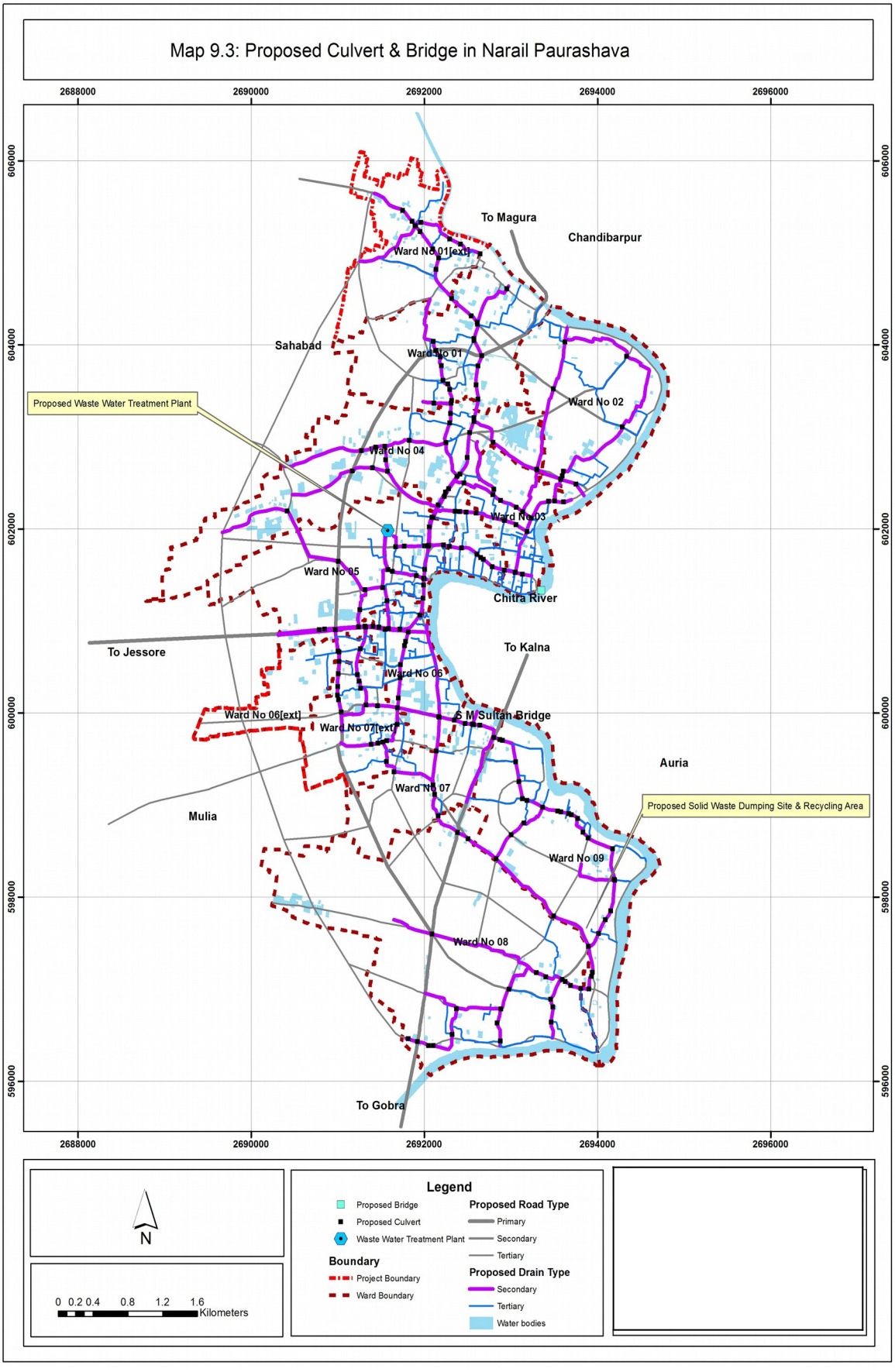

Map 9.3: Proposed Culvert & Bridge in Narail Paurashava
2688000
2690000
2692000
2694000
2696000
606000
604000
602000
600000
598000
596000
To Magura
Chandibarpur
Ward No 01[ext]
Sahabad
Ward No 01
Ward No 02
Proposed Waste Water Treatment Plant
Ward No 04
Ward No 03
Ward No 05
Chitra River
To Jessore
To Kalna
Ward No 06
Ward No 06[ext]
S M Sultan Bridge
Ward No 07[ext]
Auria
Ward No 07
Proposed Solid Waste Dumping Site & Recycling Area
Mulia
Ward No 09
Ward No 08
To Gobra
N
0 0.2 0.4 0.8 1.2 1.6
Kilometers
Legend
Proposed Bridge
Proposed Culvert
Waste Water Treatment Plant
Boundary
Project Boundary
Ward Boundary
Proposed Road Type
Primary
Secondary
Tertiary
Proposed Drain Type
Secondary
Tertiary
Water bodies

Channel Improvement

Canal and channel improvement means the improvement and re-excavation of existing open channels. The existing Chitra river need to re-excavate in its full water path. The Garu Chira khal, Paital Beel and Raghunathpur Khal also need deepening, re-sloping and removal of their blockages. The other canals are proposed which already filled up or illegally encroached. These canals need excavation and removal of all illegal structure along the path.

Land Acquisition

New land acquisition has to be kept to as absolute minimum due to the high cost and time required for acquisition. New land acquisition is negligible as most of the proposed drains passes through land owned by Paurashava or Khas land.

Storing and Detention Ponds

Existing borrow pits, ponds, low pockets within the urban areas and agricultural low lands within the fringe area, all ac as retention ponds and all these serve to delay the peak floods during heavy storms. The retention areas also recharge the aquifer water level. In the absence of internal storage areas within the Paurashava area, the existing ponds (>= 0.25 acre) , proposed retention area, low pockets etc. continue to serve as reservoir in the coming years and the Paurashava should endeavor to remain these low lands in the future.

Drainage System Capacity

The drainage systems (tertiary and secondary drain) has been designed to handle the average runoff for 1.1 year recurrence interval for tertiary drain and 2 years recurrence interval for secondary drain from peak storms without overflowing considering the estimated development level as up to the year 2030. This means that fully built-up areas will be designed for the present situation, while areas, which are not fully built-up, will have excess capacity to handle rainfall of greater intensity during the developing period.

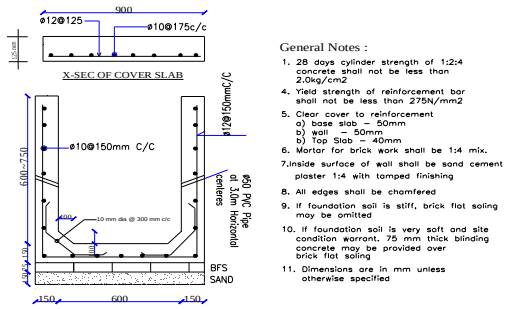


Figure 9.3: Cross Section of a typical drain

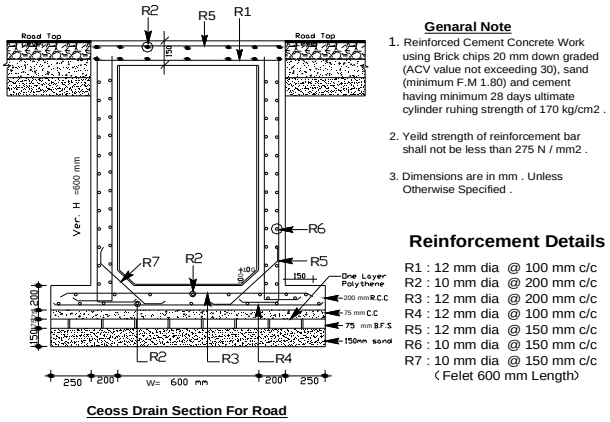


Figure 9.4: Cross section of Road cum drain

Trash Rack and Sumps
Trash racks and sumps are normally used to prevent debris (silt/ solid wastes) from entering into the drainage systems where major problems could occur as a result of debris accumulation. Trash racks and sumps are considered appropriate for the Paurashava situation. In the drainage management plan, locations for trash racks and sumps along the major road network will identify during preparation of final plan.

Preventive Maintenance Program
For the proper functioning of the drainage system, it is essential to have an appropriate maintenance program. The program must include inspection, enforcement, cleaning and repair. The frequency of inspection and cleaning will be dependent on the season of the year with more frequent inspection and cleaning at the start of the rainy season and on the importance of the drain. The maintenance programs are:

a) Inspection
Open pucca drains-monthly in general; weekly in market areas.
Covered pucca drains-monthly with drains opened in February.
Kutcha drains-monthly.
All drains-following first heavy rainfall in year.

b) Cleaning
Open pucca drains-as required.
Covered pucca drains-in February when opened
Kutcha drains and culverts- January to February prior to rains.
All drains-as revealed by inspection.
The inspections will also show where repairs are required and where encroachment into the drain and deliberate blocking of the drain is taking place. Appropriate action to enforce the regulations must be initiated immediately. The cleaning of permanently closed pucca drains and small culverts is difficult and time consuming. New drains should have removable covers to facilitate cleaning.

Responsibility of development and construction of khal/drains rests with Engineering Department. Whereas, the responsibility of cleaning and conservancy of drains falls under the conservancy section under health department. Operation and maintenance of drains of the Paurashava involve the set vices in the following areas.

- Conservancy (Cleaning of drains)
- Mosquito killing
- Solid waste management
- Structural maintenance of drains
-

It is essential that the Paurashava should develop a routine preventive maintenance program for the drainage system. The structural improvements to be taken up under the project will provide a sustainable benefit. A failure to develop the capacity and methods related to preventative maintenance program will entirely eliminate the benefits of the program in the long run.

Though the needs and methods must ultimately be identified by the personnel responsible for the maintenance, it is suggested that the following guidelines should be followed for initial development of the staffing and equipment for a preventive maintenance program:

- drain should be cleaned once per month, but not less frequently than once per three month;
- task objective for I cleaner/sweeper should be 50m of primary / secondary drains, per day;
- supervisors should be provided at the rate of 1 Jamader for-each 10 sweepers, and I sanitary inspector for each 4 Jamaders;
- adequate equipment should be provided for efficient operations of cleaning crews, including wheel barrows and miscellaneous hand tools for each drain cleaner, 3 ton dump truck for waste transport and disposal.

Based on this, standard drain cleaning crews consisting of 51 cleaners, 5 Jamaders and 2 sanitary inspectors will be adequate to carry out the routine preventive maintenance operation required to keep the system in good operating condition.

9.1.4.2 Implementation, monitoring, Evaluation and Coordination of the Plan

In some specific area of Narail Paurashava, there are some scattered low-lying areas which are subjected to water-logging during and after heavy rainfall in a year between July and August normally for 30-40 days. The depth of stagnant water varies between 0.25 m to 0.35m and usually lasts for 4.00 to 6.00 hours. The water —logging situation is likely to further aggravate in the years to come with increasing urbanization. The primary causes of this water-logging are as follows:

1. Lack of cleaning and maintenance of the khals/drains
2. Unplanned and under designed existing drainage system
3. Obstruction and encroachments in the khals/ drains
4. Lack of construction and integration of tertiary, secondary drains and primary khals
5. Due to non-existence of drains in different places.

In order to address the above mentioned problem the following proposals have been made in the drainage master plan:

- The proposed drainage system for Narail Paurashava has been planned with a view to discharge most, of the storm run-off in the Chitra river through proposed primary outfall by gravity flow and no pumping is necessary.
- Under the provision of proposed drainage master plan, major khals constitute the storm water run-off delivery system and have been defined as the primary khals. These khals through the road culverts discharge to Chitra River.
- Timely undertaking of the drainage master plan including study is considered a timely venture to know the drainage issues within Narail Paurashava and to formulate and investment project to reduce sufferings of the Paurashava residents.
- The proposed drainage management plan is justified technically, economically and socially. The priority program is recommended for implementation considering the present serious drainage problems faced by the Paurashava residents. The project after implementation will mitigate the major drainage problems in the core and semi-core area where the density of population varies from high to medium.
- The proposed drainage master plan is likely to be co-coordinated with other utility providing organizations to avoid over-lapping and duplication. As such, very close co-ordination with DPHE, BWDB and other utility organizations should be maintained during the project implementation so that, disruption does not take place in utility services.
- It is recommended that cadre cost of the first phase of the project priority program is funded as grant financing to Paurashava by ADB because the Paurashava is not in a position to implement this project from their own resources.
- The revenue collection of Narail Paurashava is moderate. The Narail Paurashava authority' is unable to make assessment of tax timely. Narail Paurashava shall have to improve significantly in revenue collection and the efficient financial management so that the Narail Paurashava can properly maintain the drainage system including the control of environmental sanitation.
- Financial sustainability is possible by increasing revenue collection efficiency with activities like more arrear collection & re-assessment of taxes in regular intervals. Re-assessment in every 5 years is recommended. Re-assessment process should commence sufficiently in advance so that appeal process could be completed prior to the effective date. Distress warrants against big-defaulters both in terms of amount due and years over due may be executed in order to achieve good Governance & financial sustainability.

9.2: Environmental Management

9.2.1 Existing Environmental Condition

9.2.1.1 Solid Waste and Garbage disposal

Narail Paurashava, with a population of more than 56,852 generates a huge quantity of solid waste everyday from various sources. According to the Paurashava authority, at present more than 10 tons of solid wastes are generated per day within the Paurashava area. There is one garbage truck and one damaged van for collection of garbage. There are no authorized dumping sites at all for solid waste disposal. Generally wastes are dumped in crude dumping in two sites. Paurashava collects solid waste regularly from the collection points with inadequate transport facility. However, the hospital waste, industrial wastes are not separated before dumping.

Most of dwellers of the Paurashava used to dispose solid waste in the vicinity of the household, nearby ponds, ditches, canals, drains and vacant lands. Solid waste from Katcha Bazaar of Rupganj Bazar generally thrown out to the Chitra river and polluting the river water. The areas around the kitchen market, Cow Hat are also found very nuisance having rotten waste and are spreading bad smell. Kitchen market wastes are disposed directly in the Chitra River. However, In the CBD area like ward no.4, 5 and 6 where there is concentration residential settlements, community based waste disposal system is observed. The solid waste management facilities are available in the Narail Paurashava are given below:

Table-9.7: Solid Waste Management in Narail

	Solid Waste Management in Narail	Number (Condition)
Solid Waste Management	Dumping Ground	2 (Crude)
	Truck	01(Useable)
	Van/Cart	01(Damaged)
	Dust bin	25
	Sweepers/ Manpower	35
	Frequency of collection	Daily

9.2.1.2 Latrine

Majority of the household of the Narail Paurashava use sanitary latrines consisting of ring and slab. The record to the Paurashava authority regarding the sanitation condition within the Paurashava area shows the following table.The town is lacking of sewerage system and people use to dispose household sewer to the surface drains and or surface water bodies.

Table-9.8: Status of Toilet Facilities of the Paurashava

	Type	Number
Sanitation Facilities	Sanitary Latrine	5676
	In-sanitary Latrine	2433
	Public Toilet	02

Source: Narail Paurashava 2009

9.2.1.3 Industry

There are six brick fields, poultry and dairy firms, one ice cream factory and some other factories were found in that area which are very small in number . Although the existing industries are new and the effluent reduced from these are mainly less harmful in nature, but in the future the ecology and hydrology of the area will be degraded and water of the river Chitra will be polluted adversely. So the project area needs special attention to save the environment.

9.2.1.4 Brick Field

There are five brick fields inside the Paurashava boundary are the important causes of air pollution. Although these brick fields are just outside of the core area, the future impact of the brick fields will be dangerous on the expanding core area. Besides, Emissions from vehicle exhausts of old and poorly maintained buses and trucks, loading, unloading, and carrying of sand and soil without any dust preventive measures are also found within the Paurashava.

9.2.1.5 Pollution

Water pollution

The town is lacking of sewerage system and people use to dispose household sewer to the surface drains/ surface water bodies. Most of the outlets of the drains are fallen to the river Chitra without any treatment measure. Inadequate maintenance of human, domestic and market wastes, open and poor drainage system, water logging etc. create environmental degradation within the Paurashava area. Besides, Jute rotten process is very common around this area during the season. This jute rotten process is take place almost everywhere of this Paurashava except Mohiskhola and Kurigram. Jute processing take place extremely at wards no. 7, 8 & 1. During this season from August to September and mid of October the degradation of environment is considerable. The menaces of mosquito increase, water get rotten and infected with germs, air polluted with bad and rotten smell during this period.

Sound pollution

Noise pollution is not a serious environmental consideration having adverse impacts within the Paurashava area. The presence of saw mills and rice mills in the core area also has definite

adverse impact on the living condition in Narail Paurashava. However, the change of location of the bus terminal into the entrance of the city reduces the noise pollution of the buses although a little sign of noise pollution is observed at old bus terminal area and Paurashava area from where the buses headed towards Dhaka.

9.2.1.6 Natural Calamities and Localized Hazards

Flooding

The area of Narail Paurashava is not subject to annual flooding. This Paurashava didn't get affected during the major floods of 1988 and 1998 or 2004. 'High water level' with respect to the mean sea level(Annex 8) in latest (as well maximum level in the record, please see figure 6.2) available data (2004) shows that the level ranges from 2.65 meter (in February) to maximum 4.86 meter (in September). However, the survey point (benchmark data) near Narail Paurashava just beside the river - approximate 6 meter (above the maximum high water level) provides the justification of flood free Narail. On the contrary, tides in the Chitra river ranges from 0.5 meter to 1.0 meter during the dry season and 1 meter to 1.5 meter during the wet season.

River Erosion

Narail Paurashava is located on the bank of the Chitra River and the Paurashava was once vulnerable for river erosion. However, the Paurashava is not major river erosion prone due to new siltation on the river at the moment.

Salinity

Surface water salinity especially the water quality of Chitra River has been an issue. The Chitra River receives flows from the irrigation waste flows from the Ganges-Kobadak surface irrigation system. Due to the reduced flow of the river during the dry season, salinity intrudes into the river systems, although its levels are generally within the acceptable limits for paddy cultivation.

9.3: Environmental Management Plan

9.3.1 Proposals for Environmental Issues

9.3.1.1 Solid waste management Plan

The present level of service in respect of solid waste management is not satisfactory in Narail Paurashava. It is not only creating problem for Paurashava cleaning but also contributing much to the drainage problem by blocking / obstructing the normal flow of drainage water. There is no specific dumping site in Narail Paurashava. The proposed facilities for Narail paurashava are as follows:

Solid Waste Disposal site and waste separation site:

Area: 12.03 acre
Location: Ward 09
Mouza: Uzir pur No. 100 (03)
Plot Id: 2331-2334, 2485-2504, 2510-2524, 2529, 2532,

Table: 9.9: Community bins/ secondary collection points:

Community Bin No.	Ward no.	Mouza	JI No. (Sheet No.)	Remarks
01.	Ward 01	Durgapur Dumur Tala	075(03)	Adjoining Neighborhood Centre Complex
02.	Ward 02	Borasula	049(00)	Adjoining Neighborhood Centre Complex
03.	Ward 03	Moheskhola	074(00)	Adjoining Neighborhood Centre Complex
04.	Ward 04	Durgapur Dumur Tala	75(02)	Adjoining Neighborhood Centre Complex
05.	Ward 05	Vaukhali	068(02)	Adjoining Neighborhood Centre Complex
06.	Ward 06	Kurigram	069(00)	Adjoining Neighborhood Centre Complex
07.	Ward 07	Machim Dia	058(00)	Adjoining Neighborhood Centre Complex
08.	Ward 08	Uzirpur	100(02)	Adjoining Neighborhood Centre Complex
09	Ward 09	Bramman Danga	56(00)	Adjoining Neighborhood Centre Complex

The total management system, however, shall be improved through

1. Incorporation of new/ additional garbage truck (open/ covered body), pushcarts, commercial bins, and tractor-trailer.

2. Provision of tipping type trucks and 1, 5, 2 and 3 ton (open or covered body) trucks for collection of wastes from congested residential/ commercial areas and narrow lanes.

3. Recovery of gas from the decomposed wastes for domestic cooking and heating purpose.

4. Composing of wastes in the composting plants (Renewable energy plants) for using and manure for agriculture and gardening purposes. In this purpose about 9 Renewable Energy Centre is proposed in Narail Paurashava.

5. The produced electricity from the Renewable Energy Plants will provide electricity to the neighborhood center complex and if possible the residential houses.

6. Primary collection of wastes from house to house through polythene garbage bags and transferring to the bins/ secondary collection points.

7. Launching of community participation program by motivating the community through campaigns for keeping the Paurashava town neat and clean, educating the school children from primary level about town cleaning, disposal system of wastes and knowledge on health and hygiene, diseases and impacts on environments.

8. Initiating pilot privatization program comprising the following works:
   - primary collection of waste from door to door and transferring the wastes to the community bins/ secondary collection points
   - secondary collection of wastes and transferring the wastes to the final disposal sites
   - leasing out and collection equipment and garbage trucks to the contractors/ private parties/ NGO's
   - awarding of solid waste management to the NGO's/ private parties or contractors for fixed term on tender and contract basis.

9. The existing and conventional method of disposal system of solid wastes, open dumping system should be modified into a controlled solid waste disposal system and for this purpose the following criteria should be followed:
   - The dumping site is proposed 12.03 acre in the south-eastern portion of Narail Paurashava.
   - The site is as proposed to minimize haulage distance and also far from the residential area.
   - The site will not create any nuisance to the residential and urban areas and placed at a distance 1000 to 1500 meters away and proposed as controlled disposal site.
   - Site has the connection with main road/ highway.
   - Site has the accessibility to roads of sufficient width for truck movement.
   - Site has not placed on an area seasonally flooded by rainwater/ river water/ surface water.
   - Site has not placed on low lying area, swampy lands/ ponds/ditches, otherwise leachate will contaminate ground/ surface area.
   - Site should have proper drainage system for drains storm water runoff into the large open area with flowing water.
   - Infiltration of rain water into the dump should be prevented by covering the wastes with a layer of soil and slopping surface of the dump.
   - Contamination of ground water with effluent/ leachate should be prevented by covering the wastes with a compacted layer of clay.
   - A regular soil of 15cm to 20cm thick on top of waste should be provided to control and reduce the following effects:
     - Smell of decomposing waste, breeding of flies, rats and insets etc.
     - Scaverger birds, animals
     - Rag-pickers
     - Smoke from fires
     - Pollution of ground/ surface water by leachate/ effluent seeping out of the wastes

   - After filling and closing up of solid waste disposal site, it can be reused for many purpose such as play ground, parks, recreational area, or other public facilities prone to agriculture.

9.3.1.2 Open space, wet-land and relevant features protection Plan

Parks and Recreational Places

Birsersto Nur Mohammad Stadium within Paurashava area and few play fields are the main recreational sites in the area. However, with implementation of this plan, new open space, playground, parks, lake, etc. will provide more leisure places for the people.

Enhancement Activities:

1. Ensure new open space, playground, parks, increasing facilities to visit the river bank etc. to increase recreational facilities in the Paurashava area.
2. Develop Chitra river side as water base recreation to expedite the traditional boat race with properly designed modern facilities to attract outside visitors also.

Responsible Organizations: Paurashava, Bangladesh Parjatan Corporation.

Loss of Wetlands

Wetlands are mainly affected first by the urbanization process. Earth filling fills up the ponds, low land , khals . Waste water affects the aquatic ecosystem and makes the ponds, khals unproductive and as a result the aquatic plants, fishes and animals have to die or migrate to other places. Suitable urban facility attract more residential development with the cost of filling of low cost wetland. There is no strict regulation on earth filling of ponds. However, Wetlands Conversation Act exists in Bangladesh, which is applicable only to natural beels and khals. Number of ponds in Narail Paurashava is reduced every year to accommodate housing and commercial structures. Wetlands play an important role as a reservoir of rain and flood water. They are also important to maintain the balance of ecosystems and for replenishing the ground water level through seepage.

Mitigation:

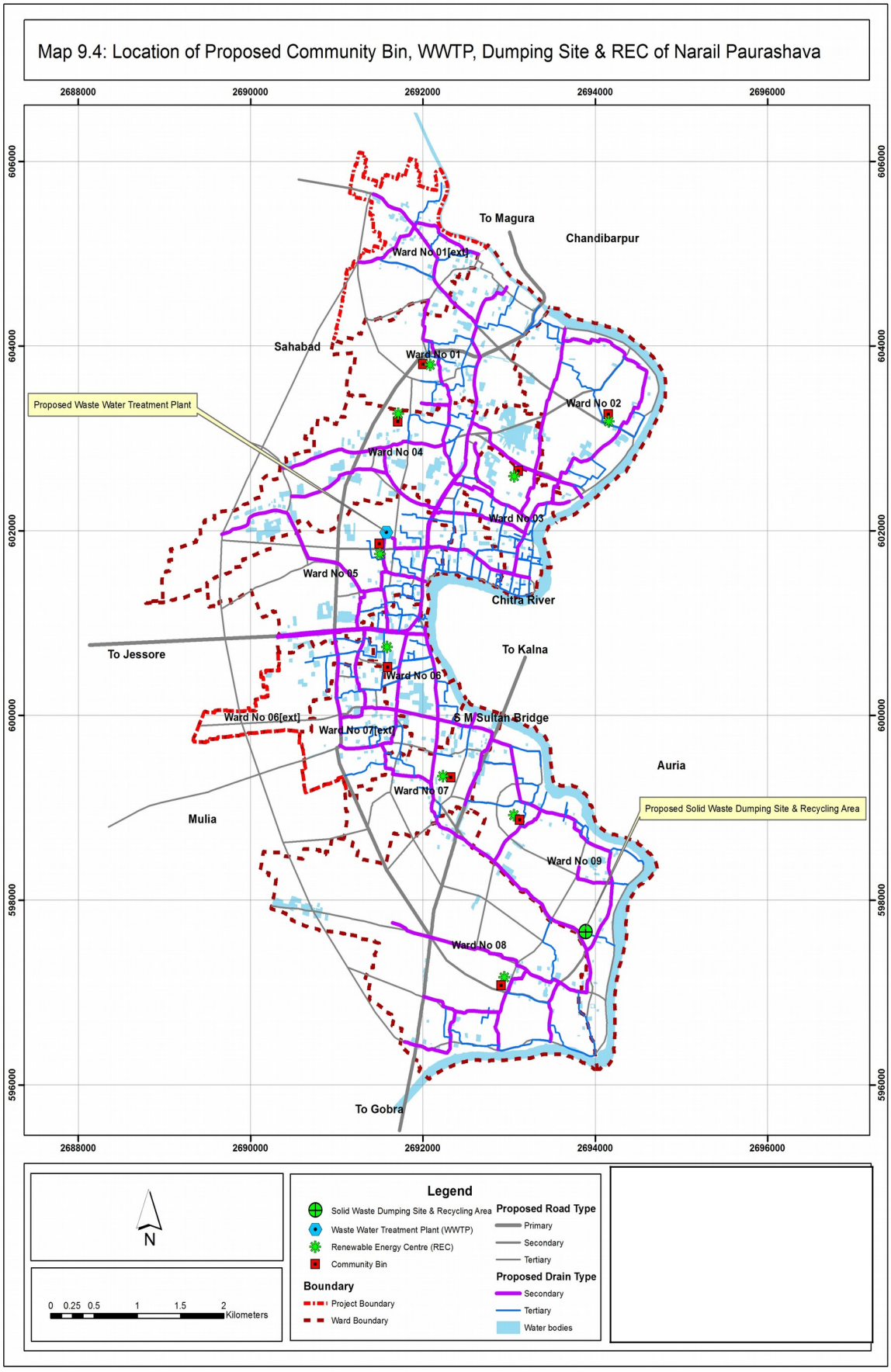
1. Cutting of drainage outlets to the khals and ponds.
2. Avoiding wetlands during road alignment fixation.
3. Stopping housing estate, industries and other development works in wetlands through earth filling.
4. Stopping earth filling of ponds in Paurashava area through creation of public awareness.
5. Strict implementation of Wetland Conservation Act, 2000.

Responsible Organizations: *Paurashava*, DOE and NGO's

9.3.1.3 Pollution Protection Proposals

9.3.1.3.1 Industrial /Brickfield

Industrialization is not prominent economic sector in Narail Paurashva. With implementation of this project and establishment of Industrial Zone nearby with road, drainage, water, gas, electricity and telephone facilities will attract the promoter and NBRs to invest here and help in industrialization in the project area.



Enhancement Activities:

1. Arrangement for gas pipe line in the industrial zone.
2. Arrangement for water, electricity, telephone, fire-service and drainage facility in industrial zone.
3. Arrangement for soft-loan for agro-industry, garments, electronics, IT etc.
4. Strengthening the activities of Narail Shilpa and Banik Samity (CSBS).
5. Invite the national and foreign investors to visit and invest in industrial zone.
6. Initiate the local entrepreneurs through incentives for industrialization.
7. The existing brick fields can continue next 10 year and after that they have to relocate outside the Paurashava boundary. The existing brick field must follow Brick manufacturing (Control) Act, 1989.
8. Any new brick field can not permit in the Paurashava area.

Responsible Organizations: Board of Investment, Banks, Narail Shilpa and Banik Samity

9.3.1.3.2 Air/Water/Land/Sound

a. Noise Pollution

Noise is unacceptable level of sound that creates annoyance, hampers mental and physical peace and may induce severe damage to the health. Along with the increasing degree of air and water pollution, noise pollution is also emerging as a new threat to the inhabitants of Paurashava. Motorized traffic is one of the major sources of noise pollution in urban areas. Although there are many sources of noise, which include industries, construction works and indiscriminate use of loud speakers, motorized traffic is the principal source of creating noise in urban areas. With the increase in the number of motorized vehicles in the city, the hazard of noise pollution has increased and exceeded the level of tolerance. The more noisy area are Narail Bus Terminals, Rupgaonj bazar, Old Bus terminal node, Ghora Khalir node.

Exposure to high level of noise may cause severe stress on the auditory and nervous system of the city dwellers, particularly the children. Regular exposure to loud noise damages the hearing capability and has adverse effects on health, like increasing mental stress and blood pressure and sleeplessness, resulting in poor work performance. With expansion of urban area, the noise pollution will be increased for increasing motor vehicles, market places, industries etc.

Mitigation:

1. Stop using hydraulic horn in buses, trucks and other motor vehicles.
2. Declare some areas like hospitals, schools, parks, etc. as silent zone.
3. Strict implementation of law.
4. To control abnormally high noise from saw mill the old machines should be repaired or replaced.
5. Foundation of machines should be specially prepared to reduce noise.
6. Special type of silencer may be attached with the machines to reduce noise.
7. Welding and blacksmith workshops can be fenced with classes to protect the passersby from possible pollution effects.
8. People constantly working in welding and blacksmith workshops should wear earplugs and glasses. Regular medical checkups can be carried out to identify possible health problems.

Responsible Organizations: Paurashava, BRTA, Narail Sadar Hospital, Motor Owners Association and Labor Unions, etc.

b. Air Pollution

Almost all the project area has the same level of air quality. The same-rural characteristic of the project area with an agricultural land about 59.59 % and the river Chitra has fallen the overall air quality in “Residential and rural” Category.

As from the standard of The Environment Conservation Rules, 1997 (ECR, 1997) the air quality of the category “Residential and rural” has the density of different air particles in the project area as follows:

1. Suspended Particulate Maters (SPM) = 200 microgram per cusec meter,
2. Sulphur-dioxide = 80 microgram per cusec meter,
3. Carbon Monoxide = 2000 microgram per cusec meter and
4. Oxides nitrogen = 80 microgram per cusec meter.

Mitigation:

1. Use catalytic converter in buses, trucks, taxis and tempos.
2. Use CNG instead of petrol.
3. Set up 120 ft. high stack in brickfields and use filter to reduce the CO, SO_2 and NO_2 gases in atmosphere.

4. Stop the operation of brick-fields which have grown near the homesteads, bazars and growth centres.
5. Impose ban on movement of stone and sand carrying trucks using the tertiary and access roads.

Responsible Organizations: Paurashava, DOE, BRTA, DC office, Motor Owner and Labour Unions, etc.

c. Surface Water Pollution

The surface water quality of Chitra River, Raghunathpur Khal, Garu Chira Khal, ponds and ditches are polluted in respect of pH, turbidity and coliform bacteria with national standard. The present pollution level of these sites is found to be low except coliform bacteria. The main causes of surface water pollution are wastewater, sanitary sewage, solid waste dumping. The present trend of development in the project area, the surface water pollution level may further increase for high volume of discharge of wastewater, sanitary sewerage, over spilling of pit and septic tank, industrial effluents, surface run-off of katcha bazars, indiscriminate solid and medical waste dumping.

Mitigation:

1. Stop katcha, hanging and pit latrines.
2. Create underground sewerage system for Paurashava area.
3. Use pucca latrine with septic tank and soak well.
4. Prohibit indiscriminate dumping of medical and solid waste in drainage, khals and river.
5. Improve sanitation condition of slaughter house, fish market and katcha bazars.
6. Prohibit the direct discharge of Paurashava waste water to any chhoras, low lying areas and river.
7. Establish waste water and sewerage treatment plant.

Responsible Organizations: Paurashava, LGED and DOE

d. Groundwater Depletion

Groundwater level of Paurashava has a considerable lowering over the last few decades. It has been calculated that in 2030 the lowering of ground water level might be 20m. Eventually fall of groundwater table is a common phenomenon in project area during dry period (Feb.-May). With expansion of urbanization and industrialization, the groundwater table may further fall if present tradition of using groundwater is continued.

Mitigation:

1. Use Chitra river water for pipeline supply to households and industries.
2. Use of surface water treatment plant to purify the river water and use as drinking water.
3. Introduce rainwater harvesting system and use in the project area.
4. Stop land filling of ponds and water bodies (area more than 0.25 acre) to maintain the groundwater level through recharge and leaching process.

Responsible Organizations: *Paurashava*, DPHE, and NGOs

e. Groundwater Pollution

Groundwater pollution due to manganese, iron and hardness is a major problem in the project area. With expansion of urban area, more dependency on groundwater sources may increase the pollution level of sub-surface water.

Mitigation:

1. Use surface water of Chitra river for supply water system.
2. Introduce rain water harvesting system.
3. Reduce dependency on groundwater.
4. Preserve surface water in ponds, khals, ditches and rivers for irrigation.

Responsible Organization: Paurashava, LGED, BWDB, DOE and NGOs

f. Drainage Congestion

Drainage congestion may increase further with the present trend of development. Faulty design, slope problem in head and tail area, solid-waste and rubbish dumping, encroachment and un-authorized structures, siltation, lack of renovation and re-excavation are the main causes of drainage congestion. As a result discharge of new drainage network will create severe drainage problem in paurashava area, particularly in monsoon period.

Mitigation:

1. Excavation of the primary drainage networks specially the existing and the proposed khals.

2. Re-excavate the water retention and detention area with link khals proposed in the master plan.
3. Remove all un-authorized structures, developed on drainage structures.
4. Make proper drainage network in new area considering the slope and local topographical condition.
5. Strictly prohibit the people in dumping of rubbish and solid waste in drain.
6. Regular cleaning and maintenance by the concerned authorities.

Responsible Organizations: Paurashava, LGED

9.3.2 Natural calamities and regular hazard mitigation proposals

9.3.2.1 Protection plans addressing Natural Calamities

a. Flood Protection

The Chitra River is subject to bank erosion, but it is not continuous. With implementation of Master Plan Project, the whole project area will be protected from flooding.

Enhancement Activities:

1. Footpath along the river side
2. River front development

Responsible Organizations: BWDB and Paurashava

b. Earthquake

Earthquake is among the most destructive and terrifying disaster that nature can unleash. Bangladesh Sits on several seismically active faults are the focal point of tremors. Narail Paurashava is located in the seismic zone 3 and so it is less vulnerable to earthquake. Earth quake of 4 to 5 magnitude has the probability of occurrence in the locality. Unplanned and unregulated urbanization and disregard to BNBC rules in building construction aggravate the situation more. With the implementation of master plan the planned urbanization will strictly follow the actual zoning plan and following of BNBC rule will minimize the earthquake damage.

Enhancement Activities:

- Ensure all new buildings are designed and constructed following the guideline of BNBC.
- Development of a comprehensive plan for managing post earthquake situation.
- Train community workers who would carry out the initial search and rescue efforts.
- Launch a massive public awareness campaign.

Responsible Organizations: Paurashava, Civil Surgeon, Civil Defence, Fire Service and DOE.

9.3.2.2 Protection plans addressing regular hazards

a. Traffic Congestion

Traffic congestion is space-based problem. It occurs at particular junction and or at a particular land use area. Urbanization and growth of population will increase movement of vehicles in and around the Paurashava. Number of rickshaws will also increase to meet the people's demand. Rickshaw and battery driven auto rickshaw will be the main cause of traffic congestion in Narail Paurashava in future.

Mitigation:

1. Phase wise implementation of proposed road network.
2. Strict implementation of traffic rules to improve traffic management.

Responsible Organization: Paurashava, LGED, RHD.

b. Fire Hazard

In future the probability of fire may increase for more offices, institutions, markets, growth centers and industries. Electric short-circuit is mainly responsible for fire hazards in urban area. However, human error may also cause for fire sometimes. Slums and some industries like garments and plastic products are more susceptible to fire hazards. The present fire station facility is not enough to cope with future fire hazards.

Mitigation:

1. Set up one new fire station at proposed location
2. Collect modern fire prevention devices.
3. Refrain people from using low quality electrical wire in buildings and industries.
4. Ensure periodical checking of electric lines.
5. Create awareness of people about fire hazards.
6. Ensure fire-fighting devices in new industries, high-rise buildings and markets.
7. Strict implementation of BC rule.

8. Large and medium scale water bodies should be conserved for quick and huge supply of water at the time of emergency.

Responsible Organizations: Paurashava, PDB, DOE and Fire Service and Civil Defence

9.3.2.3 Protection plan addressing encroachment and other relevant issues

a. Change in Topography

Topographically Narail Paurashava is flat and gentle sloping. The natural topography of Paurashava area has already been changed for urbanization. The present trend of development like roads, drainage, bridge/culvert, housing and industrial estates and bazars will radically change the natural topography and land use pattern of the area. The agricultural area will be converted into urban and semi-urban area. The present green scenic beauty will disappear, water bodies will be lost and general slope will be diminished for earth cutting due to rapid urbanization. The current effort of master plan will ensure sustainable development.

Mitigation:

1. Careful planning to minimize the change of topography.
2. Avoid water bodies during construction of roads, housing and industrial estates.
3. Practice good architectural/engineering design during planning of housing estates, buildings and the intersections of main roads.
4. Enhancement of plantation and gardening to increase the scenic beauty of the city.
5. Preserve the natural greenery, ponds, khals and large water bodies.

Responsible Organizations: Paurashava, DOE and Forest Department

d. Land Use Change

With the implementation of master plan, the Peripheral-urban and agricultural land use will be controlled and conserved using landuse control mechanism.

Mitigation:

1. Careful planning to reduce change of agricultural land use and rural set up.
2. Conserve water bodies and productive agricultural land free from haphazard urban development.
3. Economical use of land.

Responsible Organizations: Paurashava and Ministry of Agriculture& Livestock, DOE

c. Loss of Habitat

The habitat for fauna and wildlife has been losing day by day in the Paurashava area. For urbanization and industrialization, agricultural land will be disappear, water bodies will be filled up, rivers and khals will be polluted and trees will be cut down for new settlement. Birds, fishes and other animals will permanently lose their habitat and food in the urban area.

Mitigation:

1. Careful planning to avoid the sensitive ecosystem.
2. Minimum use of land for urbanization.
3. Preservation of water bodies and khals.
4. Initiate people to avoid tree cutting and vegetation clearing.

Responsible Organizations: Paurashava, DoE and NGOs.

d. Loss of Biodiversity

Continuous expansion of the urban area will enhance the urban development in this area. Urban elements like roads, infrastructure development, housing, commercial places, industrialization etc. will replace the existing green natural environment to manmade environment. Trees will be cut down, water bodies will be filled up and polluted; garden and bush will disappear for urban expansion in new area. Wild animals, birds and fishes will lose their habitats and as a result a big loss of biodiversity will happen for urban expansion in the Paurashava area.

Mitigation:

1. Avoid critical ecological area and refugee sites from development works.
2. Aware people for keeping some trees and bushes around the homesteads.
3. Increase tree plantation in roadsides along the river and khals and homesteads.
4. Preserve the lakes for aquatic birds and fishes and some bush areas as wildlife refugee sites.
5. Ban on hunting of birds and wildlife.

Responsible Organizations: Paurahsva, Forest Department, Fisheries Department and NGO's.

e. Loss of Capture Fisheries

The project area is mainly high and medium high land. Khals and low lands are very limited. Therefore, open water fisheries resources are low in the project area. Only 15-20% fish demand is met by the capture fisheries. Chitra River, ponds, khals support the capture fisheries in the project area. Lowering of water level in the river also there is no water in the khals in dry season is a major reason of the damage of aquatic environment.

With the continuing urbanization, the capture fisheries will be remarkably reduced for loss of habitat due to water pollution of sewerage and drainage discharge, industrial effluent, solid waste dumping, earth filling and less flushing. Area of khals, beels and other water bodies will be reduced for land development and urbanization.

Mitigation:

1. Stop direct drainage outfall to river, khals and beels.
2. Set up sewerage and wastewater treatment plant.
3. At the early monsoon, keep open the gates of sluices and regulators during spawning period of fish.
4. Excavation of khals and natural water bodies
5. Strict regulation on land filling of water body.

Responsible Organizations: Paurashava, and DOE

f. Loss of Ponds and Culture Fisheries

There are about 1551 ponds and ditches (308.31acre) in the master plan area. With urbanization and industrialization through this project, many ponds will be lost for land filling by the owners for increasing land value due to human pressure, settlement and development accordingly loss of fishes. There is no strict regulation on earth filling of ponds in the area.

Mitigation:

1. Designate all ponds in Master Plan Map and protect the large ones according to the ecological importance and public interest.
2. Protect the ponds having area more than 0.25 acre as per regulatory framework of Master Plan.
3. Create public awareness about the importance of ponds and its role in culture fisheries, bathing and water reservoir for surface run-off during monsoon.

Responsible Organizations: Paurashava, DOF and DC (Land)

g. Loss of Productive Agricultural Land

The Master plan Project has included a vast area of agricultural land in the project area. Both highlands and lowlands fall into this project. After implementation of MP project, agricultural environment will be converted into un-productive urban and semi-urban area.

Mitigation:

The DOE EIA Guidelines emphasized on the avoidance of productive agricultural land during any development project. Therefore, it will be wise to consider more economical use of land to avoid some fertile lands. The land acquisition should be based on the growth rate of population. The designated agricultural land in the master plan must conserve from any type development or land use change. Strict rules and regulation must be imposed to control the agricultural land.

Responsible Organizations: Paurashava and DOE

9.4: Plan Implementation Strategies

9.4.1 Regulations to implement the Drainage and Flood Plan

Legal Framework: Legal instrument to implement the Drainage and Disaster Management Plan is comprised with Land Acquisition Act, 1894 (to preserve the Right of Way of natural khals and channels), Water Reservoir Conservation Act, 2000 (for individual property rights), Paurashava Act, 2009.

Table-9.0*: Regulations to implement the Disaster Management Plan*

Specific Plan Components	Legal Instrument to implement the plan
Solid Waste Management	Paurashava Act, 2009, Medical Waste Management, 2008 and Public-Private Partnership to install the landfill system and solid-waste collection.
Wet Land and Open Space Preservation	Land Acquisition Act, 1894 and Paurashava Act, 2009 and Public-private partnership (Leasing the buffer land)
Industrial and Brick Field Pollution control	Green Category industries of DOE and Brick Burning (Control) Act, 2001
Water/Land Pollution	Environmental Conservation Rule, 2002 (Section 6, clause (a)).

Sound Pollution	Sound Pollution Control Rule, 2006	
Disaster Management	**Components**	**Implementation Agency**
	Housing, Road, Tube wells	Paurashava, BWDB, LGED, RHD and DPHE
	Drainage	Paurashava and project fund
	Embankment	BWDB
	Early warning System	Paurashava and NGO
	Afforestation	Department of Forest
	Community Participation	NGOs and CBOs

Prioritization: The proposed disaster management plan has been justified in light of National Disaster Management Plan, 2007-15. It is required to make a priority among different wards. It means as per risk area the measures will be taken or implemented. In taking structural and non-structural measures in each ward, higher ranked ward area will be obtained preference than other areas.

Co-ordination: Proposed plan is likely to be co-coordinated with other utility providing organizations to avoid over-lapping and duplication. As such, strong co-ordination with DPHE, BWDB and Paurashava should be maintained.

Financing: In light of National Disaster Management Plan, 2007-15, Disaster Management Committee at the Paurashava level will constitute its Disaster Management Fund to implement programmes and activities. This fund will make up of the following:

a) Contribution from the government,
b) Contribution from local government and
c) Local donation.

9.4.2 Implementation, monitoring, Evaluation and Coordination of the Plan

Different implementing agency like Paurashava, BWDB, LGED, RHD, DPHE, NGOs etc will be responsible for implementing and monitoring the drainage and environmental management plan while Paurashava Mayor, the caretaker of the Master plan will take vigilant action if the project is being implemented in line with the master plan.

Drainage and Environmental Management Plan will evaluate considering future attempting context to Narail region as well as to Narail Paurashava. Therefore, the plan has been evaluated in light of its key components and proposals.