (RPM)	Annual Avg*	120	60	50	Respirable particulate matter sampler
	24 hours**	150	100	75	
Lead (Pb)	Annual Avg*	1.0	0.75	0.50	AAS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5	1.00	0.75	
Carbon Monoxide (CO)	8 hour **	5.0	2.0	1.0	Non dispersive infra red Spectroscopy
	1 hour	10.0	4.0	2.0	

* Annual Arithmetic mean of minimum: 04 measurements in year taken twice a week 24 hourly at uniform interval.

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

NOTE:

1. National Ambient Air Quality Standard: the levels of air quality with an adequate margin of safety, to protect the public health, vegetation and property.
2. Whenever and wherever two consecutive values exceeds the limit specified above for the respective category, it would be considered adequate reason to institute regular/ continuous monitoring and further investigation.

SOURCE : Pollution Control Acts, Rules and Notifications Issued Thereunder, Pollution Control Law Series : PCLS/02/1992 (Fourth Edition) of Central Pollution Control Board, September 2001, pp 381-82

[1] Inserted by Rule 5(b) of the Environment (Protection) Rules, 1996 published by G.S.R. 176(E), dated 2.4.1996

Appendix A5.7

THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000

SCHEDULE

[See Rule 3(1) and 4(1)]

Ambient Air Quality Standards in respect of Noise

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

Note :

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.

2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

[a][3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority].

4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale 'A' which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq : It is an energy mean of the noise level over a specified period.

SOURCE : Pollution Control Acts, Rules and Notifications Issued Thereunder, Pollution Control Law Series : PCLS/02/1992 (Fourth Edition) of Central Pollution Control Board, September 2001, pp 711

[a] Substituted by Rule 4 of the Noise Pollution (Regulation and Control) (Amendment) Rules, 2000 notified vide S.O. 1046(E), dated 22.11.2000.

Appendix A5.8

GUIDELINES FOR EIA REPORT PREPARATION

"Environmental Impact Assessment: A Manual" issued by the IA Division of Ministry of Environment and Forests, Government of India in January 2001 briefly lists the components of an EIA in its introductory chapter as given below. The complete manual can be downloaded from httP://www.envfor.nic.in.

1.3 Components of EIA

The difference between **Comprehensive** EIA and **Rapid** EIA is in the time-scale of the data supplied. Rapid EIA is for speedier appraisal process. While both types of EIA require inclusion/ coverage of all significant environmental impacts and their mitigation, Rapid EIA achieves this through the collection of 'one season' (other than monsoon) data only to reduce the time required. This is acceptable if it does not compromise on the quality of decision-making. The review of Rapid EIA submissions will show whether a comprehensive EIA is warranted or not.

It is, therefore, clear that the submission of a professionally prepared Comprehensive EIA in the first instance would generally be the more efficient approach. Depending on nature, location and scale of the project EIA report should contain all or some of the following components.

Air Environment

- Determination of impact zone (through a screening model) and developing a monitoring network
- Monitoring the existing status of ambient air quality within the impacted region (7-10 km from the periphery) of the proposed project site
- Monitoring the site-specific meteorological data, viz. wind speed and direction, humidity, ambient temperature and environmental lapse rate
- Estimation of quantities of air emissions including fugitive emissions from the proposed project
- Identification, quantification and evaluation of other potential emissions (including those of vehicular traffic) within the impact zone and estimation of cumulative of all the emissions/impacts
- Prediction of changes in the ambient air quality due to point, line and areas source emissions through appropriate air quality models
- Evaluation of the adequacy of the proposed pollution control devices to meet gaseous emission and ambient air quality standards
- Delineation of mitigation measures at source, path ways and receptor

Noise Environment

- Monitoring the present status of noise levels within the impact zone, and prediction of future noise levels resulting from the proposed project and related activities including increase in vehicular movement
- Identification of impacts due to any anticipated rise in noise levels on the surrounding environment
- Recommendations on mitigation measures for noise pollution

Water Environment

- Study of existing ground and surface water resources with respect to quantity and quality within the impact zone of the proposed project
- Prediction of impacts on water resources due to the proposed water use/pumping on account of the project
- Quantification and characterisation of waste water including toxic organic, from the proposed activity
- Evaluation of the proposed pollution prevention and wastewater treatment system and suggestions on modification, if required
- Prediction of impacts of effluent discharge on the quality of the receiving water body using appropriate mathematical/simulation models
- Assessment of the feasibility of water recycling and reuse and delineation of detailed plan in this regard

Biological Environment

- Survey of flora and fauna clearly delineating season and duration.
- Assessment of flora and fauna present within the impact zone of the project
- Assessment of potential damage to terrestrial and aquatic flora and fauna due to discharge of effluents and gaseous emissions from the project
- Assessment of damage to terrestrial flora and fauna due to air pollution, and land use and landscape changes
- Assessment of damage to aquatic and marine flora and fauna (including commercial fishing) due to physical disturbances and alterations
- Prediction of biological stresses within the impact zone of the proposed project
- Delineation of mitigation measures to prevent and / or reduce the damage.

Land Environment

- Studies on soil characteristics, existing land use and topography, landscape and drainage patterns within the impact zone
- Estimation of impacts of project on land use, landscape, topography, drainage and hydrology
- Identification of potential utility of treated effluent in land application and subsequent impacts
- Estimation and Characterisation of solid wastes and delineation of management options for minimisation of waste and environmentally compatible disposal

Socio-economic and Health Environment

- Collection of demographic and related socio-economic data
- Collection of epidemiological data, including studies on prominent endemic diseases (e.g. fluorosis, malaria, fileria, malnutrition) and morbidity rates among the population within the impact zone
- Projection of anticipated changes in the socio-economic and health due to the project and related activities including traffic congestion and delineation of measures to minimise adverse impacts
- Assessment of impact on significant historical, cultural and archaeological sites/places in the area
- Assessment of economic benefits arising out of the project
- Assessment of rehabilitation requirements with special emphasis on scheduled areas, if any.

Risk Assessment

- Hazard identification taking recourse to hazard indices, inventory analysis, dam break

probability, Natural Hazard Probability etc.

- Maximum Credible Accident (MCA) analysis to identify potential hazardous scenarios
- Consequence analysis of failures and accidents resulting in fire, explosion, hazardous releases and dam breaks etc.
- Hazard & Operability (HAZOP) studies
- Assessment of risk on the basis of the above evaluations
- Preparation of an onsite and off site (project affected area) Disaster Management Plan

Environment Management Plan

- Delineation of mitigation measures including prevention and control for each environmental component and rehabilitation and resettlement plan.
- Delineation of monitoring scheme for compliance of conditions
- Delineation of implementation plan including scheduling and resource allocation

Appendix A5.9 List of Existing Nala/ Drains in Allahabad

Area	No.	Name of Nala	Measured Discharge 1998-1999 (mld)	Expected Average Discharge 2005 (year) (mld)	2020 (year) (mld)	2035 (year) (mld)	Point of Discharge	Remark
ALLAHABAD CITY AREA	1	**MAIN GHAGHAR NALA**	40.00	40.00	50.00	64.00	Yamuna River (Left Bank)	8.68 mld waste water flow has already been tapped in GAP-I & is reaching to Gaughat MPS directly through existing sewer
	1A	**GHAGHAR NALA 1'A'**	4.00	4.00	5.00	6.50		
	1B	**GHAGHAR NALA 1'A' -1**	0.20	0.20	0.40	0.60		
	1C	**GHAGHAR NALA 1'B'**	0.75	0.75	1.50	1.80		
	1D	**DARIABAD - KATHARAGHAT DRAIN**	0.10	0.10	0.15	0.20		
	1E	**DARIABAD - PEEPALGHAT DRAIN**	0.03	0.03	0.04	0.05		
	1F	**DARIABAD - JOGIGHAT DRAIN**	0.05	0.05	0.06	0.10		
	2	**CHACHAR NALA**	34.00	34.00	41.30	52.80		
	3	**EMERGENCY OUTFALL DRAIN**	18.25	18.25	22.20	28.40		
		(through existing sewers)	8.68	8.68	8.68	0.00		
	4	**DRAIN AT GATE NO. 9**	2.00	2.00	3.00	4.00		
	5	**DRAIN AT GATE NO. 13**	4.00	4.00	5.30	7.00		
	6	**FORT DRAIN NO.1**	-	-	-	-		Under the control of Ministry of Difence & hence, discharge was not measured in 1998-1999
	6A	**FORT DRAIN NO.2**	-	-	-	-		
	7	**MORIGATE NALA including MUMFORDGANJ DRAIN**	33.94	33.94	42.40	53.70	Ganga River (Right Bank)	Near Shastri Bridge
	8	**DRAINS OF DARAGANJ AREA**	3.00	3.00	4.00	5.00	Morigate Nala	
	9	**ALENGANJ NALA**	27.10	27.10	32.90	42.00	Salori Nala	Near Buxi Bund
	10	**SALORI NALA**						Near Buxi Bund
DRAINS OF TELIYARGANJ AREA/ RASULABAD DRAINS	11	**JONDHWAL NALA**	2.50	2.50	3.10	3.90	Ganga River (Right Bank)	Teliyarganj
	11A	**SHANKARGHAT NALA**	0.20	0.20	0.21	0.31		Teliyarganj
	11B	**RASULABAD PACCAGHAT DRAIN**	0.04	0.04	0.05	0.06		Rasoolabad Ghat
	11C	**ADA COLONY NALA**	1.60	1.60	1.95	2.50		Rasoolabad Ghat
	11D	**JONDHWAL RASULABAD DRAIN (MURDAGHAT)**	0.07	0.07	0.08	0.11		Rasoolabad Ghat
	11E	**SHANKARGHAT COLONY DRAIN (near Phaphamau Bridge)**	0.01	0.01	0.01	0.02		Near Phaphamau Bridge
	11F	**JONDHWALGHAT DRAIN**	0.07	0.07	0.08	0.11		Teliarganj
	12	**RAJAPUR NALA**	7.00	7.00	8.50	10.90		Rajapur Area
	12A	**T.V. TOWER NALA**	2.00	2.00	2.45	3.10	Rajapur Nala	Rajapur Area
	12B	**SADAR BAZAR NALA**	3.00	3.00	3.65	4.70		Rajapur Area
	12C	**UNCHWAGHARI DRAIN-I**	0.70	0.70	0.85	1.10		Kachhar of Rajapur Area
	12D	**UNCHWAGHARI DRAIN-II**	0.25	0.25	0.30	0.40		Kachhar of Rajapur Area
	12E	**BELIGAON DRAIN**	0.25	0.25	0.30	0.40		Kachhar of Rajapur Area
	12F	**MUMFORDGANJ DRAIN (balance discharge)**	0.40	0.40	0.50	0.62		Kachhar of Rajapur Area
	12G	**MUIRABAD (GANESH NAGAR) NALA**	1.00	1.00	1.21	1.55		Kachhar of Rajapur Area
	12H	**NAYAPURWA DRAIN**	0.06	0.06	0.07	0.10		Kachhar of Rajapur Area
	12I	**MEHDAURI GAON DRAIN**	0.20	0.20	0.25	0.31		Kachhar of Rajapur Area
	13	**MAWAIYA NALA**	9.00	9.00	11.00	14.00	Ganga River (Right Bank)	Near Mawaiya Village (Naini Area)
	14	**SHIVKUTI DRAIN NO.1**	0.02	0.02	0.02	0.03		Near Shivkuti Temple
	14A	**SHIVKUTI DRAIN NO.2**	0.01	0.01	0.01	0.02		Near Shivkuti Temple
	14B	**SHIVKUTI DRAIN NO.3 (North)**	1.60	1.60	1.95	2.50		Near Shivkuti Temple
	14C	**SHIVKUTI DRAIN NO.4**	0.01	0.01	0.01	0.02		Near Shivkuti Temple
	14D	**SHIVKUTI DRAIN NO.5**	0.01	0.01	0.01	0.02		Near Shivkuti Temple
	14E	**SHIVKUTI DRAIN NO.6**	0.02	0.02	0.02	0.03		Near Shivkuti Temple
	14F	**SHIVKUTI DRAIN NO.7 (East)**	0.72	0.72	0.90	1.15		Near Shivkuti Temple
	15	**CHILLA DRAIN**	-	-	-	-		Absorbed in sandy Strata of river Ganga & hence, discharge was not measured in 1998-1999
	15A	**GOVINDPUR PURANI BASTI DRAIN**	-	-	-	-		
	15B	**GOVINDPUR DRAIN NO.1**	-	-	-	-		
	15C	**GOVINDPUR DRAIN NO.2**	-	-	-	-		
	15D	**GOVINDPUR DRAIN NO.3**	-	-	-	-		
	15E	**GOVINDPUR DRAIN NO.4**	-	-	-	-		
DRAINS OF PHAPHAMAU AREA	16	**CO-OPERATIVE DRAIN**	-	-	-	-	Ganga River (Left Bank)	Stagnating in a pond and does not meet river Ganga & hence, discharge was not measured in 1998-1999
	17	**BASNA DRAIN**	-	-	-	-		Carries seepage of canal water & hence, discharge was not measured in 1998-1999
	18	**INDIRA AWAS DRAIN**	0.23	0.23	0.30	0.40		Near Phaphamau Area
	19	**SHIVPUR DRAIN**	-	-	-	-		Carries seepage of canal water & hence, discharge was not measured in 1998-1999
DRAINS OF JHUSI AREA	20	**LOTEY HARAN NALA**	2.15	2.15	2.60	3.38		Jhunsi Area down stream of sangam
	21	**SHASTRI BRIDGE NALA**	0.02	0.02	0.02	0.03		Near Shastri Bridge
DRAINS OF SULEMSARAI AREA	22	**KODARA NALA**	6.75	6.75	8.25	10.50	Ganga River (Right Bank)	Near Sulem Sarai Area
	23	**NEHRU PARK NALA**	0.50	0.50	0.60	0.80		Near Sulem Sarai Area
	24	**PONGHAT NALA**	1.75	1.75	2.15	2.75		Near Sulem Sarai Area

AVERAGE METEOROLOGICAL DATA RECORDED AT IMD STATION ALLAHBAD FROM 1951 TO 1980

Month	Reading at	Tempera-ture (°C) Daily Max	Daily Min	Relative humidity (%)	Rainfall (mm)	No. of rainy days	Heaviest fall in 24 hours	Date and year	Wind speed (km/hr)	% of days wind from									No. of days with wind speed (km/hr)			
										N	NE	E	SE	S	SW	W	NW	Calm	>=62	20-61	1-19	0
January	8:30	23.6	8.7	78	19.2	1.6	70.9	24 1900	3.4	2	5	9	4	5	16	25	3	31	0	0	19	12
	17:30			53						8	11	6	2	0	1	21	16	35	0	0	18	13
February	8:30	27.2	11.2	66	15.6	1.4	51.3	11 1898	4.1	4	4	6	4	4	18	29	5	26	0	0	19	9
	17:30			40						9	9	5	1	2	2	31	25	16	0	1	22	5
March	8:30	33.6	16.5	46	9.2	0.9	35.5	11 1978	4.8	4	4	8	5	8	19	30	7	15	0	1	25	5
	17:30			25						12	6	3	1	1	2	29	38	8	0	2	26	3
April	8:30	39.4	22.5	32	5.7	0.5	26.8	1 1965	5.9	2	5	10	6	8	16	32	10	11	0	2	24	4
	17:30			18						13	8	3	1	1	2	25	45	2	0	4	24	2
May	8:30	42.3	26.7	36	9.9	0.7	54.0	18 1971	7.0	5	10	19	5	5	9	27	9	11	0	2	24	5
	17:30			20						18	15	5	1	2	3	18	36	2	0	3	26	2
June	8:30	40.1	28.5	55	85.4	4.4	176.0	23 1916	8.0	3	11	21	6	5	12	25	9	8	0	4	23	3
	17:30			41						12	19	14	3	3	6	18	21	4	0	5	24	1
July	8:30	34.1	26.4	80	300.1	12.8	229.4	15 1963	7.4	2	8	23	6	10	17	21	4	9	0	3	25	3
	17:30			71						5	12	18	6	8	13	20	8	10	0	2	25	4
August	8:30	32.7	25.7	85	307.6	14.4	335.3	20 1953	6.2	2	9	23	7	7	12	19	6	15	0	2	25	4
	17:30			77						7	14	17	4	5	9	23	8	13	0	1	25	5
September	8:30	33.2	24.7	80	189.8	8.7	266.2	4 1938	5.7	4	9	20	6	6	11	23	7	14	0	2	24	4
	17:30			71						10	13	16	3	2	6	17	15	18	0	1	22	7
October	8:30	33.1	20.5	69	40.1	2.2	163.3	4 1894	3.4	3	7	10	6	6	10	20	6	32	0	0	20	11
	17:30			55						11	9	7	1	0	2	7	14	49	0	1	14	16
November	8:30	29.7	13.8	65	11.7	0.5	96.0	1 1956	2.4	2	3	3	3	3	11	28	5	42	0	0	15	15
	17:30			49						9	4	2	0	0	0	8	12	65	0	0	10	20
December	8:30	24.8	9.3	75	3.4	0.5	54.6	11 1886	2.6	1	2	5	2	3	13	29	3	42	0	0	17	14
	17:30			56						6	6	4	0	0	0	12	9	63	0	0	10	21
Mean/total	8:30	32.8	19.5	65	1017.7	48.6	335.3		5.1	6	6	13	5	6	14	26	6	21	0	16	260	89
	17:30			48						10	11	8	2	2	4	17	21	23	0	20	246	99

Appendix A5.11

CLIMATOLOGICAL NORMALS OF WIND DIRECTION AND SPEED AT ALLAHABAD

Month		Percentage No. of days wind from									Wind Speed kmph	No. of Days with Wind speed, kmph		
		N	NE	E	SE	S	SW	W	NW	Calm		20-61	1-19	0
January	I	2	5	9	4	5	16	25	3	31	3.4	0	19	12
	II	8	11	6	2	0	1	21	16	35		0	18	13
February	I	4	4	6	4	4	18	29	5	26	4.1	0	19	9
	II	9	9	5	1	2	2	31	25	16		1	22	5
March	I	4	4	8	5	8	19	30	7	15	4.8	1	25	5
	II	12	6	3	1	1	2	29	38	8		2	26	3
April	I	2	5	10	6	8	16	32	10	11	5.9	2	24	4
	II	13	8	3	1	1	2	25	45	2		4	24	2
May	I	5	10	19	5	5	9	27	9	11	7.0	2	24	5
	II	18	15	5	1	2	3	18	36	2		3	26	2
June	I	3	11	21	6	5	12	25	9	8	8.0	4	23	3
	II	12	19	14	3	3	6	18	21	4		5	24	1
July	I	2	8	23	6	10	17	21	4	9	7.4	3	25	3
	II	5	12	18	6	8	13	20	8	10		2	25	4
August	I	2	9	23	7	7	12	19	6	15	6.2	2	25	4
	II	7	14	17	4	5	9	23	8	13		1	25	5
September	I	4	9	20	6	6	11	23	7	14	5.7	2	24	4
	II	10	13	16	3	2	6	17	15	18		1	22	7
October	I	3	7	10	6	6	10	20	6	32	3.4	0	20	11
	II	11	9	7	1	0	2	7	14	49		1	14	16
November	I	2	3	3	3	3	11	28	5	42	2.4	0	15	16
	II	9	4	2	0	0	0	8	12	65		0	10	20
December	I	1	2	5	2	3	13	29	3	42	2.6	0	17	14
	II	6	6	4	0	0	0	12	9	63		0	10	21
Mean/Total	I	3	6	13	5	6	14	26	6	21	5.1	16	260	89
	II	10	11	8	2	2	4	19	21	23		20	246	99

Source: Climatological tables, 1951-1980; IMD Publication

Appendix A5.12

LITHOLOGICAL LOGS OF EXPLORATORY BOREHOLES DRILLED BY CENTRAL GROUND WATER BOARD IN ALLUVIAL AREA OF ALLAHABAD DISTRICT (LOCATION DARAGUNJ 25°26'30" : 81°53'30" :: 63 G/5)

Lithology	Depth Range (m)	Thickness (m)
Clay sticky and hard yellowish	0.0-6.50	6.50
Clay sticky and hard grayish mixed with sand fine grained	6.50-12.95	6.45
Sand medium to fine grained grayish comprised of quartz feldspars and muscovites in excess and ferromagnesian minerals. Rounded to sub-rounded sediments	12.95-30.57	17.62
Sand & gravel grayish comprised of smoky quartz, feldspars & ferromagnesian minerals. Quartzitic in nature. Angular to sub-angular sediments.	30.57-33.57	3.00
Clay sticky and hard yellowish	33.57-37.67	6.10
Clay sticky and hard yellowish mixed with sand fine to medium grained grayish angular to sub-angular sediments	37.67-40.67	3.00
Sand medium to fine grained grayish comprised of quartz, feldspars & ferro magnesian minerals rounded to sub-rounded sediments	40.67-50.29	9.62
Sand medium grained brownish comprised of quartz feldspars & biotities. Rounded to sub-rounded sediments	50.29-56.84	6.55
Sand medium to coarse grained brownish comprised of smoky quartz in abundance felspars & little amount of ferromagnesian minerals. Rounded to sub rounded sediments	56.84-80.14	23.30
Sand coarse grained brownish comprised of quartz & felspars in abundance with illemenite, magnetite & chlorite. Angular to sub-angular sediments	80.14-99.84	19.70
Sand & gravel comprised of quartz felspars & ferromagnesian minerals. Angular to sub angular sediments	99.84-103.19	3.35
Clay reddish mixed with gravel of quartz, felspars & ferromagnesian minerals. Angular to sub-angular sediments	103.19-106.19	3.00
Sand medium to coarse grained reddish comprised of quartz, felspars & ferromagnesian minerals & equal amount of clay	106.19-110.34	3.15
Sand medium to coarse grained brownish comprised of quartz, felspars & ferromagnesian minerals. Angular to sub-angular sediments	110.34-113.24	2.90
Sandy clay dark yellowish & sticky with sand medium grained brownish	116.44-125.94	9.50
Clay sticky and hard yellowish mixed with sand medium grained	125.94-132.29	6.35
Sand medium grained yellowish comprised of quartz, felspars & ferromagnesian minerals. Rounded to sub rounded sediments.	132.29-145.39	13.10
Sand medium to fine grained grayish mixed with clay	145.39-151.49	6.10
Sand medium to coarse grained grayish comprised of quartz, felspars & ferromagnesian minerals. Rounded to sub-rounded sediments	151.49-158.61	17.12
Sand medium to coarse grained mixed with little amount of clay	158.61-161.61	3.00
Sand medium to coarse grained grayish comprised of quartz, felspars, chlorite, magnetite rounded to sub-rounded sediments	161.61-183.36	22.75
Clay sticky and hard yellowish with little amount of sand in patches	183.36-206.15	22.79
Sand medium to coarse grained grayish quartz felspars rounded to sub-rounded sediments	206.15-209.15	3.00
Clay sticky and hard yellowish mixed with sand fine grained in between	209.15-232.97	13.82
Sand medium to coarse grained grayish. Angular to sub-angular sediments rich in iron content with boulder of sandstone	232.97-235.27	2.30
Clay reddish hard & plastic	235.27-242.10	6.83
Weathered limestone angular to sub-angular sediments rich in iron	242.10-250.55	8.45
Of cherty limestone greenish grey (satisfied limestone)	250.55-251.55	1.00

LITHOLOGICAL LOGS OF EXPLORATORY BOREHOLES DRILLED BY CENTRAL GROUND WATER BOARD IN ALLUVIAL AREA OD ALLAHABAD DISTRICT (LOCATION SULEM SARAI 25°27'00" : 81°45'45" :: 63 G/15)

Lithology	Depth Range (m)	Thickness (m)
Surface soil-clay sticky and hard yellowish	0.0-26.80	26.80
Clay sticky and hard yellowish mixed with kankar and sand fine grained grayish	26.80-32.85	6.65
Sand medium to fine grained grayish comprised of quartz felspars & ferromagnesian minerals & clay intercalations at places	32.85-47.05	14.20
Sand medium to coarse grained brownish comprised of quartz, felspars & abundance of little amount of ferromagnesian minerals. Angular to sub-angular sediments	47.05-72.85	25.80
Sand fine grained grayish mixed with equal amount of clay	72.85-76.32	3.47
Sand medium to coarse grained grayish comprised of quartz felspars & ferromagnesian minerals in excess. Rounded to sub-rounded sediments	76.32-99.64	33.32
Sand medium to coarse grained brownish comprised of quartz felspars & ferromagnesian minerals. Angular sub-angular sediments	99.64-111.77	12.13
Clay sticky & hard yellowish mixed with equal amount of sand fine grained	111.77-115.25	3.48
Weathered material. Iron nodules rounded to sub-rounded sediments	115.25-118.25	3.00
Clay sticky and hard yellowish mixed with weathered material	118.25-124.75	6.50
Weathered material ferruginous Iron nodules. Rounded to sub-rounded	127.75-131.85	6.10
Clay silty, pale yellow	131.85-137.90	6.05
Clay sticky and hard yellowish	137.90-144.90	7.00
Clay sticky and hard yellowish mixed sand fine grained grayish	144.90-151.40	6.50
Clay sticky and hard yellowish mixed with little amount of bluish clay and indurated sand	151.40-164.88	13.48
Clay sticky and hard yellowish mixed with indurated sand	164.88-169.00	4.12
Clay sticky and hard yellowish mixed with little amount of sand fine grained & bluish clay at places	169.00-201.48	32.48
Clay sticky and hard yellowish with kankar & sand fine gravel at places	201.48-215.18	13.70
Sand medium to fine grained grayish comprised of quartz, felspars & ferromagnesian minerals	215.18-219.08	4.90
Sand medium to fine grained grayish comprised of quartz, felspars & ferromagnesian minerals mixed with clay intercalations	219.08-226.16	7.08
Clay sticky and hard yellowish	226.16-229.18	3.02
Sand medium to coarse grained grayish comprised of quartz, felspars & ferromagnesian minerals. (friable sandstone)	229.18-239.65	10.47
Sand medium to coarse grained grayish comprised of quartz & felspars. Angular to sub-angular sediments (weathered). Probably sandstone friable in nature	239.65-263.85	24.20
Sand stone medium to fine grained grayish felspathic in nature	263.85-278.12	14.27
Core of sandstone felspathic fine grained (probably Arkose)	278.12-279.12	1.00

Using the borehole data geological cross section have been drawn to depict the sub surface geology of the study area and shown in Fig 4.2. The review of the geological cross section brings out following salient features:

1. There are 8 aquifer (sandy horizon) down to explored depth of 278 m.
2. The thickness of alluvial sediment is limited as the pre Cambrian formation have been encountered at a depth of 241 m (limestone) at Daraganj and at a depth of 229 m (sandstone) at Sulem Sarai
3. The thickness of individual aquifer varies between 20-60 m
4. Invariably thick clay occurs at the top (12-32 m) over entire township.

5. The first aquifer which is of prime importance from environmental view point occurs just below the top clay and it is 20-30 m thick constituting fine to medium sand mixed with occasional gravel
6. Total thickness of sandy horizon at Daraganj is 162.6 m while at Sulem Sarai it is 101.3 m

Appendix A5.13

WELL WISE WATER LEVEL (1969 TO 2003)

Year	January	May	August	November	Average
Well No. : ALD04 (Allahabad)					
1969			9.28	9.43	9.36
1970	9.96			6.75	8.36
1971	7.60			4.68	6.14
1972	5.55				5.55
1973				4.49	4.49
1974					
1975	7.11			6.93	7.02
1976	7.98			8.05	8.02
1977	8.91			6.08	7.50
1978	6.55			5.86	6.21
1979	6.09			7.69	6.89
1980	7.77			3.65	5.71
1981	3.29			1.95	2.62
1982	2.45			1.41	1.93
1983	2.56			2.52	2.54
1984	4.80			3.15	3.98
1985	3.47	4.63	3.88	3.07	3.76
1986	3.35	4.57	2.93	2.29	3.29
1987	2.14	4.00	5.05	2.75	3.49
1988	3.31	4.37	2.11	2.35	3.04
1989	3.08	3.65	2.45	2.71	2.97
1990	2.87	3.24	2.06	1.61	2.45
1991	1.55	3.13	1.00	1.64	1.83
1992	1.75	2.95	3.02	2.18	2.48
1993	2.73	3.85	3.28	3.82	3.42
1994	3.82	4.35	2.70	3.09	3.49
1995	3.47	4.31	2.46	2.49	3.18
1996	2.80	4.05	2.29	2.44	2.90
1997	2.95	4.52		2.63	3.37
1998	2.65	4.10	1.61	2.09	2.61
1999	2.81	3.57	1.22	2.05	2.41
2000	2.31	3.21	1.17	2.11	2.20
2001		3.67	1.65	1.45	2.26
2002		3.45	2.35	1.95	2.58
2003	2.18				2.18
Average	**4.26**	**3.87**	**2.81**	**3.61**	**3.64**
Well No. : ALD26 (Mandari)					
1989	18.94	12.93	18.53	19.90	17.58
1990	20.00	20.90	17.09	21.00	19.75
1991	18.90	19.88	18.37	19.00	19.04
1992	19.03	19.28	19.40	18.29	19.00
1993	18.57	20.55	19.60	20.45	19.79
1994	19.27	3.00	19.00	19.67	15.24
1995	19.69	20.50	18.91	19.22	19.58
1996	19.57	3.00	18.07	19.02	14.92
1997	20.32	3.00	19.10	17.36	14.95
1998	19.30	20.64	17.10	17.80	18.71
1999	18.16	19.21	1.48	3.95	10.70
2000	16.80	18.16	16.72	17.59	17.32
2001		19.00	17.24	17.30	17.91
2002		19.10	18.90	19.42	19.14

Year	January	May	August	November	Average
2003	5.40				5.40
Average	**18.00**	**15.67**	**17.11**	**17.86**	**17.16**
Well No. : ALD30 (Naini)					
1991	13.62	15.90	13.10	12.95	13.89
1992	14.70	14.81	12.27	13.01	13.70
1993	15.53	15.40	16.20	15.85	15.75
1994	15.64	15.60	13.64	15.14	15.01
1995	15.32	17.30	14.20	15.40	15.56
1996	15.82	15.40	14.00	13.73	14.74
1997	14.50	15.56	12.31	14.70	14.27
1998	15.40	14.81	12.41	12.70	13.83
1999	13.45	16.03	9.25	11.42	12.54
2000	12.05	13.78	8.52	11.50	11.46
2001		13.68	11.00	11.60	12.09
2002		3.30	11.60	12.00	8.97
2003	4.83				4.83
Average	**13.71**	**14.30**	**12.38**	**13.33**	**13.43**

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पर्यावरण भवन, सी. जी. ओ. कॉम्प्लेक्स
PARYAVARAN BHAVAN, C.G.O. COMPLEX
लोदी रोड, नई दिल्ली-110003
LODHI ROAD, NEW DELHI-110003

No.Q15018/4/2000-C

To

The Chairman, Central Pollution Control Board,
East Arjun Nagar, Delhi 110 032.
The Chairmen, All State Pollution Control Boards.
The Chairman, Delhi Pollution Control Committee,
6th Floor, ISBT Building, Kashmere Gagate,Delhi-
Concerned Laboratories.

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Sub: Recog
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Sir

Please a sed a cop ie notification brought out by the Minisry
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ASHOK BHATIA
Joint Directo

6. का.आ. 375 (अ), दिनांक 26 मई, 1994
7. का.आ. 633 (अ), दिनांक 31 अगस्त, 1994
8. का.आ 54(अ), दिनांक 15 जनवरी, 1997
9. का.आ. 305 (अ), दिनांक 7 अप्रैल, 1997
10. का.आ 173 (अ), दिनांक 9 मार्च, 1998
11. का.आ. 1508 (अ), दिनांक 27 जुलाई, 1998

NOTIFICATION

New Delhi, the 11th February, 2000

S.O. 454.—In exercise of the powers conferred by clause (b) of sub-section (1) of section 12 and section 13 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 10 of the Environment (Protection) Rules, 1986, the Central Government hereby recognises the laboratories specified in column (2) below as environmental laboratories and specifies the persons in column (3) to be the Government Analysis and for that purpose makes the following further amendment in the notification of the Government of India in the Ministry of Environment and Forests, number S.O. 728(E), the 21st July, 1987, namely:—

In the Table appended to the said notification, after serial number 91 and the entries relating thereto, the following serial number and entries shall be added, namely :—

1	2	3	4
"92.	Thapar Centre for Industrial Research & Development, Thapar Technology Campus, Post Box No. 68, Patiala-147001.	1. Shri Rajesh Kumar Kapoor	M.Sc (Chemistry)
		2. Shri Sarabjeet Singh Ahluwalia	M.Sc (Bio-technology)
		3. Shri Sandip Chandra	M.Sc. (Chemistry)
93.	M/s Mahabal Enviro Engineers Private Limited, 88, New Modella Industrial Estate, Padwal Nagar, Wagle Estate, Near Check Naka, Thane West-400604	1. Col. B.S. Parmar	M.E. (Environmental Engineering)
		2. Shri Rajesh H. Barad	B.Sc. (Chemistry)
		3. Shri Sunil H. Gajbar	B.Sc.
94.	M/s Padmaja Aerobiologicals (Private) Limited, 'Nandan', Plot No. 36/3 & 36/4, Sector 24, Turbhe, Navi Mumbai-400705	1. Shri Pramod J. Harugade	B.Sc. (Chemistry)
		2. Shri Manohar P. Konar	B.Sc. (Chemistry)
		3. Mrs. Hemamata R. Raul	B.Sc. (Chemistry)
[redacted]		1. Shri B.D. Sharma	B.E.
		2. Dr. M. K. Sarkar	Ph.D.
		3. Shri Sanjay Prasad	M.Sc."

The recognition of the laboratories is valid for a period of five years from the date of publication of this notification. The recognition can be revoked earlier by the Government.

[F. No.Q-15018/4/97-CPW]
Dr. G. K. PANDEY, Director

Note:—The principal notification was published in the Gazette of India vide S.O. 728(E) dated 21st July, 1987 and subsequently amended vide:—

(1) S.O. 838 (E), dated 23rd September, 1987, (2) S.O. 989 (E), dated 17th November, 1987, (3) S.O. 156 (E), dated 24th February, 1989, (4) S.O. 489 (E), dated 17th May, 1989, (5) S.O. 846 (E), dated 24th October, 1989, (6) S.O. 375(E), dated 26th April, 1990, (7) S.O. 633 (E), dated 31st August, 1994, (8) S.O. 54 (E), dated 15th January, 1997, (9) S.O. 305 (E), dated 7th April, 1997, (10) S.O. 173 (E), dated 9th March, 1998 and (11) S.O. 1508 dated 27th July, 1998.

MGIPRRND—404 E & F/2000—(V—I)-3-2000—100.

EXTRACT FROM THE GAZETTE OF INDIA : PART II, SEC. 3, SUB-SEC. (ii)

Appearing on Page No. 1162 - 1164

Dated : 19-2-2000

पर्यावरण और वन मंत्रालय

MINISTRY OF ENVIRONMENT AND FORESTS

अधिसूचना

नई दिल्ली, 11 फरवरी, 2000

का.आ. 454.—केन्द्रीय सरकार, पर्यावरण (संरक्षण) नियम, 1986 के नियम 10 के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 12 की उपधारा (1) के खंड (ख) और धारा 13 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, नीचे स्तम्भ (2) में विनिर्दिष्ट प्रयोगशालाओं को पर्यावरणीय प्रयोगशालाओं के रूप में मान्यता देती है और स्तम्भ (3) में के व्यक्तियों को सरकारी विश्लेषकों के रूप में विनिर्दिष्ट करती है और इस प्रयोजन के लिए भारत सरकार के पर्यावरण और वन मंत्रालय की अधिसूचना सं. का.आ. 728 (अ) तारीख 21 जुलाई, 1987 में निम्नलिखित और संशोधन करती है, अर्थात् :—

उक्त अधिसूचना से संलग्न सारणी में क्रम सं. 91 और उससे संबंधित प्रविष्टियों के पश्चात् निम्नलिखित क्रम संख्यांक और प्रविष्टियां जोड़ी जाएंगी, अर्थात् :—

		3	4
"92.	भाभा सेंटर फार इंडस्ट्रियल रिसर्च एण्ड डेवलपमेंट, थापर टैक्नोलाजी कैम्पस, पोस्ट बाक्स सं. 68, पटियाला-147 001	1. श्री राजेश कुमार कपूर 2. श्री सरबजीत सिंह [illegible] 3. श्री संदीप [illegible]	एम. एससी. (रसायनशास्त्र) एम. एससी. (बायो-टेक्नोलाजी) एम. एससी. (रसायनशास्त्र)
93.	मेसर्स महाजन एनवायरो इंजीनियर्स प्राइवेट लिमिटेड, 48, न्यू मार्डेला इंडस्ट्रियल एस्टेट, पदमला नगर, [illegible] एस्टेट, [illegible], थाणे-वेस्ट 400604	[illegible] बी. एम. [illegible] श्री राजेश एन. [illegible] श्री [illegible]	एम. ई. ([illegible] इंजीनियरिंग बी. एससी. (रसायनशास्त्र) बी. एससी.
94.	मेसर्स [illegible] (प्राइवेट) लिमिटेड. "[illegible]", प्लाट सं. 36/3 और 36/4, सेक्टर 2, [illegible], नवी मुम्बई-400 705 [illegible] ए-121, पर्यावरण काम्पलेक्स, आई.जी. एन.ओ.यू. रोड, नई दिल्ली-110 030	प्रमोद जे. [illegible] [illegible] श्री [illegible] पी. [illegible] 3. श्रीमती हेमलता [illegible] 1. श्री पी. पी. [illegible] 2. डा. एम. के. [illegible] 3. श्री संजय प्रसाद	बी. एससी. (रसायनशास्त्र) बी. एससी. (रसायनशास्त्र) बी. एससी. (रसायनशास्त्र) बी. ई. पी. एच. डी. एम. एससी."

[illegible]

[फा. सं. क्यू-15018/4/97-सी पी डब्ल्यू]

डा. वी. के. पांडे, निदेशक

टिप्पणी :— मूल अधिसूचना भारत के राजपत्र में का.आ. 728 (अ), तारीख 21 जुलाई, 1987 द्वारा प्रकाशित की गई थी तथा तत्पश्चात् उसमें निम्नलिखित द्वारा संशोधन किए गए :—

1. का.आ. 838 (अ) दिनांक 23 सितम्बर, 1987
2. का.आ. 989 (अ) दिनांक 17 नवम्बर, 1987
3. का.आ. 156 (अ), दिनांक 24 फरवरी, 1989
4. का.आ. 439 (अ), दिनांक 17 मई, 1989
5. का.आ. 845 (अ), दिनांक 24 अक्तूबर, 1989

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SURFACE WATER TEST RESULTS **Appendix A5.15**

Sl. No.	Parameters	Desirable Limits (IS : 10500)	Permissible Limits (IS : 10500)	Yamuna down stream (surface) (SW1)	Sangam (Surface) (SW2)	Yamuna Up stream (surface) (SW3)	Ganga up stream (Surface) (SW4)	Ganga down stream (surface) (SW5)
	Date of sampling			**09.10.2004**	10.10.2004	**10.10.2004**	**09.10.2004**	**09.10.2004**
1.	DO	-	-	07	07	06	07	06
2.	BOD	-	-	12	18	12	22	26
3.	COD	-	-	34	43	31	49	67
4.	Ammonical nitrogen (as N), mg/l	-	-	0.08	0.10	0.06	09	0.10
5.	Kjeldahl nitrogen	-	-	<0.05	<0.05	<0.05	<0.05	0.06
6.	Magnesium as Mg	-	-	14	20	12	13	11
7.	Colour, Hazen units	5	25	<5	<5	<5	<5	<5
8.	Odour	-	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
9.	Taste	-	-	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
10.	Turbidity, NTU	5	10	<5	<5	<5	<5	<5
11.	pH value	6.5-8.5	6.5-8.5	8.0	8.1	8.0	8.1	8.0
12.	Total hardness (as $CaCO_3$) mg/l	300	600	120	152	120	156	164
13.	Iron (as Fe) mg/l	0.3	1.0	2.98	0.12	0.10	0.29	0.12
14.	Chlorides (as Cl) mg/l	250	1000	32	28	28	28	36
15.	Residual, free chlorine, mg/l	0.2	-	<0.05	<0.05	<0.05	<0.05	<0.05
16.	Dissolved solids, mg/l	500	2000	245	243	532	274	292
17.	Calcium (as Ca), mg/l	75	200	24	27	28	41	48
18.	Copper (as Cu) mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01
19.	Manganese (as Mn) mg/l	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1
20.	Sulphate (as SO_4) mg/l	200	400	10	14	11	21	21
21.	Nitrate (as NO_3) mg/l	45	100	7.5	8.7	6.8	7.0	7.2
22.	Fluoride (as F) mg/l	1.0	1.5	0.32	0.10	0.16	0.16	0.16
23.	Mercury (as Hg) mg/l	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24.	Cadmium (as Cd) mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25.	Selenium (as Se), mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
26.	Arsenic (as As), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
27.	Lead (as Pb), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
28.	Zinc (as Zn), mg/l	5	15	0.06	0.07	0.08	0.06	0.06
29.	Chromium (as Cr^{6+}), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
30.	Mineral oil, mg/l	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
31.	Alkalinity, mg/l	200	600	140	128	424	148	152
32.	Aluminium (as Al)	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01
33.	Boron, mg/l	1	5	<0.1	<0.1	<0.1	<0.1	<0.1
34.	Total coliform MPN / 100 ml	-	10/100 ml	15	09	12	07	08

SURFACE WATER TEST RESULTS

Sl. No.	Parameters	Desirable Limits (IS : 10500)	Permissible Limits (IS : 10500)	Ganga river near downfall of Rasulabad nala (SW6)	Yamuna river near Bisona village (SW7)	Ganga river near down stream of Kodra nala (SW8)	Yamuna river near downfall of Ghaghar nala (SW9)	Ganga river near downfall of Ponghat nala (SW10)
	Date of sampling			**05.11.2004**	05.11.2004	**05.11.2004**	**05.11.2004**	**05.11.2004**
1.	DO	-	-	6.5	7.5	6.5	7.2	7.0
2.	BOD	-	-	32	10	28	14	14
3.	COD	-	-	58	26	50	32	32
4.	Ammonical nitrogen (as N), mg/l	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
5.	Kjeldahl nitrogen	-	-	<0.05	<0.05	<0.05	<0.05	0.06
6.	Magnesium as Mg	-	-	19	24	23	22	21
7.	Colour, Hazen units	5	25	<5	<5	<5	<5	<5
8.	Odour	-	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
9.	Taste	-	-	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
10.	Turbidity, NTU	5	10	<5	<5	<5	<5	<5
11.	pH value	6.5-8.5	6.5-8.5	7.3	7.8	7.4	7.4	8.0
12.	Total hardness (as $CaCO_3$) mg/l	300	600	188	160	204	164	176
13.	Iron (as Fe) mg/l	0.3	1.0	0.12	1.10	0.12	0.15	1.30
14.	Chlorides (as Cl) mg/l	250	1000	36	52	20	52	24
15.	Residual, free chlorine, mg/l	0.2	-	<0.05	<0.05	<0.05	<0.05	<0.05
16.	Dissolved solids, mg/l	500	2000	452	415	490	409	395
17.	Calcium (as Ca), mg/l	75	200	43	24	44	29	35
18.	Copper (as Cu) mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01
19.	Manganese (as Mn) mg/l	0.1	0.3	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Sulphate (as SO_4) mg/l	200	400	24	34	30	28	23
21.	Nitrate (as NO_3) mg/l	45	100	7.0	6.8	6.6	6.2	5.8
22.	Fluoride (as F) mg/l	1.0	1.5	0.16	0.73	0.62	0.63	0.51
23.	Mercury (as Hg) mg/l	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24.	Cadmium (as Cd) mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25.	Selenium (as Se), mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
26.	Arsenic (as As), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
27.	Lead (as Pb), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
28.	Zinc (as Zn), mg/l	5	15	0.05	0.06	0.03	0.04	0.04
29.	Chromium (as Cr^{6+}), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
30.	Mineral oil, mg/l	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
31.	Alkalinity, mg/l	200	600	192	164	228	160	160
32.	Aluminium (as Al)	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01
33.	Boron, mg/l	1	5	<0.1	<0.1	<0.1	<0.1	<0.1
34.	Total coliform MPN / 100 ml	-	10/100 ml	12	14	15	16	16

DRINKING WATER TEST RESULTS (AS PER SELECTED PARAMETERS OF IS : 10500) (GROUND WATER SAMPLES)

Sl. No.	Parameters	Desirable Limits	Permissible Limits	NainiSTP (Bore well) (GW1)	Dahi Village (Dugwell) (GW2)	Numaya Village (Hand pump) (GW3)	Kandharpur (Handpump) (GW4)	Kondra (Hand pump) (GW5)
	Date of sampling			**09.10.2004**	10.10.2004	10.10.2004	10.10.2004	10.10.2004
1.	Colour, Hazen units	5	25	<5	<5	<5	<5	<5
2.	Odour	Unobjectionable	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
3.	Taste	Agreeable	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
4.	Turbidity, NTU	5	10	<5	<5	<5	<5	<5
5.	pH value	6.5-8.5	6.5-8.5	7.7	7.6	7.7	8.0	7.9
6.	Total hardness (as $CaCO_3$) mg/l	300	600	304	456	360	304	1432
7.	Iron (as Fe) mg/l	0.3	1.0	0.09	0.10	0.30	0.20	0.17
8.	Chlorides (as Cl) mg/l	250	1000	48	128	68	64	688
9.	Residual, free chlorine, mg/l	0.2	-	<0.05	<0.05	<0.05	<0.05	<0.05
10.	Dissolved solids, mg/l	500	2000	512	794	618	622	1764
11.	Calcium (as Ca), mg/l	75	200	91	104	96	76	216
12.	Copper (as Cu) mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01
13.	Manganese (as Mn) mg/l	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1
14.	Sulphate (as SO_4) mg/l	200	400	12	57	40	41	150
15.	Nitrate (as NO_3) mg/l	45	100	6.2	7.9	7.2	8.4	11.5
16.	Phenolic Compounds (as C_6H_5OH) mg/l	0.001	0.002	0.44	<0.001	<0.001	<0.001	<0.001
17.	Fluoride (as F) mg/l	1.0	1.5	<0.001	0.64	0.37	0.27	1.40
18.	Mercury (as Hg) mg/l	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
19.	Cadmium (as Cd) mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Selenium (as Se), mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21.	Arsenic (as As), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
22.	Cyanide (as CN), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
23.	Lead (as Pb), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
24.	Zinc (as Zn), mg/l	5	15	0.04	0.04	0.03	0.03	0.03
25.	Chromium (as Cr^{6+}), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
26.	Mineral oil, mg/l	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
27.	Alkalinity, mg/l	200	600	300	372	324	336	412
28.	Aluminium (as Al)	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01
29.	Boron, mg/l	1	5	<0.1	<0.1	<0.1	<0.1	<0.1
30.	Total coliform MPN / 100 ml	-	10/100 ml	02	06	02	03	03

DRINKING WATER TEST RESULTS (AS PER SELECTED PARAMETERS OF IS : 10500) (GROUND WATER SAMPLES)

Sl. No.	Parameters	Desirable Limits	Permis-sible Limits	Rasulabad (Supply water) (GW6)	Kharkauri (Dug well) (GW7)	Near Ponghat Nala Temple (Handpump) (GW8)	Nayapurwa (Handpump) (GW9)	Ghayasuddinpur (supply water) (GW10)
	Date of sampling			**09.10.2004**	10.10.2004	**09.10.2004**	**09.10.2004**	10.10.2004
1.	Colour, Hazen units	5	25	<5	<5	<5	<5	<5
2.	Odour	Unobjectionable	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
3.	Taste	Agreeable	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
4.	Turbidity, NTU	5	10	<5	<5	<5	<5	<5
5.	pH value	6.5-8.5	6.5-8.5	8.0	7.6	7.5	8.2	7.7
6.	Total hardness (as $CaCO_3$) mg/l	300	600	124	296	800	560	500
7.	Iron (as Fe) mg/l	0.3	1.0	0.14	0.14	0.17	0.16	0.11
8.	Chlorides (as Cl) mg/l	250	1000	40	144	252	88	176
9.	Residual, free chlorine, mg/l	0.2	-	<0.05	<0.05	<0.05	<0.05	<0.05
10.	Dissolved solids, mg/l	500	2000	250	662	1138	940	844
11.	Calcium (as Ca), mg/l	75	200	24	108	168	70	115
12.	Copper (as Cu) mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01
13.	Manganese (as Mn) mg/l	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1
14.	Sulphate (as SO_4) mg/l	200	400	12	95	75	70	85
15.	Nitrate (as NO_3) mg/l	45	100	6.7	6.3	6.6	6.4	7.1
16.	Fluoride (as F) mg/l	1.0	1.5	0.29	0.50	0.26	1.01	<0.001
17.	Phenolic Compounds (as C_6H_5OH) mg/l	0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.27
18.	Mercury (as Hg) mg/l	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
19.	Cadmium (as Cd) mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Selenium (as Se), mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21.	Arsenic (as As), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
22.	Cyanide (as CN), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
23.	Lead (as Pb), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
24.	Zinc (as Zn), mg/l	5	15	0.03	0.05	0.04	0.04	0.04
25.	Chromium (as Cr^{6+}), mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
26.	Mineral oil, mg/l	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
27.	Alkalinity, mg/l	200	600	128	128	400	508	300
28.	Aluminium (as Al)	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01
29.	Boron, mg/l	1	5	<0.1	<0.1	<0.1	<0.1	<0.1
30.	Total coliform MPN / 100 ml	-	10/100 ml	02	07	02	03	04

Appendix A5.16

SOIL ANALYSIS REPORT

Date of sampling : 10.10.2004
Date of testing : 12.10.2004

Sr. No.	Parameters	Unit	Rasoolabad, near proposed Rajapur STP (S1)	Numaya village, near proposed Numaya Dahi STP (S2)
1.	Colour		Pale brown	Brown
2.	pH value		8.0	7.9
3.	Temperature	°C	34	34
4.	Type of soil		Silty clay	Silty clay
5.	Moisture	% by mass	6.1	8.0
6.	Bulk density	gm/cm^3	1.20	1.28
7.	Conductivity	micro-mhos/cm	371.6	270.5
8.	Water holding capacity	% by mass	47.70	49.54
9.	Organic matter	% by mass	1.08	1.16
10.	Chloride as Cl	% by mass	0.03	0.02
11.	Sulphate as SO_4	% by mass	0.02	0.02
12.	Calcium carbonate as $CaCO_3$	% by mass	8.4	10.6
13.	Calcium as CaO	% by mass	5.2	7.7
14.	Iron as Fe_2O_3	% by mass	0.02	0.03
15.	Phosphorus as P_2O_5	% by mass	0.04	0.06
16.	Nitrate as N	% by mass	0.10	0.12
17.	Sodium as Na	% by mass	0.21	0.16
18.	Potassium as K	% by mass	0.45	0.23

Appendix A5.17

NOISE LEVELS WITHIN THE STUDY AREA [Leq in dB(A)]
SEWERAGE MASTER PLAN OF ALLAHABAD

Hours	Numaya Dahi (N1)	Sulem Sarai(N2)	Near D.M. Office (Civil Line) (N3)
Date of monitoring	**11-12/10/2004**	**09-10/11/2004**	**07-08/10/2004**
1.00	40.60	44.20	50.30
2.00	40.90	47.60	55.40
3.00	41.50	48.30	58.50
4.00	41.50	48.60	50.00
5.00	41.60	44.90	53.40
6.00	41.30	51.80	50.70
7.00	46.40	54.40	71.20
8.00	50.50	57.90	74.60
9.00	40.20	58.80	71.50
10.00	45.60	57.80	77.20
11.00	43.40	56.60	73.90
12.00	49.60	55.50	68.10
13.00	45.60	56.80	68.80
14.00	47.70	56.60	77.70
15.00	49.00	58.70	69.80
16.00	45.90	57.00	74.40
17.00	42.20	53.60	72.50
18.00	47.00	55.60	70.90
19.00	46.70	53.10	71.90
20.00	46.70	58.20	68.20
21.00	40.30	54.00	75.90
22.00	40.50	51.10	58.60
23.00	41.00	50.70	58.40
24.00	41.10	48.70	55.20
Day time Leq.	**45.80**	**56.30**	**72.40**
Night time Leq.	**41.10**	**48.40**	**54.50**
Average Leq.	**44.00**	**53.40**	**65.70**
Permissible (Day)	**55**	**55**	**55**
Permissible (Night)	**45**	**45**	**45**

Appendix A5.18

CONSOLIDATED LIST OF FLORA PRESENT IN AND AROUND ALLAHABAD CITY AREA

Botanical name	Common name	Family
TREES		
Aegle marmelos (L.) Corr.	Bel	Rutaceae
Ailanthus excelsa Roxb.	Maha neem	Simaroubaceae
Albizia lebbeck (Linn.) Benth	Kala siris	Mimosaceae
Artocarpus heterophyllus Lamk.	Kathal	Moraceae
Azadirachta indica A.J.Juss.	Neem	Meliaceae
Bombax ceiba L.	Semar	Bombacaceae
Caesalpinia pulcherrima L.	Gulmohar	Caesalpiniaceae
Cinnamomum tamala (Buch-Ham.)	Tejpatta	Lauraceae
Citrus aurantifolia (Christm)	Nimbu	Rutaceae
Dalbergia sissoo Roxb.	Shisham	Papilionaceae
Emblica officinalis Gaertn.	Anola	Euphorbiaceae
Eucalyptus globules (Labitt)	Eucalyptus	Myrtaceae
Ficus benghalensis Linn.	Bargad	Moraceae
Ficus glomerata Roxb.	Gular	Moraceae
Ficus religiosa L.	Pipal	Moraceae
Ficus rumphii (Blume)	Pakar	Moraceae
Jasminum arborescons (Roxb.)	Chameli	Oleaceae
Jatropha curcas L.	Jatropha	Euphorbiaceae
Lawsonia inermis L.	Mehndi	Lythraceae
Litchi chinensis (Gaertn.)	Litchi	Sapindaceae
Mangifera indica L.	Am	Anacardiaceae
Moringa oleifera	Sajna	Moringaceae
Pongamia pinnata	Karanj	Papilionaceae
Psidium guajava L.	Amrud	Myrtaceae
Punica granatum L.	Anar	Punicaceae
Roystonea oleracea (Mart.)	Bottle palm	Palmae
Saraca asoca (Roxb.)	Ashok	Caesalpiniaceae
Syzygium cumini (L.) Skeels	Jamun	Myrtaceae
Tamarix dioica (Roxb.)	Jhau	Tamaricaceae
Tectona grandis L.f.	Sagwan	Verbenaceae
Thevetia neriifolia Juss. Exsterd.	Kanel	Apocynaceae
Ziziphus rugosa L.	Ber	Rhamnaceae
Acacia arabica (L.) Wild	Babul Acacia	Mimosaceae
Acacia nilotica (L.) Willd.	Babul acacia	Mimosaceae
Sterculia urens Roxb.	Kateera-gum	Sterculiaceae
SHRUBS		
Aloe barbadensis Mill	Ghiakanwar	Liliaceae
Carissa corandas L.	Karaunda	Apocynaceae
Lantana camara L.	Phulkhri/Bangenda	Verbenaceae
Rosa centifolia L.	Gulab	Rosaceae
Vitis vinifera L.	Angoor	Vitaceae
Withania semnifera (L.)	Ashwagandha	Solanaceae
Ziziphus jujuba (L.) Lam. non Mill.	Bara Koli	Rhamnaceae
Calotropis procera (Willd.) Dryand	Safed ak	Asclepiadaceae
Datura metel L.	Sadahdhatura	Solanaceae
Sida cordifolia L.	Bisiripi/Kungyi	Malvaceae
Croton bonplandianum	Croton	Euphorbiaceae
Lantana indica	Lantana	Verbenaceae
Euphorbia microphylla	Dudhi	Euphorbiaceae
Polygonum barbatum L.	Bekhunjubaz	Polygonaceae
Ipomea palmate	Railway Creeper	Convolvulaceae

Botanical name	Common name	Family
*Solanum nigrum*L.	Makoi	Solanaceae
HERBS		
Amaranthus virdis	Tandulia	Amaranthaceae
Achyranthes aspera L.	Puthkunda	Amaranthaceae
Andgrographis paniculata (Burm.f.)	Kalmegh	Acanthaceae
Evolvulus alsinoide L.	Shyamakranta	Convolvulaceae
Mentha arvensis L.	Pudina	Labiatae
Ocimum sanctum L.	Tulsi	Labiatae
Rauvalfia serpentina (L.) Benth.ex.Kurz	Sarpgandha	Apocynaceae
Euphorbia hirta L.	Lal dudhi	Euphorbiaceae
Solanum xanthocarpum	Kateli	Solanaceae
GRASSES		
Cymbopogon citrates (DC) Stapf.	Lemon grass	Gramineae
Cyperus scariosus R.Br.	Nagarmotha	Cyperaceae
Saccharum spontaneum L.	Thatch grass	Gramineae
Saccharum munja Roxb.	Sarkanda	Gramineae

Appendix A5.19

LIST OF FAUNA PRESENT IN AND AROUND ALLAHABAD CITY

Zoological Name	Common name	Reference to Schedule of the Wildlife (Protection) Act, 1972 amended in 1995		
		Schedule	Part	Section
Avifauna				
Acridotheres tristis	Indian Myna	IV	11	45
Alcedo athis	Kingfisher	IV	11	37
Bubulcus ibis	Bagula	IV	11	22
Columba livia	Pigeon	IV	11	54
Corvus splendens	House crow	V	-	1
Coturnix coromandelica	Bater	IV	11	36-A
Eudynamys scolopacea (Linnaeus)	Koel	IV	11	17
Francolinus pictus	Titar	IV	11	51
Gallinago gallinago L.	Chaha	IV	11	
Milvus migrans	Cheel	IV	11	24
Passer domesticus	House sparrow	IV	11	78
Polypectron bicalcaratum L.	Peacock Pheasants	I	III	10C
Streptopelia decaocto	Ring Dove	IV	11	19
Dinopium benghalensis (Linnaeus)	Golden backed woodpecker	IV	11	79
Phalacrocorax niger (vieills)	Little cormorant	IV	11	15
Tadorna ferruginea	Surkab, Brahmini Duck	IV	11	26
Neophron percnopterus (Linnaeus)	White scavanger vulture	IV	11	75
Reptiles				
Bungarus caeruleus (Schneider)	Common Indian Krait	IV	-	12 vi
Chamaeleon zeylanicus (Laurenti)	Indian chameleon	II	I	24
Naja naja (Linn.)	Indian cobra, Naga	II	II	11
Ptyas mucosus (Linn.)	Rat snake, Dhaman	II	II	19
Lissemys punctata (Laeipede)	Indian Mud Turtle	i	II	7
Kachuga kachuga (Gray)	Sail Terrapin	I	II	14-B
Mammals				
Funambulus palmarum	Five striped palm squirrel	IV	-	3A
Macaca Mulatta	Monkey	I	I	17A
Felis chaus (Guldenstaedt)	Jungle Cat	II	II	2C
Presbytis entellus	Langur	II	I	4A
Vulpes benghalensis	Fox	II	II	1B
Cynopterus sphinx	Shortnosed fruit-bat	V		3

Appendix A5.20

AQUATIC FLORA IN ALLAHABAD

Total 16 microphytes have been identified out of which 4 species belongs to order Cyanophyta and rest of the 12 species are belongs to order Cholorophyta.

Algae	Cyanophyta	Oscillatoria
		Anabaena
		Microcystis
		Coelosphaerium
	Chlorophyta	Hydrodictyon
		Cladophora
		Spirogyra
		Stigeoclonium
		Chlamydomonas
		Oedogonium
		Pandorina
		Eudorina
		Pediastrum
		Synura
		Scenederonus
		Chlorella

Perusal of above list shows that the diversity of green algae is higher than the brown algae.

Besides microphytes four types of macrophytes consisting 17 species were observed and identified in both the rivers.

a)	Marginal type:	1)	Polygonum glabrum
		2)	Potamogeton nodosus
		3)	Marsilea quadrifolia
		4)	Ipomea aqualica
		5)	Cyperus tegelum
b)	Floating type	1)	Eichhornia crassipes
		2)	Trapa bispinosa
		3)	Pistia stratioiles
		4)	Spirodella polyrhiza
c)	Submerged type	1)	Hydrilla verticillata
		2)	Najas minor
		3)	Ceratophyllum demersum
		4)	Vallisnaria spiralis
		5)	Chara
d)	Rooted emergent type	1)	Nelumbium spiciosum
		2)	Nymphoides indicum
		3)	Aponogeton monostachyon

Appendix A5.21

LIST OF FISHES AVAILABLE IN GANGA AND YAMUNA, ALLAHABAD

Biological Name	Local Name
Aspidoparia morar (Ham)	Karaunchi/Kenoachi
Labeo rohita (Ham.)	Rohu
Cirrhinus mrigala (Ham.)	Nain
Channa gachua (Ham.)	Chaina/Chanaga
Rita rita (Ham.)	Gegra
Chela atpar (Ham.)	Chelwa
	Jhingwa
Bagarius bagarius (Ham.)	Gohuan/Gonch
Colisa chuna (Ham.)	Koinsa/Kholisa
Labeo calbasu (Ham.)	Kalbasn
Catla catla (Ham.)	Bhakur/catla
Pangasius apiensis	Pariyas/Payas
Puntiuscosuatis (Ham.)	Sindauri
Mistus singhala (Ham.)	Tengan

Appendix A5.22

Literacy

There are 43 Nursery, 357 Junior Basic and 148Sr. Basic School, 94 Higher Secondry,16 Degree Colleges in the town. The education level is generally limited to middle school as 47% of male population have up to class VIII level schooling while 13% have gone up to college level. Nearly 34% have degree level education while 5% have post graduation. While among women higher education is quite low as compared to male. Only 1.6% of girls go for post graduation, 12.7%go up to degree level. Majority of girls child get education up to class 12^{th} only. The 75% of total population of Allahabad town is literate. literacy percentage is moderately high (72.3%). The male literacy is 77.4% while the female literacy is 66.0%. Obviously the female literacy is quite low as compared to male. The population break up as per the Census data of 2001 concerning literacy among total population of the town is given in Table 4.28.

LITERACY LEVEL OF THE ALLAHABAD TOWN

Description	Persons	Percentage
Total literates	736599	72.35
Male literates	435968	59.19
Female literates	300631	40.81
Total illiterate	281493	27.65
Male illiterates	126896	45.08
Female illiterates	154597	54.92

Social Status

The total worker strength of the town population is 260034 (25.54% of total population). The break up of population as per their social status is given in Table 4.29. The review of the table indicate that out of total workers the male worker are more (86.88% of total worker). It is thus evident that majority of women in the town remain engaged only in household work. The main workers strength is quite high (84.67% of total workers) and remaining are marginal workers. The strength of male main worker surpasses the female (88.64% of total main worker). The study of data concerning break up of main worker indicate that cultivators, as one could expect for urban population, are few in number (2613) and male domination as cultivator is evident from the census data (Table 4.29). The agricultural labour as well are (1318 only) are limited. The percentage of population employed in household industries is 6.4% of total main workers, majority of which is male population. The persons falling in the category of other workers is quite high (91.82% of total main workers).

SOCIO-ECONOMIC CONDITIONS IN THE ALLAHABAD TOWN

Description	No. of Persons	Percentage
A. BREAK UP OF WORKERS		
Total workers	260034	25.54
Total male workers	225915	86.88
Total female workers	34119	13.12
Total main workers	220177	84.67

Description	No. of Persons	Percentage
Male main workers	195182	88.65
Female main workers	24995	11.35
Total marginal workers	39857	15.33
Male marginal workers	30733	77.11
Female marginal workers	9124	22.89
Total non workers	758058	74.46
Male non workers	336949	44.45
Female non workers	421109	55.55
B. BREAK UP OF MAIN WORKERS		
Main cultivators	2613	1.18
Main male cultivators	1904	72.87
Main female cultivators	709	27.13
Main agricultural labours	1318	0.60
Main male agricultural labours	1068	81.03
Main female agricultural labours	250	18.97
Main house hold industries	14084	6.40
Main male house hold industries	10923	77.56
Main female house hold industries	3161	22.44
Main other workers	202162	91.82
Main male other workers	181287	89.67
Main female other workers	20875	10.33
C. BREAK UP OF MARGINAL WORKERS		
Marginal cultivators	456	1.14
Marginal male cultivators	318	69.73
Marginal female cultivators	138	30.26
Marginal agricultural labours	1373	3.45
Marginal male agricultural labours	932	67.88
Marginal female agricultural labours	441	32.12
Marginal house hold industries	5126	12.86
Marginal male house hold industries	3002	58.56
Marginal female house hold industries	2124	41.44
Marginal other workers	32902	82.55
Marginal male other workers	26481	80.48
Marginal female other workers	6421	19.52

The marginal workers constitute 15.33% of total workers. The marginal cultivators are few in number (456). The marginal agriculture labour are 1373 and persons employed as marginal household industrial worker are 5126. The persons employed as marginal other workers constitute the majority (82.55%) of total marginal workers. The break up of marginal workers in the town is given in Table 4.29.

The non workers constitute 74.46% of total population and majority is women population (55.55%). It is evident that social status of the total population is quite low as majority of population is unemployed. Of course, the demographic status indicate that 10.5% of population is below the age of 6 years and equal strength may be senior citizens. But still socio-economic conditions in general is likely to be poor in the town. The household industries are quite limited and industrial growth is quite low. Naturally majority of population does not get sufficient opportunity to improve their social status. The local fairs (Kumbh, Ardh Kumbh, Magh Mela) may be the temporary source of earning for the local inhabitant. The general conclusion regarding

Appendix A5.23

LAND OWNER LIST FOR NUMAYA DAHI STP SITE
VILLAGE I - NUMAYA

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
35	1.695	582	
36	0.451	429	Subrati and Keridi
37	0.455	74	Mulchand, Gulab Chand etc.
38	0.629	74	Mulchand etc.
39			
40			
41	0.782	55	Banaras
43	0.049	167	Check Road
44	0.832	29	Jang Bahadur Chowrasiya
45	2.309	22	Chandu
46	1.902	105	Ram Kali etc.
47	3.151	8	Kesho Parshad, Ram Babu and Shushil Kumar
48	3.342	3/0.539	Amsery / Ram Naya
48	3.342	39/1.122	Mrs. Dev Kali
48	3.342	44/1.110	Pawan Kumar
48	3.342	98/0.571	Ramdhavi Pal
49	1.290	111	Ram Chand, Anil Kumar etc.
50	0.800	150	Sita Ram
51	0.194	2/0031	
		5/0.018	Amar Nath
		35/0064	
		45/0016	Parasnath Dubri etc.
		69	Mahadev etc.
52	0.205	162	Road
53	1.137	2/0023	Alari
		5/0.097	Asharam
		35/0.0045	Dayrath etc.
		45/0019	Paras etc.
		69/0064	Mahadev etc.
54	0.308	28	Jagdev
55	1.832	35	Dayrath etc.
56	0.890	161	Check Road
57	0.194	121	Nala
58	0.0097	161	Check Road
59	3.168	119	Rajchand / Florichand
95			
96			
97			
98			
110			
111			
112			
113			
114	0.603	45	Paras etc.
115	0.323	93	Radhey Charan
116	1.233	89	Raja Ram
117	1.208	139/2.208	Sukhu etc.
118	0.568	61	Brij Mathur Kumar, Ballu Kumar etc.
119	0.025	139	Gheemal Hiralal etc.
120	0.779	126	Santosh Kumar, Shincal etc.

LAND OWNER LIST FOR NUMAYA DAHI STP SITE
VILLAGE 2 - KARHENDI

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
509	0.068	1/0.034	Govt. Local
		472/0.34	Ram Sakil
510	0.084	1/0.017	Rajya Sarkar
511	0.457	1/0.228	Rajya Sarkar
		472/0.228	Ram Sakil
512	0.628	346	Mehmuri / Munni
514	0.684	1/0.171	Rajya Sarkar
		1/0.342	Rajya Sarkar
		10/161	Arjun
515	1.342	1/0.114	Rajya Sarkar
		633/0.114	Sivcharan
516	0.799	1/0.139	Rajya Sarkar
		117/0.560	Bailha Lal etc.
517	1.388	471	Rafeed etc.
518	0.411	444	Ram Mani
519	0.411	1/0.137	Sarkar
		633/0.137	Sivcharan
520	0.685	444	Ramdhani
521	0.525	1/0.175	Sarkar
522	0.616	335	Phulchand etc.
523	5.313	154	Dakhini Prasad
524	0.536	335	Phulchand etc.
525/1	0.114	764	Heera Lal
525/2	0.057	717	Matru
526	0.672	636	Shiv Prasad etc.
527	1.039	1/0.194	Sarkar
		26/1585	Mauti / Garor etc.
		615/0.260	Sushil
528	0.591	294/0.571	Brij Mohan Lal
		538/0.183	Lal Prasad etc.
529	0.457	636	Sire Prasad etc .
530	0.628	77	Tulnagil Lal etc.
531	0.560	1/0.105	Sarkar
		26/315	Mohd. Ali etc.
		615/140	Sushil
532	0.685	1/0.228	Sarkar
		17/0.457	Saikran / Koshiran etc.
533	0.320	1/107	Sarkar
		17/0.213	Onkar Lal etc.
534	1.152	530	Lalji Bihari
535	0.548	422	Ram Avtar etc.
536	0.640	127/0.320	Jai Ram
		499/0.329	Ram Das
537	0.628	1/0.216	Sarkar
		143/0.097	Jhhagru
		499/0.314	Ram Das
538	0.434	1	Sarkar
539	0.455	133/0.445	Jang Bahadur
540	0.148	256	Beli Prasad etc.
541	0.274	256	Beli Prasad etc.
542	0.297	256	Beli Prasad etc.
543	0.228	256	Beli Prasad etc.
544	0.548	6	Alaru
545	0.419	37	Pulneli Lal
546	0.696	456	Phulchand
547	0.696	486	Ram Manohar
548	0.228	256	Beli Prasad
549	0.694	1/0.85	Sarkar
		117/0.253	Chomu etc.
		288/0.243	Baidi Lal etc.
550	0.297	93	Gulshan etc.
551	0.205	93	Gulshan etc.

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
552	0.228	93	Pulsan etc.
553	1.541	396	Rampal
554	0.112	773	Naveen Barso
555/1	1.635	10	Arjun
555/2	1.634	1	Sarkar
555/2	1.635	1	Sarkar
555/4	1.635	1/0.230	Sarkar
		416/1.405	Ram Bahadur etc.
556	0.608	808	Ram Sumer

LAND OWNER LIST FOR NUMAYA DAHI STP SITE
VILLAGE 3 - DAHI

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
1		0.970	Omkarnath etc.
2		0.171	
3		0.180	Rampatan
4		0.171	Omkarnath etc.
5		0.228	Ramsumer and Ramdas
6		0.217	Ramsumer and Ramdas
7		0.180	Amrit Kumar

LAND OWNER LIST FOR NUMAYA DAHI STP SITE
VILLAGE 4 - SAYYEDPUR

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
476	0.342		Intesar Haider
477	0.559		Amarnath Salik Ram
478	0.502		Bankelal
479	0.210		Jafarnisaar
480	0.21		Ashfak Hussain
481	0.31		
482	0.342+0.331		Shankar
483	0.514		Hiralal
484	0.342		Shankar
485	0.148		Ganga Das
486	0.205		Ganga Das
487	0.582		Chandrasen
488	0.205		
489	0.411		Chaubey
490	0.13		Alimuddin
491	0.514		Alimuddin
492	1.13		Ram Sevak
493	0.342		Chaubey
494	0.730		Chaubey
495	0.605		Jawahar Lal
496	0.365		Ali Raja
497	0.365		Nairool Hussain
498	0.354		Shambhu
499	0.525		Intesar
500	0.183		Ram Chandra
501	0.171		Mushtaq Hussain
502	0.171		Brijmohan
503	0.171		Akhtar Abbas
505	0.137		Husnain Haider
506	0.297		Ram Surat
507	0.365		Shambhu
508	0.320		Harnari Lal
509	0.137		Lala
510	0.126		Shambhu
	0.240		Amar Nath

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
511	0.382		Shambhu
512	0.240		Sabih Abbas
513	0.297		State Government
518	0.034		Abhinav
721	0.491		Bududdin
737	0.345		Chotte Lal
738	0.399		Intesar Haider
740	0.583		Nafis
741	1.02		Bududdin
742	0.753		Chaubbey
743	0.616		Chandrabhan
	0.593		Bansilal
744	0.342		Bansilal
745	0.719		Ram Sunder
746	0.913		Ameena
	0.171		Ameena
747	0.685		Ram Achal
748	0.639		Ameena
749	0.434		Alim Uddin
750	0.091		Alim Uddin
751	0.091		Alim Uddin
752	0.879		Choubey
753	0.582		State Government
754	0.263		Shankar
755	0.103		Rasta
756	0.114		Shankar
757	0.365		Sabih Abbas
758	0.240		Mithai Lal
759	0.251		Mithai Lal
760	0.210		Maimu
761	0.628		Mohd. Akram
762	0.354		Ram Bhawan
763	0.183		
	0.171		

Appendix A5.24

LAND OWNER LIST FOR PONGHAT STP SITE
VILLAGE - MARIYADIH

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
27	0.616	36/0.137	Nishor Ahmed etc.
		111/0.479	Raheem Ahmed etc.
28	0.105	111	Sahid Ahmed
29	0.140	26	Khal Luraheman
30	0.936	30/0.200	Jiyauddin etc.
		112/0.696	Amit
		183/0.048	
31	0.140	30	Jiyauddin etc.
32	0.422	68	Mustaffa
33	0.089	9	Ahmed Niffed
34	0.685	112/0.800	Soin Jiyauddin
		138/0.057	Soin Jiyauddin
		124/0.685	Manku
20	0.822	143	Rasul Ahmed etc.
20/2	0.114	46	Bhai Lal
21	0.685	36	Nisar Ahmed
22	0.193	123/0.180	Kallu
		136/0.136	Kallu
23	0.399	113	Saeed Ahmed
24	0.160	36	Nisar Ahmed
25	0.263	56	Arif Shakeel
26	0.0468	19/0.130	Ashfal Ahmed
70	0.960	125/0.228	Ram Sevak
		131/0.685	Sangam Lal etc.
		143/0.057	Sangam Lal etc.
71	0.783	36	Nishar Ahmed
72	0.619	109	Saeed Ahmed etc.
73	0.285	36	Nishar Ahmed etc.
78/2	0.919	111	Ahmed
74	0.228	81	Mohd.
75	0.342	111/0.365	Shakeel Ahmed
76	0.080	6	Abdul etc.
77	0.259	116	Habibur Rehman etc.
78	0.160	29	Ramphal, Sant Lal
79	0.136	49	Baplu etc.
80	0.274	52	Mainddin
95	0.1600	24/0.160	Kadir Ahmed
		138/0.140	Kadir Ahmed
96	0.616	12/0.114	Amrit Lal
		143/0.382	Amrit Lal
97	0.080	10	Abdul Aziz
98	0.118	10/0.080	Abdul Aziz
99	0.169	10	Abdul Aziz
100	0.619	130	Lakhan
101	0.342	132	Lakhan
102	0.924	36/0.619	Nisar Ahmed
		102/148	Sahid Ahmed
103	0.924	5/6.057	Mrs. Aayashar
		83/1.278	Modh. Mehfuj
		92/0.900	Abdul Matin etc.
		84/0.068	Mohd. Masood

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
		138/0.24	Mohd. Masood
104	0.225	81	Mohd. Masood Ahmed etc.
105	0.946	36	Nishar Ahmed
106	0.377	76	Khali Luriman etc.
107	0.183	76	Mohd. Maruddin
109	0.893	36/0.730	Nishar Ahmed
		111/0.148	Sakeel Ahmed
110	0.425	76	Mohd. Marud Ahmed
111	0.582	18	Munna etc.
112	0.148	102	Saffuddin etc.
113	0.160	33	Tuffail Ahmed
114	0.160	81	Mohd. Masud
115	0.043	59	Rasool Ahmed
116	0.091	11	Saeed Ahmed
117	0.285	111	Sakeed Ahmed
118	0.023	1	Abdul Aziz
119	0.251	76	Mohd. Masud Ahmed.
120	0.297	69	Man Uddin etc.
121	0.251	116	Habibur Rehman
122	0.114	63	Mohd. Saheen
123	0.148	59	Ajaj Ahmed
124	0.719	63	Mohd. Saheen
125	0.274	81	Mohd. Masud Ahmed etc.
126	0.377	91	Mohd. Masud Ahmed etc.
127	0.126	91	Mohd. Masud Ahmed etc.
128	0.114	81	Mohd. Masud Ahmed etc.
129	1.849	76	Mohd. Masud Ahmed etc.
130	0.161	76/130	Mohd. Masud Ahmed etc.
131	0.342	63	Mohd. Saheen
132	0.502	63	Mohd. Saheen
133	0.068	139	Mohd. Saheen
134	0.091	14	Munne etc.
1311/2	0.091	14	Munne etc.
220	125.000	14/0.011	Munne etc.
		115/0.114	Suleman etc.
221	0.126	16	Munne etc.
222	0.160	139	Munne etc.
223	0.160	53	Muhsana etc.
224	0.161	141/0.059	Muhsana etc.
225	0.080	100	Saffuddin etc.
226	0.228	100	Saffuddin etc.
227	0.365	100	Saffuddin etc.
228/1	0.068	104	Saffuddin etc.
228/2	0.023	76	Mohd. Masud Ahmed
229/1	0.011	33	Tuffail Ahmed
229/3	0.057	123	Kallu
230	0.057	124	Maiku
231	0.080	113/0.057	Saeed Ahmed
		134/0.023	Gyan Chand etc.
232	0.034	95/0.017	Rajya Sarkar
		96/0.017	Ram Asre etc.
233	0.080	113	Saeed Ahmed etc.
234/1	0.034	134	Gyan Chand etc.
234/2	0.399	95/0.200	Rajya Sarkar
235	0.034	134	Gyan Chand etc.

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
236	1.161	113/0.046	Saeed Ahmed
		133/0.136	Huj Lal
237	0.136	111/0.011	Saeed Ahmed
238	0.080	50	Mohd. Ateek Ahmed
239	0.059	92	Maiket etc.
240	0.057	8	Maiket etc.
260	0.056	113/0.061	Saeed Ahmed
261	0.059	25/0.161	Kabeer Uddin etc.
		111/0.046	Saeed Ahmed
		113/0.918	Saeed Ahmed
262	0.931	113	Saeed Ahmed
263	0.169	88	Mohd. Safat etc.
264	0.140	80	Mohd. Safat etc.
265	0.057	114	Saeed Ahmed
266	1.571	114/0.593	Saeed Ahmed
267	0.296	83	Mohd. Islamuddin
268	0.354	114	Saeed Ahmed etc.
269	0.298	44/0.057	Brahada
		114/0.240	Saeed Ahmed etc.
270	0.148	44/0.079	Brahada
		114/0.136	Saeed Ahmed
271	1.666	111/1.553	Saeed Ahmed
272	0.126	80	Bachai etc.
273	0.268	70	Abu Bakar etc.
		22/0.268	Rasul Ahmed etc.
274	0.057	27/0.268	Rasul Ahmed etc.
275	0.103	77	Masleuddin etc.
276	0.148	88	Mohd. Safat etc.
277	0.126	14	Munne etc.
278	0.080	69	Masleuddin etc.
279	0.263	46	Bhai Lal etc.
280	0.080	6	Abdul Badud etc.
281	0.399	103	Sakeel Ahmed
282	0.126	77	Masleuddin etc.
283	0.161	77	Masleuddin etc.
284	0.080	51	Manna Lal etc.
285	0.105	59	Manna Lal etc.
286	0.250	51	Manna Lal etc.
287	0.114	36	Mishor Ahmed
288	0.240	51	Manna Lal etc.
289	0.216	113	Sahid Ahmed
290/1	0.011	139	Sahid Ahmed
290/2	0.136	36	Nishar Ahmed
291	0.068	108/240	Saeed Ahmed
292	0.068	86	Mohd. Saffeek etc.
293	0.068	86	Mohd. Saffeek etc.
294	0.148	86	Mohd. Saffeek etc.
295	0.160	79	Ramjan Ahmed
296	0.320	79	Ramjan Ahmed
297	0.197	113	Saeed Ahmed
298/1	0.161	50	Mohd. Aateek Ahmed
298/2	0.296	137	Mohd. Aateek Ahmed
299	0.161	113	Saeed Ahmed etc.
300	0.023	113	Saeed Ahmed etc.
301	0.137	86	Saeed Ahmed etc.

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
302	0.137	86	Mohd. Saffeek Ahmed
303	0.342	80	Mohd. Saffeek Ahmed
304/1	0.207	86	Mohd. Hamid etc.
304/2	0.205	94	Rasul Ahmed etc.
304/3	0.203	7	Abdul Kadir etc.
305	0.297	114	Saeed Ahmed
306	0.320	114	Saeed Ahmed
307	0.251	114	Saeed Ahmed
308	0.274	114	Saeed Ahmed
309	0.216	86	Mohd. Saffeek Ahmed
310	0.251	16	Munne etc.
311	0.308	25/0.320	Kabeer Uddin etc.
312	0.068	51	Munna Lal etc.
313	0.228	76	Mohd. Masud Ahmed
314	0.343	76	Mohd. Masud Ahmed
315	0.057	62	Mohd. Masud Ahmed
316	0.651	133/0.89	Hublal
		76/0.389	Mohd. Masud Ahmed etc.
		82/0.251	Mohd. Masud Ahmed etc.
317	0.080	25	Baburuddin etc.
318	0.136	25	Baburuddin etc.
319	0.161	62	Mustak Ahmed
320	0.411	25	Kabiruddin
321	0.297	63	Mohd. Saleem etc.
322	0.080	66	Mohd. Yakub etc.
323/1	1.678	76	Mohd. Masud Ahmed etc.
323/2	0.046	2	Akul, Badur etc.
324	1.119	76	Mohd. Masud etc.
325	0.103	38	Bismilla, Mohd. Mustak
326	0.114	81	Mohd. Masud etc.
327	0.251	106	Mrs. Sadiya etc.
328	0.034	138	Mrs. Sadiya etc.
329	0.137	39	Bai Saklu etc.
330	0.228	49	Mrs. Mumta Devi
331	0.799	12/0.200	Abdul Matin etc.
332	0.285	5/0.969	Mrs. Aayasha Baba
333	0.251	5/0.057	Mrs. Aayasha Baba
		11/0.14	Abdul Rasul etc.
		139/0.023	Abdul Rasul etc.
331/1	0.623	65	Murlidhar etc.
334/2	0.899	74	Mohd. Masud etc.
335	0.263	5	Mrs. Aayashu Baba
336/1	0.111	64	Murlidhar
336/2	0.080	74	Mohd. Masud etc.
337	0.136	5	Mrs. Aayasha Baba
338/1	0.034	65	Murlidhar
338/2	0.411	11	Ashok Kumar
338	0.023	64	Murlidhar
339/108	0.034	8	Haffij Akul
340/165	0.046	3	Abdul Rahman etc.

Appendix A5.25

LAND OWNER LIST FOR KODARA STP SITE
VILLAGE - MANOHARPUR

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
1	1.039	356/0.457	Badri Prasad
		528/00.91	Rajinder Prasad
		918/0.491	Banjar
2	1.165	786/0.605	Salik Ram etc.
		918/0.571	Banjar
3	0.308	302	Parmu & Sukaru etc.
4	0.091	136	Gulab Singh etc.
5	0.137	118	Khublal etc.
6	0.057	118	Khublal etc.
7	0.285	529/0.794	Mrs. Rajwati
		884/00.91	Hublal etc.
122	0.161	459	Masuriya etc.
123	0.114	44	Sharda
124	0.148	118	Khub Lal etc.
125	0.160	597/0120	Radhe Shyam
		1/0.40	Road
126	0.106	102/0.160	Kundhai Lal
		884/0.160	Dhup Lal etc.
126	0.126	118	Khub Lal etc.
127			
128			
129			
130			
131			
132			
133			
134	2.043	528/0.038	Rajindra Prasad
		884/1.370	Khub Lal etc.
		1/1.179	Road
		1/0.456	Road
135	103.000	-	Sarkari
136			
210	0.398	232	Dassu / Darshal Lal
211	0.433	771	Sangam Lal etc.
212	0.011	918	Banjar
213	0.161	772	Sunder Lal etc.
214	0.182	192/0.091	Jagroop
		103/0.091	Sikender Lal
215	0.411	462/00.77	Mishri Lal
		1/0.169	Road
216	0.171	602	Radhey Shyam etc.
217	0.183	602	Radhey Shyam etc.
218	0.228	550/0.091	Raghunath
		602/0.137	Radhey Shyam
119	0.205	19/0.103	Ayodhya Prashad etc.
		711/0.103	Surender Lal
220	0.205	791	Surender Lal etc.
221	0.046	917	Purani Basti
222	0.388	52	Indernath etc.
223	0.228	118	Khub Lal etc.
224	0.091	118	Khub Lal etc.
225	0.308	121	Ganesh Prasad
226	0.091	188	Jethee Lal
227	0.046	188	Jethee Lal
236	0.924	611/0.759	Bade Lal etc.

Appendix A5.26

LAND OWNER LIST FOR RAJAPUR STP SITE
VILLAGE - MAHENDORI KACCHAR

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
10	0.290		Naimugha Navsaeed
32	0.400		Ram Lal S/o Dasai
33	0.570		Ram Chand S/o Sunder
34	0.220		Rambas S/o Lakshman
35	1.080		Sakkhu
36	0.890		Shivram
41	1.720		Hublal Jiyalal
42	0.430		Hariram
43	1.380		Hiralal
44	0.460		Amarnath
45	0.460		Anwar
46	1.150		Mathar Hussain
47	0.460		Aliuddin
48	0.460		Ashfugulla
49	0.460		Abdul
50	0.460		Om Prakash
51	0.460		Misun Lal
52	0.460		Kashi
72	1.150		Jafar Hussain
73	0.460		Yamuna
74	0.460		Yamuna Prasad
75	0.460		Jeewan Lal
76	0.460		Jungi
77	0.460		Smt. Umri
78	0.460		Sau Rakha
104	0.460		Smt. Munni
105	0.460		Bhai Lal

Appendix A5.27

LAND OWNER LIST FOR GHAGHAR NALA SPS SITE

VILLAGE - SADIYA PUR

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
269	0.157	374/0.099	Sib Baran Lal
		402/0.039	Sib Lal, Sanbhu etc.
		351/0.006	Rajya Sarkar
270	0.191	464	Hari Mohan etc.
271	0.057	19/0.009	Amrit Lal
		364/0.002	Sib Baran Lal
		402/0.012	Sib Baran Lal
		351/0.001	Rajya Sarkar
272			

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LAND OWNER LIST FOR SASUR KHADERI SPS SITE
VILLAGE - BAJUPUR

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
343	1.141	105/0.950	Susheela, Suneeta, Kaushalya, Munni, Hrish Chand, Kishori Lal, Dashrath, Naffu and Beni
		107/0.183	Susheela etc.
369	0.856	67/0.500	Mohd. Saeed and Mohd. Rahees and Dhani Ram, Chhote Miya
		117/0.214	Kikida
		117/0.242	Kikida

Appendix A5.29

LAND OWNER LIST FOR MUMFORDGANJ SPS SITE
VILLAGE - BELI UPPARHAR

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
140	0.359	110/0.034	Banjar
141	0.023	110/0.05	Barren Land
142	0.072		Population Improvement Trust
143	0.171	1.31/0.171	Population Improvement Trust
149	0.205	131/0.205	Population Improvement Trust
148	0.114	131/0.114	Population Improvement Trust

Appendix A5.30

LAND OWNER LIST FOR NUMAYA DAHI CHANNEL
VILLAGE - KARHONDA

Land Serial No. (Khet No.)	Area (Ha.) (Rakwa)	Account No. (Khatoni No.)	Name of Owners
580	0.879		Dua Askari
581	0.898		Ramphal
577	0.468		UP Govt.
575	1.027		Jung Bahadur
574	0.719		Sulabh
573	0.228		Ramraj
572	0.228		Sulabh
571	0.457		UP Govt.
570	0.263		UP Govt.
566	0.753		UP Govt.
568	0.679		Lallan & Ninda
567	0.616		UP Govt.