

CHAPTER

3

DETAILED AREA DEVELOPMENT PLAN

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3.0 INTRODUCTION

Chapter-3 contains the detailed area plan proposals and other relevant overviews, observations and proposals. The plan has been devised under the framework of Master Plan, 2001 that serves as the higher-level plan.

3.1 REVIEW OF HIGHER LEVEL FRAMEWORK

Structure Plan and Master Plan (2nd tier) are the two hierarchical components of 2001 Master Plan. This Detailed Area Development Plan (DADP) has been prepared based on these two upper level plans.

3.1.1 Structure Plan Policies

The ToR asks to review the policies of the Structure Plan before drawing up planning proposals. Since the current DADP is a continuation of the 2001 Master Plan, the Structure Plan policies have their implications in the current planning exercise. Policies are usually formulated for a long period of time. As this DADP is prepared within the valid period of the Structure Plan, its policies are still valid for DADP. Whenever, the consultant makes minor deviation from the policies of the Structure Plan or formulates a new policy, proper arguments are shown in its favor.

3.1.1.1 Projected Population

Khulna Master Plan, 1961 assumed that the population of its jurisdiction would increase at a rate of 2.50% per annum, thus, the total population of **Khulna City** area would reach 2,35,000 while that of the Master Plan area (1961) would be 4,00,000 by the year 1981 (Khulna Master Plan, Vol.-II, p.43). In reality, however, the projected population of **Khulna City** for 1981 surpassed in 1974, when it reached 4,37,000. In 1981, the population of Khulna Master Plan area reached 6,65,000. The 2001 Master Plan report made a medium projection of 32,58,027 population for 2020, of which about 55% was projected to be migrated population (Khulna Master Plan 2001, Vol.-II, Structure Plan, p. 46). For this current project, the consultant has forecasted a total population of 16,62,294 for the year 2023.

3.1.1.2 Policies on Population Density

Khulna Master Plan 1961 anticipated a net population density of 130 ppa. The plan also suggested that 80% of the land for housing would be developed with an average density of 130 ppa, while the remaining 20% areas with only 30 ppa net. Master Plan 2001 projected 125 persons as the per-acre gross density by 2010 in the core area of the city and expected that by 2020 it would raise up to 185.03 ppa (Khulna Master Plan 2001, Vol.-II, Structure Plan p. 54).

There has been steady rise of the density of population in **Khulna City** since early 60s. Following the war of liberation, there was a sudden jump in the density due to rise in population. Density of **Khulna City** rose from only 7 ppa in 1961 to 38 ppa in 1974, an increase of about 54.2%. Then gradually the rate of density fell as the rate of migration went down following melt down of the local

economy. This situation continued till 1991, after that the density was found moving upward again in 2001 when it was the highest with 75 ppa or 1842 persons/sq.km.

The population of Noapara Paurashava having an area of 25.12 sq.km had a population of 85,000 as per 2001 population census report. Density of population in Noapara Paurashava as per the same report was 3384 persons/sq.km or 14 ppa. Khulna Master Plan 2001 observed the density of population doubling in KCC area in 25 years, from 38 ppa in 1974 to 76.36 ppa in 1998. The outer zone had a density of 6.44 ppa compared to core area with 76 ppa in 1998.

3.1.1.3 Economy and Employment Policy

The Structure Plan, on analyzing of the contemporary economic conditions of the city, predicted future directions of the economy and recommended policy proposals for its uplift. The plan recommended to make poverty reduction as the major objective of the development plan and emphasized to keep hardcore poverty at lower level. Revival of the jute sector was set as a major source of employment. The plan expected informal sector to play important role in employment generation, where a significant section of the urban labour force is employed.

3.1.1.4 Housing Sector Policy

The Structure Plan report identified, about 7% of the city's households not having proper housing. Regarding housing occupancy, the report found 27% of the households living in one room house, mostly in slums and squatters. In terms of floor space, 70% households used less than 800 sq. ft. The poor households living in slums and squatters used only 400 sq. ft. on average. The report estimated a housing need of 1,32,113 units in KCC area in the year 2020. After analysis, the report set 11 policy recommendations for improvement of housing. The key points of the housing policy recommendations along with the consultant's recommendation are as follows-

- the concerned development agencies should serve as facilitators in housing development;
- KDA to assist public sector agencies for development of their housing schemes;
- KDA to provide assistance to undertake housing schemes under the private sector;
- KDA to provide affordable housing to the low income groups;
- KDA and other agencies to create necessary infrastructure to facilitate land and housing development;
- planning intervention to be made by KDA in the spontaneously developed areas;
- upgrading of slums and squatters;
- monitoring of land and housing market;
- facilitate finance and investment in the housing sector;
- develop participatory programmes in the housing sector;
- innovation of appropriate technology in low income housing development;
- promotion of high rise buildings to attain maximum efficiency of municipal services provision;
- creating options of community facilities in different planned and unplanned residential areas.

For housing development, Structure Plan made responsible the agencies like, LGED, NHA, KDA, HBFC for executing the housing policies and expected that these and other public sector agencies would pursue the policies to bridge the gap between the housing need and production of housing units. Most of these policies are reflections of the national housing policy.

3.1.1.5 Traffic and Transport Sector Policy

The Structure Plan made an analysis of the current transport situation in the city where it observes good external connectivity. The city was found dominated by non-motorized traffic. Due to low level of economic activity the public transport system had not been well developed, the report observes. On review of the transportation situation the Structure Plan made 16 policy recommendations to improve traffic and transportation conditions in Khulna. After intensive review of the structure plan policies, the consultant proposes the following intervention areas including the ones identified by the Structure Plan:

- incremental development of proposed road network;
- introduction of efficient city bus service and open new routes;
- construction of new bus terminal/station;
- development of new truck terminal;
- introduce road network standard;
- develop hierarchical road network at neighborhood level;
- widening of existing narrow roads;
- introduction of commuter train service;
- waterway *ghat* development;
- development of transport stands;
- improvement of air transport;
- locating transport terminals close to major roads of the City;
- proper regulation of rickshaw and rickshaw van;
- coordination of transport system;
- develop footpath on all city roads.
- designing user friendly footpath for easy and convenient movement of pedestrians;
- designing safer and efficient intersections;
- developing cycling tracks and popularizing cycling in the city;
- promotion of street arboriculture.

3.1.1.6 Drainage Policy

Structure Plan identified that 68% of the households did not have any drainage facilities. There is no underground drainage system in the city. Drainage in the fringe and sub-urban areas was unsatisfactory. Low lying areas in the north and south are subject to water-logging due to heavy rains and tidal water during rainy season. The report found city *khals* mostly encroached, drains unable to carry water as filled with trash. Drains are narrow and uncoordinatedly developed. With a view to improve the drainage condition, the report proposed following six policy recommendations. The consultants added two more policies:

- preparation of storm water drainage improvement plan;
- phase-wise implementation of drainage improvement plan;

- environmental improvement through improved drainage system;
- non-structural measures to protect right of way and other aspects;
- regular operation and maintenance of the drainage system;
- NGOs, CBOs and civil society involvement in drainage system management;
- retention of natural drainage systems;
- protection of canals and rivers through providing walkways, boundary fencing and plantation along the banks

3.1.1.7 Water Supply Policy

Analyzing the existing water supply situation, the report focused on access to water supply by the city people and made a projection of water demand up to the year 2020. It also explored the potential ground water sources and their water quality. Finally, the report put forward some policies regarding improvement of water supply as stated below along with the new policies proposed by the consultants:

- rehabilitation of existing piped water supply system;
- exploration of new sources of ground water;
- exploration of new surface water sources;
- creation of new independent agency for water supply;
- investigation on ground water quality;
- protection and restoration of existing surface water sources;
- ensure surface water quality.

3.1.1.8 Sanitation Policy

Structure Plan reviewed the existing sanitary facilities available in the city. Ongoing sanitation projects were reviewed and future sanitation needs were assessed. It reveals that 31% of the households use unsanitary latrines comprising katcha and surface latrines. Next, the report made proposals for sanitation improvement with structural and non-structural measures. A set of policies are to be followed for future sanitation development as stated below:

- production and supply of adequate number of pit latrine components;
- promotion of public toilet facility throughout the city;
- creation of awareness about healthy sanitation at school level;
- development of network based integrated sanitary system with treatment facility;
- promotion and introduction of innovative, appropriate and sustainable sanitation technologies;
- promotion of community managed sanitation facilities for the lower-income group.

3.1.1.9 Solid Waste Management Policy

Regarding solid waste management, the Structure Plan reviewed the condition of solid waste management and made a future assessment about waste generation. It stated that by 2020 AD, 922 tons of solid waste will be generated in KCC area and an additional 301 tons of waste will be generated in the extended area each day. It also suggested some sites for solid waste disposal. Suggestion was also made about adoption of various methods of solid waste management. Lastly,

the report put forward a set of policies for solid waste management. Including the consultant's proposals, following are the policies related to solid waste management:

- improvement of collection efficiency;
- separate management of medical waste;
- recycling of solid waste;
- increase the role of NGOs and CBOs in solid waste management;
- introduction of controlled dumping method;
- monitoring of solid waste collection, disposal and recycling;
- devising appropriate solid waste management method for areas beyond KCC;
- formulation of solid waste management guidelines for different kinds of stakeholders (e.g. households, commercial usages etc.).

3.1.1.10 Health Sector Policy

The Structure Plan reviewed the existing health care facilities both at public and private sector. It also discussed the diseases pattern among the people. The recommended policy measures are stated below:

- improvement of general health infrastructure;
- creating poor's access to health services;
- primary health care at the neighborhood level;
- strengthening preventive health care services;
- health awareness building;
- location of public health care facilities as per need.

3.1.1.11 Education Sector Policy

The Structure Plan made a review of the status of literacy, education facilities available at primary, secondary and tertiary level in greater Khulna. At the end, it put forward some policy recommendations as stated below:

- establishment of quality primary and nursery schools at neighborhood level;
- sufficient space to be reserved in schools for play field;
- all categories of schools including vocational, to be provided in the Master Plan.

3.1.1.12 Open Space and Recreation Policy

The Structure Plan recommended a set of policy recommendations made for improvement of the green and open space as stated below:

- creation of waterfront green areas;
- creation of urban forest;
- creation of highway forest;
- establishment of botanical garden;
- development of public park;
- development of playground/stadium;
- provision of open space in public/private housing estates;
- creation of recreation facilities.

3.1.1.13 Industrial Sector Policy

Structure Plan, in its report, made proposals for delineation of sites for local industrial development. After review of industrial sector of the city, the report made a series of policy recommendations:

- creation of industrial incentive zone; relocation of hazardous enterprises;
- organize footloose industries; encouragement to small scale industries;
- reorganization and restructuring of large scale manufacturing;
- Control of industrial location and standard.

3.1.1.14 Conservation of Urban Heritage Policy

The Structure Plan prepared a list of the heritage sites and buildings of different historical periods and made suggestions for their conservation and management. It also proposed to erect a land mark monument. This suggestion was made to use the land mark as symbol of **Khulna City**. The report put forward some policy recommendations for conservation of local heritage. Structure Plan report recommended the following policies for conservation of local heritage:

- conservation of old and prestigious areas;
- listing all heritage sites and old historical buildings;
- restriction on incompatible and alteration of old historical buildings;
- eviction of unauthorized and incompatible uses of heritage/ historical buildings;
- old historic buildings and sites to be conserved for the tourists and visitors;
- development of Khulna Tower (or it can be named as Millennium Tower);
- all sites of Liberation War depicting the glorious history of our independence should be preserved and developed properly.

3.1.1.15 Environmental Management Policy

The Structure Plan report discussed the management issues of the city environment and reviewed the stakeholders of environmental management and the relevant legal framework. Next, recommended some policy measures as stated below:

- proper treatment of waterlogged areas and enforcement of relevant laws;
- protection and maintenance of surface water bodies;
- relocation of hazardous and red industries from high density residential areas;
- enforcement of environmental laws.

3.1.1.16 Plan Implementation and Governance Policy

Both, Khulna Master Plan 1961 and 2001 set forth measures required for plan implementation. Khulna Master Plan 1961 in its Chapter-12 under the title "Planning Administration and Implementation" made recommendations about administration and execution of the plan. The planning report suggested that all planning matters should be handled by a single authority. It would also be the executing authority for all planning functions. The plan called for retaining the matter of housing with KDA. The report termed planning as a continuous process. KDA fairly followed the recommendations of the plan.

Regarding plan implementation, the Structure Plan part of Khulna Master Plan 2001, observed inequality in the present institutional arrangements of city development agencies. It identified 33 government agencies responsible for execution of recommendations of the plan, where KDA and

KCC are the two most vital ones. Administrative weakness and coordination of activities were identified as major flaws of the present city administration.

The Structure Plan identified government intervention in the KCC and KDA administration as the major hindrances to effective delivery of services. KCC's service delivery was found less than required, where fund scarcity was identified as the most important bottleneck. The plan suggested capacity building of both KCC and KDA for carrying out development activities more effectively. The plan put forward following three options for administrative rearrangement:

- Functioning of existing multiple authorities with coordinating bodies;
- KCC as the only city body abolishing KDA;
- Creating a new city organization abolishing KCC and KDA.

Finally, the plan recommended establishing Khulna Metropolitan Development Authority as an Apex Coordination body to coordinate development activities. Lastly, the plan made the following policy recommendations make urban management and development institutions function more efficiently,

- Mobilization of resources;
- Capacity building of urban development agencies;
- Introducing MIS and GIS systems in KDA;
- Inter-agency conflict resolution;
- Partnership development for plan implementation;
- People's participation in urban development.

3.2 PRINCIPLES AND STANDARDS

Planning principles are guidelines based on which development proposals are drawn up. They are used as guidelines for systematic planning. Almost all planning standards are based on the size of future population it is going to serve.

The Terms of Reference (ToR) of the project asks to set planning principles and standards to address two distinct areas- existing urban area and new urban area. Development in these two areas will be small scale incremental and large scale planned respectively. So, the principles in two areas will be different, the ToR said. Whereas the new urban areas offer opportunities to develop areas in an ideal way, the existing urban areas in most cases will be gradual and improvement type, where restructuring is '*feasible and desirable*'. Regarding use of standard in existing urban area, the ToR says, "*Here design principles and standards cannot be implemented right away, but serve rather as a reference, or target, to be approximated to a degree that depends on available budget, willingness of local inhabitants to co-operate, ability of the formal developers to 'adopt' these principles and standards*". It calls for taking more care in drawing up principles in case of existing areas and take opportunities offered by new areas for organized development to accommodate higher density. In the backdrop of above deliberations of the ToR, the consultant sets the following planning principles for existing and new urban areas following the Master Plan, 2001.

3.2.1 Recommended Planning Principles

Development of planning principles is easier said than done. ToR demands to develop planning principles for both new and existing urban area. As, the definition of new and existing urban areas

prescribed in the ToR is completely impractical, the planning principles developed in the following section may not be totally applicable at this moment. Nonetheless, appreciating the concept, the consultant proposes the following planning principles for new and existing urban areas for future use.

3.2.1.1 Planning Principles for Existing Urban Areas

The following planning principles are proposed for existing urban areas:

- Cause minimum possible affect to existing structures while proposing new infrastructure or existing infrastructure improvement.
- Use minimum space for providing common facilities.
- Make multiple use of same space for common facilities wherever possible as a space saving approach.
- Cause minimum displacement of permanent residents.
- Keep provision for resettlement of land / house owners affected by implementation of development proposals.
- Keep development proposals at reasonably minimum to avoid affecting existing residents and avoid public opposition and budget failure.

3.2.1.2 Planning Principles for New Urban Areas

The following principles are proposed for new urban areas:

- Ensure maximum possible planned development of new/vacant areas.
- Propose urban centres at suitable locations, preferably, in hierarchical manner, in order to create activity areas.
- Use minimum space for providing common facilities.
- To save land, ensure multiple use of same space for community facilities.
- Provide local level roads minimum 300 ft. Apart.
- While lands are acquired compulsorily for development, compensates land owners with land elsewhere in the city.
- Use hierarchy in road network development.
- Provide adequate number of play field and park in areas where total planned development will not be possible.
- Preserve the existing *khals* and other *khas* water bodies as they are to ease drainage flow and water retention during rainy season.

3.2.2 Standards

2001 Master Plan developed standards for the Master Plan. These standards are well suited for the current DADP. In the following sections standards that have been adopted for plan making have been presented. In some cases, the Master Plan standards have gone through minor modifications to cope with changed circumstances.

3.2.2.1 Recommended Area Development Standard

The project ToR in Step-7-1 (p. 97) suggests density control and incremental development techniques as the standards for area development. It suggested adoption of the following techniques for existing urban area development:

- Urban Renewal
- Land Readjustment
- Guided Land Development
- Site and Services
- Community Based Participatory Area Development

The ToR recommended applying community based development techniques in existing urban areas where there is very little vacant space remains for development. In places, where some unoccupied space is available, Guided Land Development may be applied. Areas having larger tracts of open land Site and Services method, Land Readjustment Technique, Land acquisition or Land purchase for infrastructure development would be better solutions.

It is observed from ToR that a wide range of flexibility is there regarding use of standards for existing as well as new areas. For area development, the standards proposed by the ToR have been categorized by the consultant in respect of applicable area. The techniques that is more suitable for existing area will not be used for new areas. Following are the applicable area wise techniques to be adopted.

• **Area Development Techniques for Existing Urban Areas**

Following techniques are suggested for area development in existing urban area by the public sector urban development agencies:

- Guided Land Development
 - Community Based Participatory Area Development.
- **Area Development Techniques for New Urban Areas**

Following techniques are suggested for area development in new urban area by the public sector urban development agencies:

- Land Readjustment
- Guided Land Development
- Site and Services
- Community Based Participatory Area Development.

3.2.2.2 Recommended Infrastructure and Services Standards

Standards set down a system of allocation of space for infrastructure and service facilities. In most cases, population forms the basis of determining the same. Some standards are designed according to need. The ToR did not say anything about the planning standards that are to be followed for providing the infrastructure and services in the DADP area. Standards were provided in the 2001 Master Plan for Khulna. The Master Plan adopted these standards for providing the infrastructure and services. Regarding new urban area, the ToR said that since the entire area would be free and open, there would be "*more freedom to adopt formal design principles.*" It calls

for designing the new urban area with major infrastructure, like, road, drainage and public transportation. The ToR document also calls for updating the Structure Plan and Master Plan infrastructure proposals. It did not, however, directs to formulate new standards for providing infrastructure and services for new urban areas.

In most cases, the consultant follows the standards for infrastructure and services provided by Khulna Master Plan 2001. This is because significant change in the standard will cause significant change in the proposed land use. This will create conflict with the existing land use zoning (proposed by 2001 Master Plan). These standards will be used in flexible way. In case of complexities minor changes may be made whenever necessity demands. Following are the standards to be adopted for the current project:

a. **Community Services and Facilities**

i. **Recreational Open Space**

Minimum 0.45 acre of open space for every 1000 population. The standard has been lowered from what was followed in 2001 Master Plan, because that was more ambitious. None of the open space proposals recommended in the 2001 Master Plan based on above standard was implemented.

ii. **Primary School**

One school for every 3,400 populations with 1.40 acre to 2.95 acre for each.

iii. **Secondary School**

One secondary school for every 5,000 populations with minimum 1.27 to 1.92 acre to for each.

iv. **College**

One college for every 36,000 populations with approximately 5.36 acres for each.

v. **Private University**

12 (Twelve) to 20 (Twenty) acre for one university as per the criteria of University Grants Commission

b. **Road Standard**

Structure Plan in its Transport Policy-5 and Transport Policy-6 made some recommendations about road standard as shown below. Recommendations have been made for different categories of roads in the form of Right of Way (RoW).

i. **Neighborhood Level Road Standard and Hierarchy**

The consultant observed that it is difficult to implement 20 ft. RoW road standard (proposed by Khulna Master Plan 2001) in case of a re-development of a spontaneously developed neighborhood. It is also not possible practically to create road hierarchy in such areas, as they are already developed. However, considering the safety issues, the consultant's recommends to uphold the 2001 Master Plan Proposal (**minimum road width as 20 ft**) for any improvement/re-development plan/detailed area plan. This width will ensure two-way movements of the ambulances and fire brigade vehicles in case of emergencies. For **planned residential areas**

undertaken either by public or by private agencies the standard and hierarchy of roads should be as follows:

- | | | |
|-------------|---|--|
| Major Road | : | 50 ft. to 80 ft. wide |
| Feeder Road | : | 30 ft. to less than 50 ft. wide |
| Access Road | : | Less than 30 ft. (but not below 20 ft.) (Normal) |

But in special cases, such as **slum and squatter resettlement areas neighborhood roads may be allowed up to 12 ft.** This is to make such projects viable and supply land to beneficiaries at affordable cost. This width will ensure at least one ambulance and a rickshaw to move side by side at a time or one fire brigade vehicle in case of emergencies or outbreak of fire. The consultant proposes to widen all roads (with less than 12 feet width) within the existing built up areas sequentially to at least 12 feet width. However, for the current DADP, no roads have been proposed with less than 20 feet width.

ii. General Road Standard

- | | | |
|-----------------------------|---|---|
| Structure Plan (Major Road) | : | RoW 100 ft. – 120 ft. (30.49 m – 45.73 m) |
| Master Plan | : | RoW 40 ft. – 80 ft. (20.20 m – 24.40 m) |
| Detailed Area Plans | : | RoW Minimum – 20 ft. (6.09 m) (Community roads) |

c. Bazars

One bazar for every 50,000 people (0.3 acre for each bazar)

d. Graveyard, Cemetery or Crematorium

Master Plan did not provide any standard for Graveyard, cemetery or Crematorium. However, after reviewing different planning documents, the current DADP proposes to allocate 1.08 to 13.20 acres for each of land for 50,000 populations for relevant faith.

e. Mosques, Mandirs and Churches

0.50 acre for every 5,000 populations for relevant faith.

3.3 DEVELOPMENT STRATEGY

3.3.1 Review of Khulna Urban Development Strategy of 2001 Master Plan

Before drawing up strategic options for development of urban Khulna, the 2001 Master Plan, in its Khulna Urban Strategy (Vol. I), assumed some development parameters about population growth, poverty level, in-migration, international export market fluctuation for shrimp. Next it went for development of some strategic infrastructure as precondition for future development of the city. These included the Rupsha Bridge, development of Mongla Port, development of an EPZ at Mongla and an Airport for **Khulna City** and expedite completion of Dhaka-Mawa Road to reduce distance between Dhaka and Khulna. It was thought that all these elements would serve as propulsive forces for rapid development of the city.

Next, it looked for boosting investment in manufacturing and services to enhance the production and employment bases of the city and its adjoining areas. It was apprehended that if improvement of law and order situation and power supply could be ensured, there would be smooth flow of private investment into the city. It was also recommended to streamline institutional and administrative support including credit facilities and make them investment friendly. However, it

emphasized on law and order, power and gas supply as priority tasks. Regarding spatial development strategy of **Khulna City**, the report recommended to adopt a multi-centered and decentralized urban strategy through development of satellite towns around the city. To develop the east bank of the Bhairab and integrate with the main city, the report recommended develops a bridge over the river Bhairab. To harness the potentials of tourism the report recommended developing 50 km Rupsha-Bhairab riverfront from Batiaghata to Noapara and capitalizing these rivers for economic and recreational development.

3.3.2 Recommended Development Strategy

The consultant expresses its solidarity with the strategies recommended by the 2001 Master Plan. However, many of the recommendations of the strategies for future development of Khulna have already been accomplished, like; Bridge over Rupsha, Dhaka-Mawa-Khulna Road, and EPZ at Mongla Port. However, the local economy did not flourish to the level it was expected. This is because probably many vital conditions have remained unfulfilled, like, sustainable power supply and gas as a cheap energy. These are two vital elements, absence of which discourages growth of industries in Khulna area as learnt through consultation with local Chamber, press and others. The consultant recommends that **power and gas** facilities should be ensured to expedite industrialization and consequent economic growth.

Further, to attract industrial investment emphasis should be laid on the strategy to develop **special economic zone**, where all the services and facilities including energy supply will be ensured.

For urban infrastructure development, a policy of **participatory development** should be adopted instead of land acquisition based development. This is necessary to reduce cost of infrastructure development at local level and create belongingness among the land owners about development and make execution of infrastructure projects easier.

New sources should be evolved to finance urban infrastructure development including charging development cost on the beneficiaries and imposition tax on vacant land. There is provision of **charging betterment fee** in KDA Ordinance. It should be explored and used for revenue generation. All the **dues pending with (2% of KCC tax revenue)** other agencies should be realized to pay for infrastructure development.

Coordination with other local agencies involved in urban development is necessary to avoid wastage of resources.

3.4 DEVELOPMENT PROPOSALS

The current DADP comprises development proposals under various sectors that are mostly infrastructures of social and physical in nature. These include road, education, graveyard, parks, playgrounds, health facilities etc. The Project Area comprises 78.38% of the study area, therefore, a substantial part of the 2001 Master Plan development proposals are applicable to the project area. Almost all infrastructure development proposals of the 2001 Master Plan fall within the project area. After reviewing the proposals, the consultant proposed the appropriate change in the proposals and in most cases the proposals have been retained in the current DADP. Following are the sector wise description of DADP development proposals.

3.4.1 Transport Sector Development Proposals

Despite having no provision for transport sector development in the ToR, the consultant realizing the necessity of the issue on public interest, made some transport sector development proposals.

3.4.1.1 Road Network Development

a. 2001 Master Plan Road Network Proposal

The 2001 Master Plan proposed 447 km of road network for the study area, of which 434 km falls within the project area. These consist of primary and secondary roads. The plan recommended 120.60 km primary road, of which KDA and RHD implemented 32.75 km as Outer Bypass and Rupsha Bridge Approach Road. KDA developed 16.44 km City Bypass. Of the proposed secondary road length, only two road projects proposed by Master Plan, 2001 are under execution totaling about 3 km.

b. DADP Road Network Development Proposal

It is evident from the review of proposed road network of 2001 Master Plan that extremely negligible length of the road proposals has so far been implemented (about 3 km). All the proposed roads of Master Plan serve as the higher-level frameworks for the current DADP. The consultant, therefore, retaining most of the Master Plan road proposals mostly as it is and draws up the lower level roads to serve the local areas. However, alignments of some major roads have been reconsidered to ensure maximum use of existing road network and also to save huge amount of structures. The development proposals have been made based on the road standards drawn from the 2001 Master Plan. The main objective of road layout is to provide accessibility to undeveloped or underdeveloped areas with maximum possible standard road with respect to layout and width. Roads have been laid out in the project area minimum 400 ft. apart for the underdeveloped areas.

The proposed roads have been designed, mainly with a view to open up undeveloped areas by linking with major and secondary existing roads and the roads proposed by the Master Plan. Proposals have also been made to widen the existing narrow roads, wherever situation permits. Currently, mainly two categories of roads have been proposed following standards, these are feeder road (30 ft.) and access road (20 ft.) to serve local areas. **Feeder Roads** are those roads that connect any undeveloped area with existing major and secondary road. **Access Roads** are the roads that give access to any undeveloped area from any secondary or access road. Roads of greater width haven proposed wherever possible and feasible and based on need.

i. Khulna City Corporation (KCC) Area

As KCC area is the most densely populated part of the project area, new roads are almost impossible to propose. However, to resolve some of the problems like missing links, network inconsistency etc., a total of 87.44 km new roads have been proposed within the boundary of KCC, most of these roads are 10-20 feet wide (25.63 km) and 30-40 feet wide (10.08 km), 50-60 feet wide (5.09 km), 70-80 feet wide (20.57 km) and 100 feet wide takes (0.45 km). The areas where most of the new roads are proposed are located on the north-western and southern periphery and have higher potentiality for growth in future as they have City Bypass within their close proximity.

As it is the oldest and naturally grown part of the project area, there are numerous narrow roads contributing to the decreasing quality of built environment, increasing vulnerability to disasters. Therefore, a total of 25.59 km existing roads are proposed for widening. Most of these roads are proposed to be widened up to 20 feet (about 10 km). Wider roads could not be proposed because the areas that do not have any accessibility. On implementation of the proposed roads, land value in these areas will rise and new development will start. This will generate new employment and help move the local economy forward.

Apart from all of these, a new embankment cum road has been proposed on the Bank of Bhairab all the way from Noapara to Rupsha. Out of about 47.57 km road, 19.70 km has fallen within the boundary of KCC. Width of this road cum embankment is 80 feet.

ii. Noapara Paurashava Area

In Noapara Paurashava, the total new road network proposed under DADP is 80.86 km. The existing highway passing through the Paurashava will be turned into an internal road after the construction of new bypass on the western periphery of the town. New link roads have been proposed connecting the bypass and exiting Khulna-Jessore road. Most of the proposed roads are access roads are of 20 feet wide (3.21 km). About 4.96 km new road is proposed having 40 ft. width.

One of the basic planning principles of this plan is optimum utilization of existing infrastructure. Thus a total 31.16 km existing road is proposed for widening **Table-3.2**. The enumerated length of the embankment cum road in Noapara is 9.86 km.

iii. Extended Area

Comparatively, more emphasis has been laid on new road development in Extended Area. Those areas have been given priority that show trend of development and where new accessibility can expedite the development. In Extended Area, 268.45 km of new roads have been proposed. These comprise about 64 km of 20 feet wide road, about 25 km of 30 feet wide road and about 11 km of 60 feet wide road. The Extended Area is dominated by mostly farm land, where future extension of the urban activities is likely to take place if growth in the main city area swells. New road proposals are laid down in such a manner so that the maximum amount of agricultural land can be saved. Thus most of the roads are laid down on the low density rural habitation. For details of new road proposals please see **Table-3.1**. Some of the major roads are proposed through this area to promote urbanization and development. Proposed Noapara Bypass Road has passed through the extended area. Apart from the same, about 17.71 km long embankment cum road by the Rupsha river has passed through this part of the project area.

Apart from the new roads, a total of 100.18 km. road in this area is proposed for widening. Detailed zone wise road network is presented in Maps in **Appendix-3.4**. For the sake of better visualization, transport related land use is isolated from circulation network in **Map-3.13**.

Table-3.1: New Road Proposals within the Project Area

Road Category by Width (ft)	Length (m)	Length (km)
Extended Area		
10	2,743.79	2.74
20	6,4045.8	64.05
30	2,5401.7	25.4
40	1,3607.1	13.61
50	1,806.89	1.81
60	11,190.92	11.19
70	3,807.59	3.81
80	26,176.06	26.18
100	10,014.74	10.01
200	7,789.51	7.79
Sub - total	1,66,584.1	166.58
KCC Area		
10	2,140.7	2.14
20	23,497.93	23.5
30	3,314.41	3.31
40	6,770.18	6.77
60	5,097.06	5.1
70	881.62	0.88
80	19,696.6	19.7
100	452.83	0.45
Sub -total	61,851.33	61.85
Noapara Pourasava		
20	19,153.81	19.15
30	5,820.66	5.82
40	5,105.49	5.11
60	1,266.83	1.27
80	10,827.81	10.83
200	7,529.56	7.53
Sub - total	49,704.16	49.7

Source: Analysis derived by Consultants

No roads with less than 10 ft. width have been proposed in the Project Area. However, in the map some walkways are proposed with about 10 ft width. Total length of such walkways would not exceed 5 km.

The 497th Board Meeting of KDA decided that all the existing roads with less than 3.65 m (12 feet) width, should be widened to at least 12 feet. According to the minutes of the board meeting, in case of less than 12 feet width, land owners of the both side of the road must register proportionate amount of land to City Corporation, Mayor of Paurashava or Chairman of Union Parishad for expansion of the existing road to get the no objection certificate (NOC) from KDA. This decision is applicable on 23 mouzas; namely Muzgunni, Denerabad, Choto-boyra, Banargati, Baniakhamar, Tutpara, Helatala, Boyra, Tutpara, Rayer Mahal, Pabla, Daulatpur, Deyana, Goalpara, Aronghata, Labanchara, Harintana, Jabusa, Maheswarpasha, Gaikur, Jugipol, Moshiali and Atra. After careful evaluation of the proposal of the Board Meeting, the consultant proposes that no roads with less than 20 feet width should be allowed in the project area. And this principle should be applicable for the whole study area except slum and squatters.

Table-3.2: Road Widening Proposals within the Project Area

Road Category by Width (ft)	Length (m)	Length (km)
Extended Area		
10	53.79	0.05
20	22,215.04	22.22
30	21,436.89	21.44
40	16,449.53	16.45
50	4,908.99	4.91
60	19,004.17	19
70	798.4	0.8
80	4,667.65	4.67
100	9,540.4	9.54
Sub-total	99,074.86	99.07
KCC Area		
20	10,499.42	10.5
30	4,030.83	4.03
40	2,759.53	2.76
50	1,186.24	1.19
60	4,492.24	4.49
70	1,773.26	1.77
80	3,70.48	0.37
100	485.23	0.49
Sub - total	25,597.22	25.6
Noapara Poursava		
20	3,211.81	3.21
30	4,259.65	4.26
40	1,1607.28	11.61
60	3,409.23	3.41
80	8,673.04	8.67
Sub - total	3,1161.01	31.16

Source: Analysis derived by Consultants

3.4.1.2 Public Transport

a. New Bus Route

Currently, there is only one public bus route operating in the project area, running between Fultala and Rupsha. In this 35 km route, 68 buses operate daily up and down. Other public transport services are auto-rickshaw, battery-driven easy bike (latest introduction) and the rickshaw van, the cheapest mode of public transport. All these transports operate in different routes of the city and surroundings. 2001 Master Plan proposed 5 new bus routes in the city and surroundings. These are, Noapara to Natun Bazar, Koya to Rupsha, Rupsha to Shiromoni following City Bypass, Rupsha to Dighalia following outer bypass, Fulbari Gate to Rupsha through Khalishpur. But buses did not start operating in any of these routes, because of dearth of passengers. Since the public buses are operated by private operators, they did not find these routes economically feasible to start new bus service. Since Khulna experiences slow economic growth, its employment and population growths are also slow, introduction of new bus routes will be difficult for private operators. However, as a long term strategy DADP proposes following seven new bus routes. A few routes may be tried on experimental basis. The proposed new routes are:

Route-1: Noapara to Rupsha via outer bypass, Gallamari, Nirala and Moilapota

Route-2: Fultala to Rupsha via Khalishpur, Sonadanga, Gollamari, Moilapota

Route-3: Ferighat to Rupsha via Notun Bazar

Route-4: Ferry Ghat to Koiya bazar via Moilapota, Gollamari, Zero point

Route-5: Sonadanga-Boyra-Shib bari- Powerhouse moore-moilapota-nirala-gollamari-sonadanga

Route-6: Bat-talar moore-Rupsha bridge-Rupsha-Royal moore-Moilapota-Shib-bari

Route-7: Noa para-fultala-city bypass-zero point-rupsha bridge-Khudir Battalar moore.

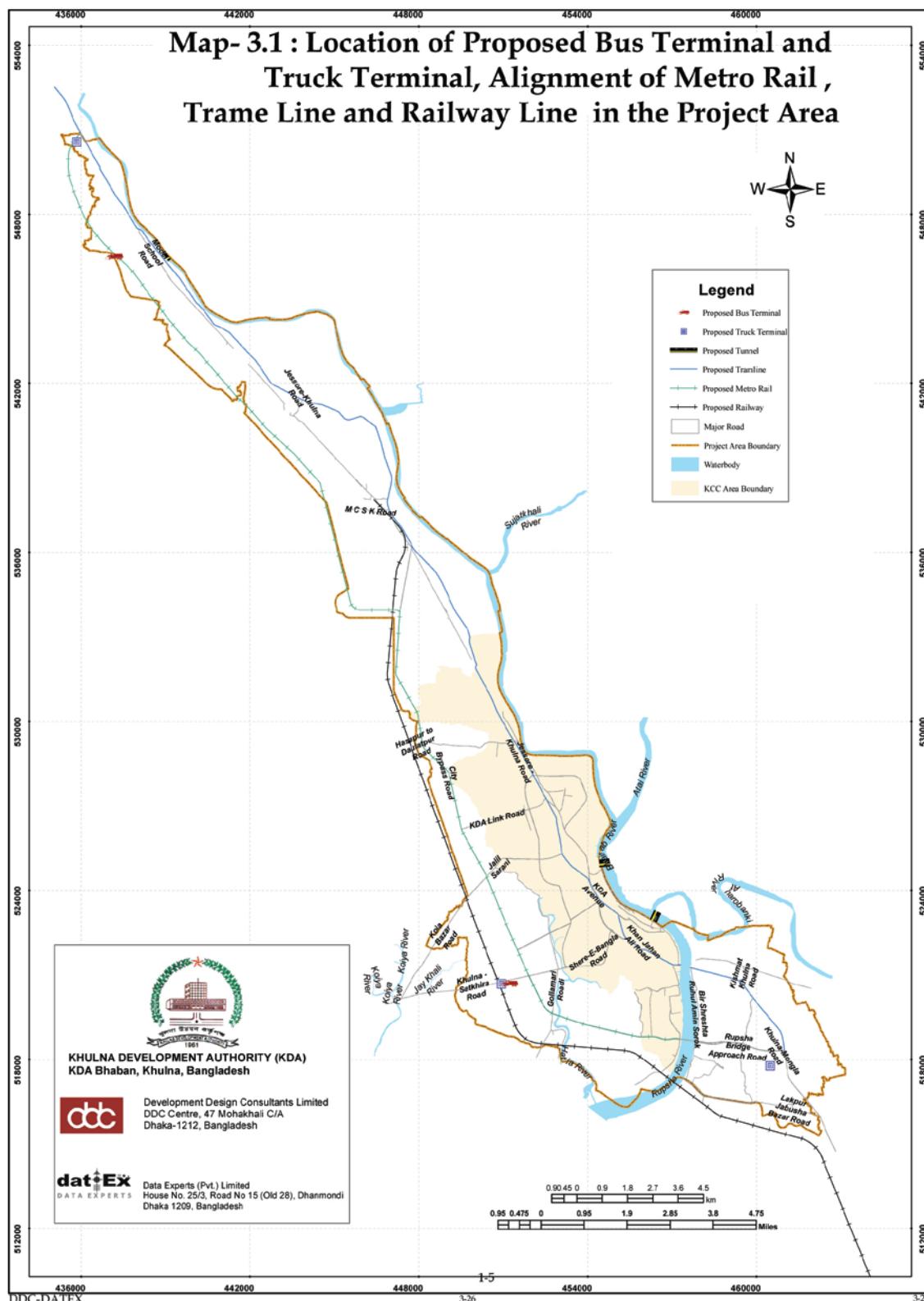
Map-3.1 shows the proposed new 7 routes. If private operators decline to operate anticipating unprofitable, government may try some of these routes with BRTC buses.

b. Metro Rail/ Tram Line

Khulna is a metropolitan city, but currently pace of economic growth is comparatively slower here. Nonetheless, it is expected that with the commissioning of Padma Bridge and transit to Bangladesh by Bhutan and Nepal through India new frontiers of investment will be opened up in the south-western region centering Khulna. Because the city is imbued with the entire positive factor for investment, like, good infrastructure, proximity to sea port, rich agricultural hinterland, low land value, everything necessary to attract investment. New employments will be generated, commercial and industrial developments will flourish. To promote new investment and attract migrants, development of good infrastructure is imperative. The current DADP is designed for a period of 10 years, that is, all its proposals will have to be executed within next 10 years. In the long run, the city will have huge number of working class people and as the city has a linear shape, metro/tram service will ease their travel to work place from north to south or south to north. The consultant proposes tram service from Noapara upto beyond Rupsha. As the metro/tram will have its dedicated line to operate, it will be free from traffic congestion and the journey will be uninterrupted.

As long term transport development strategy this mass transport service has been incorporated in the DADP. However, this proposal cannot be executed within next 10 years tenure of DADP. The proposal should continue through coming city plans of Khulna to maintain its continuity. The logic is that if land cannot be reserved for this services right now the facilities cannot be developed in future when all land would be engulfed by intense development. The 45.29 km tram line will be extended from the northern end of Noapara Paurashava to Khudir Battala in Rupsha area. The alignment will run along the Khulna-Jessore Road and reach Khudir Battal crossing Rupsha river. About 42.52 km metro rail alignment will start from Noapara to Rupsha Bridge going along the Noapara Bypass and **Khulna City Bypass**. A new bridge will be needed on the Rupsha for this purpose. This mass transit facility will help meet the future demand for local high speed transit that will also be cheaper.

Map-3.1 Location of Proposed Bus Terminal and Truc Terminal, Alignment of Metro Rail, Trame Line and Railway Line in the Project Area



c. New Railway Line

Khulna Master Plan 2001 proposed to extend the western railway network up to Mongla Port to facilitate effective use of Mongla Port facilities, serve EPZ and activate the economy of Southwestern region. This project is now under implementation. It is expected that the project will contribute to the economy largely. After finalization of the locations of the train stations, the connecting roads with the city should be constructed on priority basis.

3.4.1.3 Pedestrian Movement

a. *Walking on Footpath*

Of the entire study area, footpath exists only in the core part of the **Khulna City**. Survey shows only about 18.85 km of roads have footpath. Some of the roads have footpath on one side only. The width of the footpaths varies from 4 ft. to 6 ft. According to Master Plan 2001, over 50% of the city dwellers make their daily trips to work places on foot.

The city footpaths have varied problems that discourage pedestrians walking on them. Much of the footpath width, in the busy areas of the city, is found to be occupied by the informal small business people. This leaves little room for the pedestrians to walk. In these areas pedestrians are forced to walk on the carriageway, which increases vulnerability of accident. In many areas footpaths are not well maintained. They are either broken, or have open manholes, where walking is risky. In some areas the width of footpath is not up to standard. For all these reasons, pedestrian try to avoid footpaths of many busy areas.

Informal business activities are a major problem for pedestrians to walk in on footpath. But it is extremely difficult to remove activities on footpath. Because these activities provide about 60% urban employment. Mass eviction might result social disorder and deteriorate law and order situation. The best way is to streamline footpath business activities and ensuring sufficient space for pedestrians. At busy commercial areas time based pedestrian precinct may be created. Under such programme during peak shopping period all vehicular movement will be forbidden in a certain part of the shopping area. This will allow free and comfortable movement of the shoppers. Necessary arrangements may be made for transportation of goods.

b *Foot Over Bridge with Escalator*

2001 Master Plan proposed two foot over bridges, one at (1) Power house crossing and (2) Daulatpur near BL Collage. In the long run with the increase in population, the number of pedestrians in the city streets will increase manifolds. Indiscriminate road crossing will have to be stopped to bring discipline in movement in the streets as well as to ensure safety of the pedestrians crossing the roads. Walk up stair based foot over bridges are usually not welcomed by the pedestrians as they involve strains in minding stairs. To ease strains involved in walk up foot over bridges, escalators may be set up with foot over bridges. Such foot over bridges with escalator may be set up at busy intersections of the city. Additionally, considering the increased vehicular movement, the consultant proposes 25 foot over bridges throughout the project area. It is to be mentioned here that such high number of foot over bridges are not required in the project area in the next 10 years. However, it has been proposed on request by KDA. **Table-3.3** shows the list of over bridges including the phases of their implementation phasing (locations are also shown in **MAP-3.2**).

Table-3.3: Phasing of Implementation of Foot Over Bridge

Implementation Phase					
Sl. No.	1 st Phase (2014-15 to 2018-20)	Sl. No.	2 nd Phase (2020-21 to 2024-2025)	Sl. No.	3 rd Phase (Beyond Project Period)
1.	Near Shib Mandir, Mohakal, Noapara	1.	Khalishpur Intersection	1.	Mohakal Intersection, Noapara
2.	Near Akij Jute Mills, Noapara	2.	Khulna University	2.	Bhang Gate, Jessore-Khulna Road
3.	Pagal Bazar, Shiromoni, Khulna-Jessore Road	3.	Boira Mohila College	3.	Near Fultala Sonali Bnagk, Jessore-Khulna Road
4.	Rali Gate, Khulna-Jessore Road	4.	Royal Intersection	4.	Fulbari Gate, Khulna-Jessore Road
5.	BL College Intersection, Khulna-Jessore Road	5.	Boyra Public College	5.	Abu Nasser Hospital, Khulna- Jessore Road
6.	Natun Rasta Intersection, Khulna-Jessore Road	6.	Power House Intersection	6.	Near Surik Khal
7.	Shib Bari Intersection	7.	PTI Intersection, Khan Jahan Ali Road		
8.	Dak Bangla Intersection	8.	Rupsha Ghat		
9.	Gallamari Intersection	9.	MoilaPota Intersection		
		10.	Zero Point		

Source: Analysis derived by Consultants

c. Railway Overpass at Fulbari Gate and Noapara

The 2001 Master Plan proposed a railway overpass at the Fulbari Gate railway crossing. Within KDA area, the roadway crosses railway line at three points- Jora Gate, Fubari Gate and Bhang Gate area of Noapara. 2001 Master Plan proposed a railway overpass at Fulbari Gate. But it was not built as the traffic at this point is yet to be very high. In the long run, there will be need for the overpass to smoothen traffic movement without any delay at this railway closure. Similar overpass will be required in future at Bhang gate area where road crosses the railway line.

d. Proposal on Central Area Development

i. 2001 Master Plan Review

2001 Master Plan proposed to develop an 80 feet wide road from Kahlishpur Port Staff Quarter area up to Rupsha Ghat along the Rupsha River, passing by the northern side of Baron Bazar. But the road was not built. The plan also proposed to develop a city bus stand on the unused Ferry Ghat space. The plan proposed to re-organize railway market with arrangement of shopping areas and creation of more and better access roads to facilitate more efficient operation of commercial activities in the area. But none of these proposals was executed.

ii. DADP Recommendation

Dakbangla area is considered as the main commercial-administrative hub of **Khulna City**. This area is extended from the Ferry Ghat more at the north, Bangladesh Bank more at the south, Phul market at the west and the River Bhairab at the East. Biggest wholesale markets (Boro Bazar), Office of the KCC, Khulna Court, Khulna prison, numerous banks, offices, shops and shopping malls are located within close proximity of this area. Main problems of this area are-

- a. Traffic congestion during the official time especially in Dakbanglow to picture place more intersection

- b. High concentration of street hawkers narrowing down the effective width of the roads.
- c. Some land uses like cinema halls attract too much crowd during office hours. There are three cinema halls in this area.
- d. This is the oldest and unplanned part of **Khulna City**. Most of the roads are quite narrow. Because of very dense structures by the roads, there is very little opportunity to widen the existing roads or building new ones.
- e. Road intersections are not properly designed to ensure smooth traffic flow.

Considering this as the most problematic and also most important part of **Khulna City**, the consultant makes the following proposals for improvement of circulation system in the area-

- Some parts of this area may be declared as a pedestrian zone. The Clay Road from Dak-Bangla Intersection up to the River Rupsha in Baro-Bazar and the KD-Ghosh Road from Khulna Thana Intersection up to Boro-Bazar intersection and the Sir Iqbal Road from Khulna Thana Intersection up to Khulna Thana Intersection may be brought under this programme. Being a commercial area there will need for loading and unloading goods. For this purpose, all categories of vehicles may be allowed to operate from 9:00 pm at night to 6:30 am in the morning. Rest of the hours the area will remain free of all pedestrian traffic. Rickshaws may be allowed to enable consumers to reach shops and carry their goods home.
- Apart from the existing baby taxi stand at Dak Bangla area (approximately 8700 sq.ft.), another parking place has to be established at Power House area (opposite of Mina Bazar). This is because the existing baby taxi stand has already reached its saturation level and baby taxies over spill into the nearby street creating traffic congestion. The new parking place will also serve as the proposed multi-modal transport terminal close to the launch terminal.
- A new 30 feet wide road should be developed on the northern boundary of Baro Bazar along the Rupsha River, connecting Station Road with Sir Iqbal Road. This road will protect the Rupsha River from encroachment by Baro Bazar shop owners at the same time; it will create new and wide access to Baro Bazar. This road will ease off transportation of goods form and to the Boro-Bazar. No opening of frontage of the shops to this road should be allowed. Tracks can be unloaded at the Boro-Bazar between 9:00 pm at night to 6:30 am at the morning and leave the area following newly proposed road to go to Zoragate where the drivers can rest or pick their vehicle.
- Following the proposals of Master Plan 2001, the current plan also retains the proposal of a Multi-modal transport terminal at the current location of the Khulna Railway station and IWTA launch ghat. The plan proposed to integrate these stations together with the road transport terminal to implement a modern multi-modal transport terminal in this area, which could become a land mark for the city.
- The CBD area has already become saturated by different kinds of services. Following the process of invasion and succession of land use, this area is now expanding towards western direction. To provide scope for the CBD to expand towards eastern direction, the current DADP proposes to implement the Bridge close to the launch ghat over the river

Bhairab. The consultant proposes to discard the proposed optional bridge at Khalishpur and retains the proposal for another bridge at Mirerdanga. The DADP made no locational allocation for this bridge at Mirerdanga.

3.4.1.4 Transport Stands and Terminals

Master Plan 2001 made a couple of proposals about the bus stands and babi taxi stands. The consultant thinks that the proposals are still valid and recommends implementing the proposals as soon as possible.

Because of westward direction of growth of the city, the consultant thinks that within couple of years, the current inter-city bus terminal at Sonadanga will not be able to meet the demand of the city. The consultant envisioned that the Sonadanga bus terminal will not be serving as the Inter-city bus terminal. Instead, it will serve as the intra-city bus terminal.

Moreover, after construction of the Padma Bridge at Mawa point, the current flow of bus traffic (Khulna via Jessore to Dhaka) will be reduced. More pressure will be created on the southern route (Khulna via Bhanga to Dhaka). This will necessitate another bus terminal at the southern part of the city. Thus the consultant proposes another bus terminal on an area of 9 acres at Jalma mouza near the proposed railway station (1:3960 sheet no. G03, DADP Zone 21) **Map-3.1**. Additionally, the consultant also proposes a truck terminal by the bus terminal on an area of 7.22 acre. This truck terminal will serve the proposed the wholesale market close to the truck terminal. Consultant considering the commercial and industrial importance of Noapara proposes a truck terminal on the northern end of the Paurashava in Ward No-1. For Noapara a bus terminal has been proposed in Ward No. 4 close to the proposed bypass. Please see **Table-3.4** and **3.5**. for details.

Table-3.4: Proposed Bus terminals

DADP Zone	Area	Grid ID (1:3960 scale)	Ward/Mouza
DADP-02 GOAKHULA	6.01	A12,B12,A13,B13	Ward-5, Noapara
DADP-21 MATHABHANGA	9.60	G03	Krisnanagar

Source: Analysis derived by Consultants

Table-3.5: Proposed Truck terminals

DADP Zone	Area	Grid ID (1:3960 scale)	Ward/Mouza
DADP-01 NOAPARA	4.91	A14	Ward-1, Noapara
DADP-24 JABUSA	3.36	J01,J02	Khajura
DADP-21 MATHABHANGA	7.22	G03	Thikrabagh

Source: Analysis derived by Consultants

3.4.1.5 Easy Bike and Motorised Rickshaw Management

The number of battery driven auto-rickshaws is increasing at an alarming rate in Khulna. Because of lack of any parking places, these auto-rickshaws create traffic jam in some points of the city (e.g. Sonadanga crossing, boyar bazar more, PTI crossing, ferry ghat crossing, etc.). Clearly, these easy bikes are friendlier to maintain the air quality of the city. But, no scientifically proven study can be found on the actual energy consumption of these easy bikes. However, considering the emerging situation, the consultant proposes the following-

- To train up the easy bike drivers and make them aware about the traffic rules

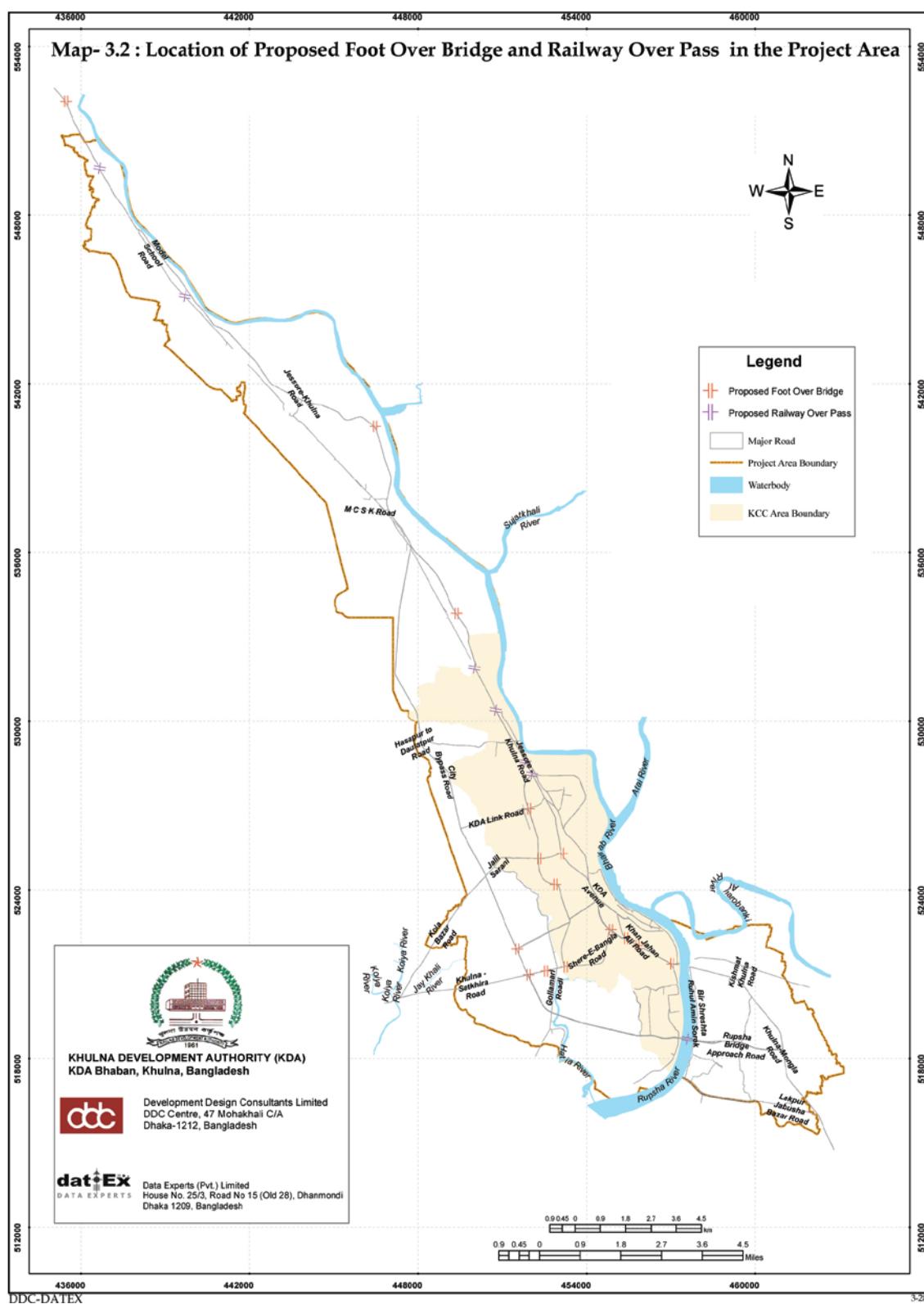
- Improve physical design of the major intersections (KCC has already taken an initiative of improving 36 intersections under City Region Development Program)
- Control the growth of illegal easy bikes (KCC provided licenses for 2000 easy bikes. In reality, this number is much higher)
- KCC should assign an specific color for these bikes
- Battery driven rickshaws should be totally banned in the study area these rickshaws are more accident prone. Moreover, these rickshaws creates confusion among other drivers (rickshaws are usually slow moving vehicles, but these rickshaws are quite fast)

3.4.1.6 Bridge and Tunnel

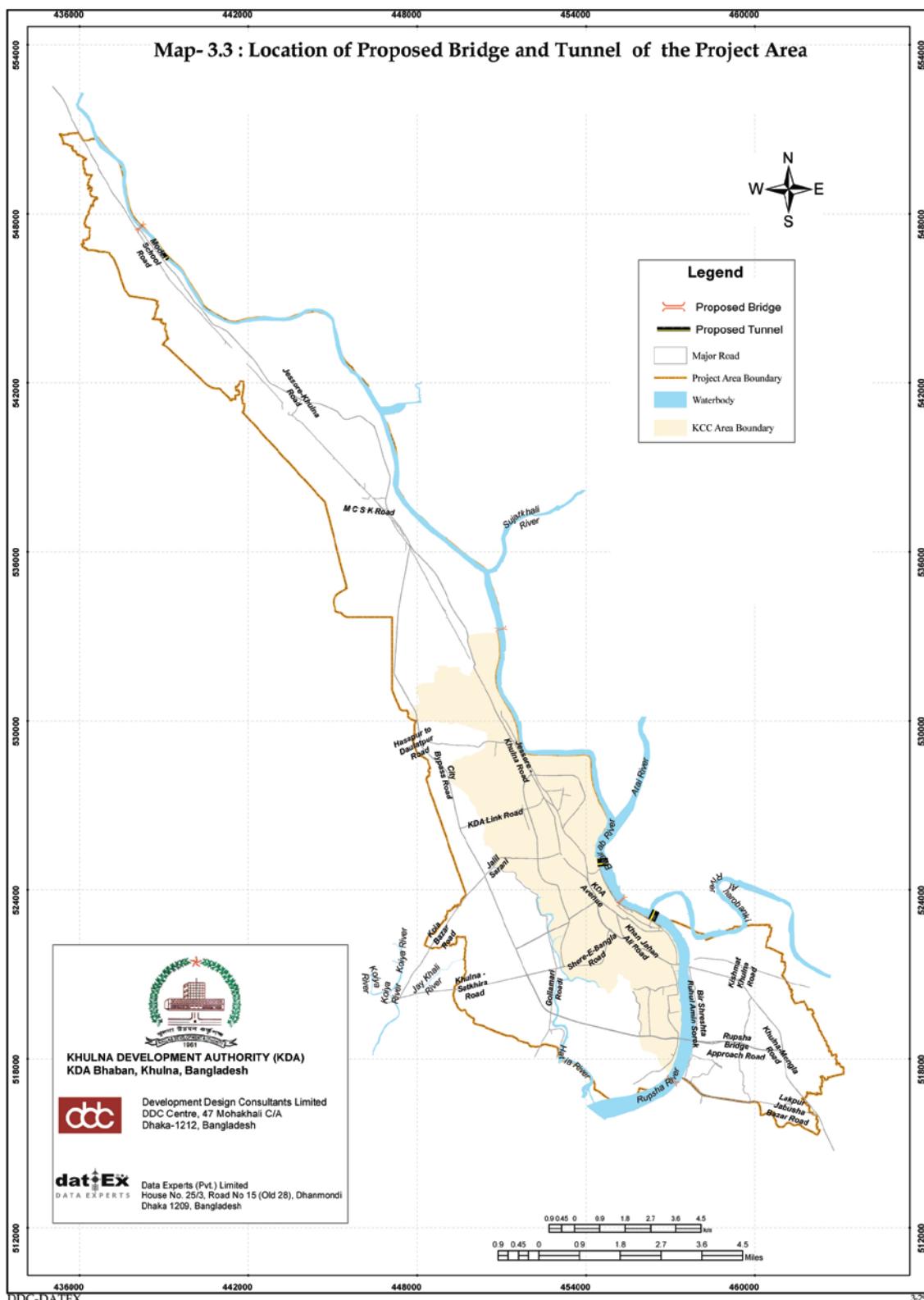
The so far **Khulna City** is expanding northward along the Khulna-Jessore Highway. Such elongated expansion raises the cost of infrastructure, travel time of the people and cost of travel. There has not been any attempt to extend the city on the other side of the Bhiab-Rupsha. This would enable economic and social integration of the settlements and establishments on the other side of the river with the main city. For this purpose, DADP proposes to build 3 tunnels and 5 bridges on the Bhaiab-Rupsh at different places of the project area. Such high number of bridges/tunnels are proposed on request by KDA.

At Noapara, a bridge can be developed near the present ferry ghat. A tunnel can also be developed near the bridge or alternatively any of the two may be developed. In the main **Khulna City** area, a bridge can be developed near the IWTA Ghat to connect Senhati area on the other side. A tunnel may be developed near the Jailkhan Ferry Ghat. A bridge/tunnel can be attempted in Khalishpur another at Rupsha Ghat area. Another bridge is proposed at Rob Sarani Ghat to connect Dighalia area with the main city (please see Map-3.2). The use of helicopter is increasing day by day for medical, matrimonial and other emergency purposes. But there is no helipad in **Khulna City**. Expecting that use of helicopter will further increase in future DADP proposes to use the divisional stadiums, circuit house ground etc. for this purpose.

MAP 3.2 Location of Proposed Foot Over Bridge and Railway Overpass in the Project Area



Map-3.3 Location of Proposed Bridge and Tunnel of the Project Area



3.4.1.7 Street Side Plantation

Street side plantation will serve two purposes, first, it will improve street view and city scape aesthetics; second, this will become a source of ecological balance. Medium height short rooted streets may be planted along the footpath beside the storm water drain. Consultant suggests that the tree lines should be developed on both side of the carriage way. Tree selection should be made carefully. Emphasis may be laid on ornamental trees than trees with wood value or fruit. Ornamental trees producing flowers will be a source of street aesthetics.

3.4.2 Education Facilities

3.4.2.1 Primary School

Usually, 6 to 10 year old children go to primary school and 11 to 15 year old juveniles go to high school. Estimating from census data, it is found that 6 to 10 year old population constitutes approximately 20% of the total population, while 11 to 15 year age group forms 14%. Using this standard, it is estimated that of the total projected population of project area will be 16,52,854 by the year 2023 and the number of primary school going children would be 3,30,571 while the number of secondary school going population would be 2,31,400. Table-3.6 and Table-3.7 show the demand estimation process for primary and secondary schools.

Table-3.6: Estimation of Primary School for 2023

Project Area Population(2023)	Primary School Going Population (6-10 Years)	
16,52,854	20%=3,30,571	Considering 100% enrolment the number of primary school going children would be 3,30,571 in the year 2023.
Assuming that all existing primary schools will be two shifts than (@300/each school) existing 541 Primary Schools with two shifts will accommodate (300 x 451x2) 3,24,600 students in 2023.		
Rest (3,30,571-3,24,600)=5,971 students will need new schools in 2023. If we consider 30 students in each class, 5 classes in one school will accommodate 300 students. If two shifts are introduced in each school it will accommodate 600 students.		5971 students will need (5971/600) for 10 new Primary Schools in the year 2023.
Total space required for 10 primary schools (@ 0.50 acre each) will be 5 acres.		

Introduction of two shifts in every school and increase of students in each school will reduce the number of schools. According to Ministry of Education, to establish a primary school, the standard is 0.17 acre of land for each school. This amount of land is not enough to provide adequate space for play area for children, which is essential for their physical and mental grow up. The Structure Plan recommended larger space for schools to ensure playing area and recommended minimum 0.50 acre for each primary school. Accepting this standard, therefore, 10 new primary schools would need of about 5 acres.

However, to avail the advantage of economies of agglomeration, many of the privately developed schools are located in settlements creating highly skewed spatial distribution. That means, some parts of the project area is well served with school and while the other remains unnerved. Considering this situation, the consultant provided 22 primary schools with area same as secondary school as a part of a package that includes a local play field and a local playground.

The consultant recommends that no school should be permitted on the rented houses except it is in a high density area. Additionally, KDA should encourage the entrepreneurs to establish new schools at the identified places in the long run to achieve a spatial balance between demand and supply.

Location of primary schools have been selected based on following criteria,

- location should be within the close proximity of the existing or proposed residential areas;
- established structures must not be disturbed;
- it should be by existing or proposed road.
- preference should be given to locate it next to proposed park or play field.

In Appendix-3.1 a list of primary schools is given. Appendix-3.2 shows the location of local level parks and play fields.

3.4.2.2 Secondary School

Master Plan 2001 proposed 800 students as standard for each secondary school and estimated total 199 secondary schools for the Master Plan 2001 area for the year 2010. Although there was sufficient number of schools already in the area, the plan provided 12 additional secondary schools. These 12 schools can accommodate additional 84,000 students. It is estimated by the consultant that by the year 2023 about 2,31,400 students will be studying in secondary schools, if all the school going students go to school. The physical survey has identified 436 secondary schools already existing in the project area. This number of schools will be able to accommodate (436 x800) 3,48,800 students (@800 per school). So there will be no need for additional secondary schools in the project area.

Table-3.7: Estimation of Secondary School for 2023

Project Area Population (2023)	Secondary School Going Population (11-16 Years)	
16,52,854	14%	2,31,400
Existing 436 Secondary Schools will accommodate (@800/each school) (436 x800) 3,48,800 students	(436 x800) 3,48,800 students in 2023.	

However, additional 12 secondary schools have been provided, because existing secondary schools are not well distributed to serve all the residential agglomerations in a balanced way. In both the cases, the primary and the secondary levels, private and NGO initiatives were not considered. It was expected that considerable part of the requirement will be fulfilled by NGOs and the private sector.

3.4.2.3 Other Education Facilities

As the number of colleges was sufficient according to standard, the Master Plan 2001 did not suggest any space for new college, except one in Abhaynagar where there were no colleges. A number of other education facilities were recommended by 2001 Master Plan at different parts of the current project area as stated below:

- The Master Plan proposed a technical training centre (TTC) at Noapara on an area of about 5.04 acres. A Religious Institute was recommended at Damodor over an area of 2.89 acres, under Fultala Upazila.
- A new orphanage at Fultala was proposed on an area of 4 acres to accommodate about 200 orphans who can be trained on general and vocational education.

The DADP consultant feels that all the above proposals should be retained and developed as early as possible. However, the consultant relocated these facilities to reduce project implementation cost and avoid destruction of physical properties. Development all these facilities would help reduce regional imbalance in education opportunities. Each secondary school will have an area of approximately 1.65 acres. Depending on the urban settings and availability of vacant land, the area may vary. A list of these educational facilities is provided at **Table-3.9**.

a. College

A new college has been proposed in Ward-07 of Noapara Paurashava on an area of 5.36 acres.

b. Technical Training Centre

A Technical Training Centre has been recommended also in Ward-07 of Noapara Paurashava on an area of 5.05 acres.

c. Religious Institute

A Religious Institute will be set up in Damodor mouza of Fultatla Upazila on an area of 2.89 acres

d. School for Disabled

No statistics is available on the exact number of disabled population in the project area. However, a study says that more than 46% of the extreme poor population is borne with some sort of disabilities (source: <http://r4d.dfid.gov.uk/PDF/Outputs/EEP/Shiree-WP12.pdf> accessed at January 26, 2014). This data shows the severity of the problem. Considering the situation, the consultant proposes to establish three schools for the disabled kids on a total area of 5.76 acres. Please see **Table-3.8** for details.

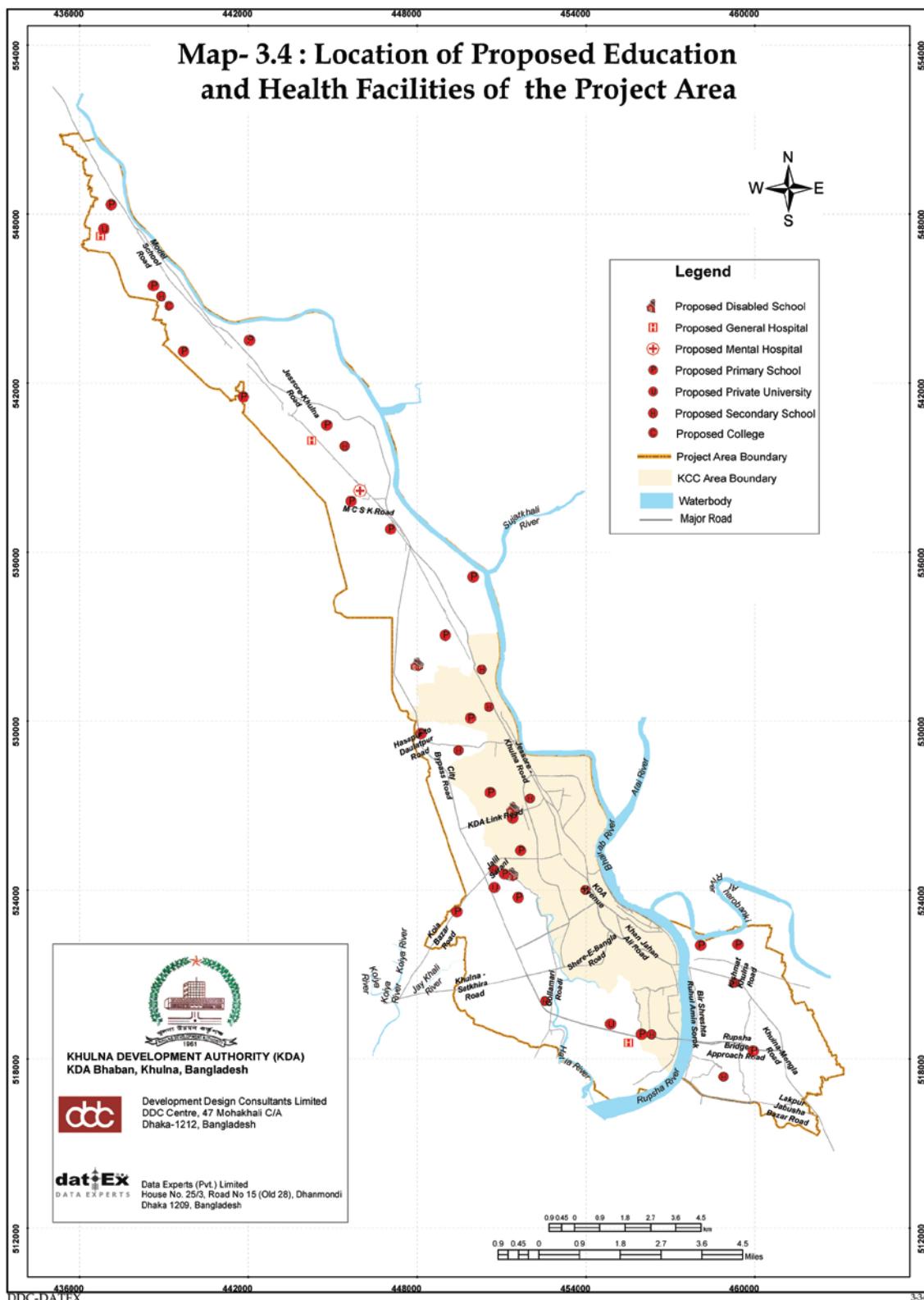
Table-3.8: Location of the proposed Disabled Schools

DADP Zone	Area	Grid ID (1:3960 Scale)	Ward/Mouza
DADP-10 TELIGANTI	1.95	F07	Teliganti
DADP-16 BOYRA	1.99	G05	Ward-09, KCC
DADP-14 BEEL PABLA	1.79	G04	Chack Ahasankhali

Source: Analysis derived by Consultants

However, for the sake of flexibility and feasibility of the selected sites for the selected usages, the consultant proposes that the proposed sites for primary schools, secondary schools and collages should be initially developed for their designated purposes, but in the long run, sites should be allowed to be used for higher education facilities. This flexibility is essential for meeting the future need which cannot be apprehended at this moment.

Map- 3.4 : Location of Proposed Education and Health Facilities of the Project Area



e. Orphanage

An orphanage is proposed at Fultala Upazila covering an area of 5.41 acres.

Table-3.9: Education Facilities Proposals

Education Facility	DADP zone	Area (acre)	Sheet Reference No. (1:3960 scale)	Union /Ward
Primary School (22)	Various	40.61	22 schools are allocated with about 1.65 acre area for future expansion	
Secondary School (12)	DADP-02	1.66	B12	Ward-6, Noapara
	DADP-07	1.67	E10	Damodar
	DADP-12	1.67	F06	Aranghata
	DADP-16	1.91	G05	Ward-09, KCC
	DADP-11	1.67	G07	Ward-02, KCC
	DADP-11	1.27	G06	Ward-01, KCC
	DADP-24	1.66	J01	Naihati
	DADP-22	1.71	G02	Jalma
	DADP-23	1.51	I02	Ward-31, KCC
	DADP-25	1.71	J03	Naihati
	DADP-17	1.92	H04	Ward-17, KCC
	DADP-14	1.87	G04	Gutudia
All Secondary School Total :		20.25		
Other Education Facilities				
College	DADP-02	5.36	B12	Sirajkathi
Orphanage	DADP-06	5.41	D11	Fultala
Technical Training Centre (TTC)	DADP-02	5.05	B12	Ward 07, Noapara
Religious Institute	DADP-07	2.89	E10	Damodor
School for the disabled (03)	DADP-14	1.80	G04	Gutudia
	DADP-16	2.00	G05	Boyra (Ward 09, KCC)
	DADP-10	1.96	F07	Taliganti
Zones for private universities (03)	DADP-14	18.40	G04	Gutudia
	DADP-01	20.23	A13	Ward-04, Noapara
	DADP-22	12.95	H02	Jalma

Source: Analysis derived by Consultants

3.4.2.4 Location for Private University

There are two public universities close to the city. One is Khulna University and another one is Khulna University of Engineering & Technology (KUET). Apart from these two universities there are Khulna Medical College, BL collage, Azam Khan Commerce Collage etc. as major education facilities in the city. However, the number of private universities is increasing quite rapidly nowadays. These universities are abruptly located mainly in the core areas of the city. Considering the potential need for space to accommodate new private universities, DADP proposes three locations on a total area of 51.58 acres details of which is shown in **Table-3.9**. Considering the standard of 05 (five) acres per university, this area of land would facilitate establishment of 10 (ten) universities within the project area which is expected to meet future demand of higher education. KDA should pursue the existing private universities located within the city boundary to relocate themselves to the proposed locations. Location of the education and health facilities are shown in **Map-3.4**.

3.4.3 Health Facilities

a. 2001 Master Plan Review

2001 Master Plan proposed two general hospitals each with 200 beds, one at Noapara and the other at Labanchora, Khulna. The one at Noapara covers an area of 20 acres (8.18 ha) and Labanchora proposed hospital covers 30 acres (12.14 ha). The plan proposed a 100 bed mental hospital at Fultala area on a land of 38.59 acres (15.62 ha). A nurses training Institute was proposed at Fultala on an area of 28 acres (11.34 ha). But none of these proposals have been materialized.

b. DADP Proposal

The DADP consultant feels that the health proposals made by the Master Plan are justified. As none of these proposals could be implemented, it is recommended that the proposed health facilities of 2001 Master Plan should be retained and implemented as early as possible. Due to increasing population DADP adds one more general hospital to serve the central part of the project area. Additionally, the consultant proposes to increase the capacity of the existing eye hospital to 250 beds. Three general hospitals have been proposed, one in Damodor mouza, Ward no. 04 of Noapara and Jalma Union.

Apart from the same, a mental hospital is proposed at Damodor on an area of about 39 acre. A nurses training institute is also proposed in Jugnipasha, Fultala on an area of about 28 acre. DADP health proposals are presented in **Table-3.10** and **Map-3.4**.

Table-3.10: Propose Health Facilities

Health Facility	Area(acre)	Grid ID (1:3960 Scale)	DADP Zone	Mouza /Ward/Union
General Hospital	27.11	D10	DADP-06	Damodarpur
General Hospital	20.97	A13	DADP-01	Ward-4, Noapara
General Hospital	29.68	I02	DADP-21	Jalma
<u>Specialized Hospital</u>				
Mental Hospital	38.84	E09	DADP-07	Damodarpur
<u>Health Training</u>				
Nurses Training Institute	28.08	C11	DADP-05	Jugnipasha, Fultala
Total	142.79			

Source: Analysis derived by Consultants

3.4.4 Community Services

a. Slaughter House

The Master Plan 2001 proposed to relocate the slaughter house from Moilapota to the south of Gollamari Bridge on an area of 2.13 acre. However, considering the growing density of structures in the Master Plan proposed area, the consultant proposes three new locations for slaughter house. Please see **Table-3.11** and **Map-3.5** for details.

Table-3.11: Locations of the proposed slaughter house

DADP	Area	Grid ID (1:3960 scale)	Mouza/Union/Ward
DADP-01	0.50	A13	Ward-3,4, Noapara
DADP-24	2.13	J02	Lakhpur
DADP-21	1.19	G03	Jalma

Source: Analysis derived by Consultants

b. Fire Station

Master Plan 2001 proposed three fire stations at Durgapur Mouza (Noapara), west of weather station near Khulna University and another one at Rupsha. Considering the current state of development and growth potential, the consultant proposes changes in the locations of the 2001 Master Plan proposed fire stations and also adds two more fire stations (in total Three) **Table-3.12** and **Map-3.5**. Arguments in favor of changing locations are (1) ensure maximum accessibility for the vehicles of the fire services, (2) to bring maximum project area under the fire services coverage.

Table-3.12: Location of Proposed Fire Stations

DADP Zone	Area	Grid ID (1:3960 scale)	Mouza / Union/ Ward
DADP-06	2.40	D10	Damodarpur
DADP-02	2.64	C12	Ward-7, Noapara
DADP-24	2.72	J02	Naihati

Source: Analysis derived by Consultants

c. Postal Service

Since preparation of Master Plan 2001, courier services has flourished significantly mainly because of slow delivery of documents and goods by the national postal service due to inefficiency and lack of confidence on the traditional postal system. Moreover, the emergence and popularity of e-mail services has significantly reduced the burden on the postal system. However, the current DADP proposes to establish one post office in each of the proposed town centers. The consultant thinks that no space needs to be allocated for the courier services. Instead they should be placed in the mixed use zone. This will ensure maximum accessibility for the public and also promote the private initiatives for enhancing postal system.

d. Central Eidgah

The Master Plan 2001 proposed to use the Boyra Divisional Stadium for Eid Prayers. But till today, this proposal is not executed. The consultant supports the recommendations of the Master Plan, 2001 and also suggests some big play fields like the playground of Khulna University, Shahid Hadis Park, and circuit house field to be used for Eid prayers held twice a year.

e. Space for Security Services

Crime rate usually increases with the increase of urban population. Although three new thanas have already been established namely, Harintana, Aarong-ghata and Labanchara thana. However, thanas alone cannot control the crime. The consultant recommends the metropolitan police to prepare a comprehensive study on spatial distribution of the crime incidences (hotspots). And

establish police outposts at the strategic locations. Permanent, semi-permanent and temporary structures can be built on the specified locations based on the type of crime of the hotspots.

f. **Mosque, Mandir and Church**

The physical feature survey by the consultant shows that there are 35 churches, 923 mosques and 379 Mandirs in the project area, which means, one mosque for every 1400 Muslims, one Mandir for every 500 Hindus and one church for every 30 Christians. This is far above of any planning standard. Thus the consultant did not provide any more provision for Mosques, Mandirs and Churches. **Table-3.15** depicts the need assessment for different religious land use.

Driven by the religious beliefs, people are building mosques, Mandirs and churches without any prior approval. Sometimes, these religious structures create external dis-economy for the surrounding land uses (for example, the mosque at Gallamari is a major traffic obstacle in this intersection). Considering this, the consultant suggests mandatory approval from KDA before converting any land use to religious land use. Moreover, the consultant thinks that the mosque at Gollamari should be relocated immediately to closest vicinity.

g. **Bazar and Wholesale Market**

i. **2001 Master Plan Review**

According to 2001 Master Plan there were 29 bazars in the Master Plan area. By 2023, the project area will need additional five bazars. However, the 2001 Master Plan proposed a total of 3 local bazars. Some of these bazars fall outside of the current project area.

iii. **DADP Recommendations**

Considering the changed situation, the consultant revises the 2001 Master Plan proposals. The consultant also proposes to retain all other proposals of Master Plan 2001 related to evening and holiday markets, wholesale markets. The proposed new retail markets in the project area stands at 04 including a fish market. These will be in Damodor, Ward no. 06 (Noapara), Naiharti and Aranghata (Fish market). The current DADP also proposes three wholesale markets to serve the existing local markets (Please see **Map-3.5** and **Table-3.13**). Additionally, the consultant also makes the following recommendations-

- No markets should be constructed or permitted on the major thoroughfare of the city.
- For the existing bazars by the major thoroughfare, service roads need to be constructed to ensure safety of the people and also to ensure free flow of traffic on the carriageway.
- KCC should perform the main responsibility for developing these bazars. Some basic utilities must be ensured in all the existing and proposed bazars. For example, toilet facilities, electricity, water supply, drainage facilities, waste dumping stations etc.
- KCC should also maintain the utility and services facilities regularly.
- Proper design should be adopted to ensure airflow and sun in the bazars

Table-3.13: Proposed Local Bazars

DADP Zone	Area(acres)	Sheet Reference No(1:3960 Scale)	Union /Ward
Local Bazar			
DADP-06	0.32	D10	Damodarpur
DADP-02	0.35	B12	Ward-6,7, Noapara
DADP-24	0.30	J02	Naihati
Wholesale Market			
DADP-24	1.83	J01, J02	Khajura
DADP-21	3.69	G03	Jalma
DADP-08	21.58	F08	Atra Gilatala
Fish Market			
DADP-12	7.12	F06	Aranghata

Source: Analysis derived by Consultants

h. Daycare Centre and Old Age Home

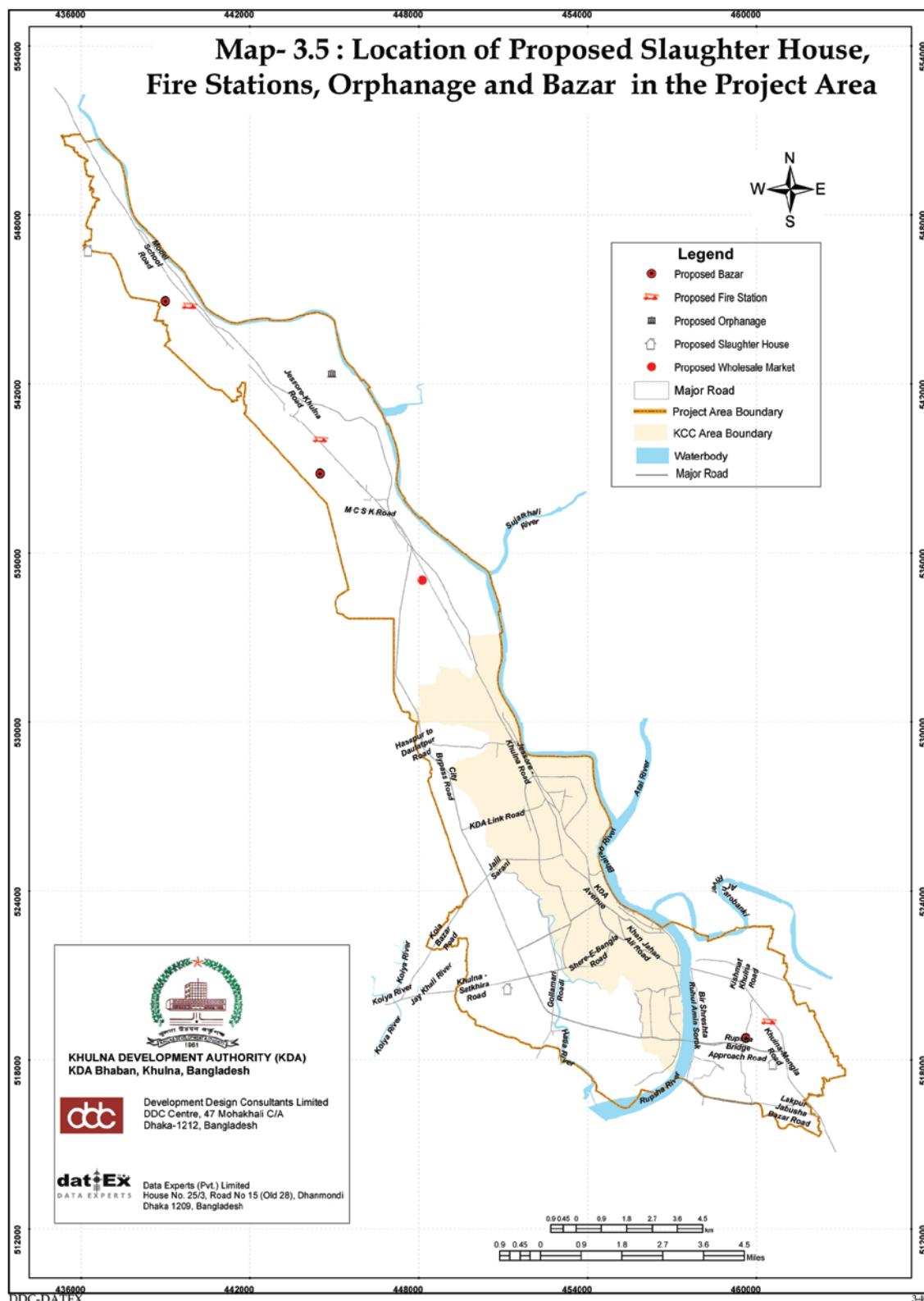
There is no daycare centre in **Khulna City** for working women with children. With the increasing participation of women in the work force such facility would enable the working women to devote to their work with more devotion free of anxiety for their children. Five daycare centres have been proposed in the project area in the major employment generation centers. No precise locations or areas are delineated for the day care centers because, day care centers can be located within a building and it also does not require bigger land parcels. There is also absence of old age home in Khulna. There are many old and helpless people in the society who have been either abandoned or have nobody to take care of them live a distressed life. Old age home can help these senior citizens in passing the last stage of the lives in peace and care. For this purpose, DADP proposed three old age homes in different parts of the project area as shown in **Table-3.14** and **Map-3.6**.

Table-3.14: Day Care Centre and Old Age Home

SL. No.	Mouza Name	Grid ID	Area
Day Care Centre			
1	Baniakhamar	H04	NA
2	Baniakhamar	H04	
3	Daulatpur	G06	
4	Guakhola	B13	
5	Masharhati	A13	
Old Age Home			
6	Ward-4	F04	6.14
7	Damodarpur	H05	4.77
8	Gutudia	D09	5.00

Source: Analysis derived by Consultants

Map- 3.5 :Location of Proposed Slaughter House, Fire Stations, Orphanage and Bazar in the Project Area



i. Graveyard, Cemetery or Crematorium

a. *2001 Master Plan Review*

The 2001 Master Plan proposed two new graveyards (one at Moheshwar pasha and the other at Sirajkathi in Noapara) with an area of 198.37 acres. But none of these graveyards was established.

b. *DADP Recommendations*

Considering the standard of 2.5 acres of land for 50,000 populations, the project area would require a total of 29.7 acres of land for graveyard and 3.48 acre land for Crematorium. According to the physical feature survey, the project area is served with 149.31 acre land for graveyard, Cemetery and Crematorium, which is more than enough for the project area. **Table-3.15** shows the space requirement for graveyard, Cemetery and Crematorium.

Table-3.15: Space Requirement for Graveyard, Crematorium, mosques and Mandirs

Locality	Population by Religion			Land for religious purpose (acre) (0.5 acre / 5000 population)		Land for Graveyard, or Crematorium (acre) (2.5 acres / 50,000 populations)	
	Muslim	Hindu	Others	Mosque	Mandir	Graveyard	Crematorium
KCC	1087500 (92.31%)	88946 (7.55%)	1649 (0.14%)	108.75	8.89	54.38	4.45
Noapara Paurashava	81839 (86.9%)	12337 (13.1%)	00 (0%)	8.18	1.23	4.09	0.62
Extended area	307662 (80.84%)	72919 (19.16%)	0 (0%)	30.76	7.29	15.38	3.65
Total	1477001	174202	1649	147.69	17.41	73.85	8.72

Source: Socio-economic survey by the consultant

Table-3.16: Proposed Graveyard and Rehabilitation Zone

Sl. no.	Area(acre)		Location (Mouza /Ward)
Graveyard			
1	11.99		Rajghat
2	11.91		Ward 07 (Noapara)
3	13.20		Ward 03 (KCC)
Cemetery			
1	4.53		Rajghat
2	7.00		Ward 04 (Noapara)
3	1.09		Jalma
Crematorium			
1	1.12		Jalma
Rehabilitation Zone			
1	43.80		Ward 01 (Noapara)
2	30.30		Naihati
3	30.61		Gutudia

Source: Analysis derived by Consultants

Currently, rotational burial is in the practice. 2001 Master Plan proposed two graveyards sites- one at Maheswarpasha and the other at Sirajkathi Mouza. DADP proposes to preserve the 2001 Master Plan graveyard proposals at Maheswarpasha. However, as there not adequate land available at Sirajkathi mouza, the graveyard site has been changed to a new site. Details of

graveyards are shown in **Table-3.16** and **Map-3.7** shows the location of the proposed Rehabilitation areas and graveyards

3.4.5 Sanitation: Public Toilet

a. 2001 Master Plan Review

The 2001 Master Plan did not propose any new public toilets to be constructed. However, it informed that 15 public toilets were being built under Municipal Services Project at markets, bazars and other important centers.

b. DADP Recommendations

No precise standard is available about the requirement of the sanitation facilities. The consultant proposes to retain all the proposals of Master Plan 2001. Apart from these proposals, the current project also proposes the following-

- Considering the poor public toilet facilities, the consultant proposes to construct toilet facilities at,
- all major road intersections (where the local motorized and non-motorized vehicles stop or wait to collect passengers) and bazar areas. The consultant proposes to construct four units of latrines (two for male and two for female) and two units of urinals as a package. For bazars and transport terminals, depending on the scale, number of this package may vary. Locations of these packages should be such that, it serves all the stakeholders. A sample design of public toilet is shown in **Appendix-3.5**.
- The consultants have identified some locations for construction of toilet facilities. No space is allocated for these toilets. Location of proposed 21 toilets in **Khulna City Corporation** area is presented in **Table-3.17**.

Table-3.17: Proposed Location of Public Toilet Facilities in KCC Area

Location of Proposed Public Toilets in KCC Area	
01. Rupsha Bridge Moore	12. Boyra moore
02. Zero point	13. Shibbari moore
03. Gollamari	14. Power House moore
04. Sonadanga bus Stand	15. Dakbanglaw moore
05. Medical College	16. Moilapota Moore
06. Public College	17. Picture Place
07. Notun Rasta moor	18. Rupsha Ghat
08. Doulatpur moore	19. Royal moore
09. Fulbarigate	20. PTI moore
10. Khalispur pupils moore	21. Tootpara Main Road
11.Boikali	

Source: Analysis derived by Consultants

Following are some additional suggestions-

- i. these toilets can be built by the KCC with financial and technical support from the government and foreign development partners
- ii. Toilet facilities for male and female should be separated such that the privacy is maintained strictly.

- iii. the toilets can be leased out to the private sector that will reduce the financial burden on KCC at the same time it will help keeping these toilets clean and hygienic.
- iv. Continuous water supply must be ensured by KCC. Overhead water tank can be built up to ensure the same.
- v. fecal sludge must be cleaned by KCC at least twice in every year.
- Shopping centers and malls with more than 500 sq.m. floor space. The consultant suggests to maintain the following standards for the shopping centers or malls –

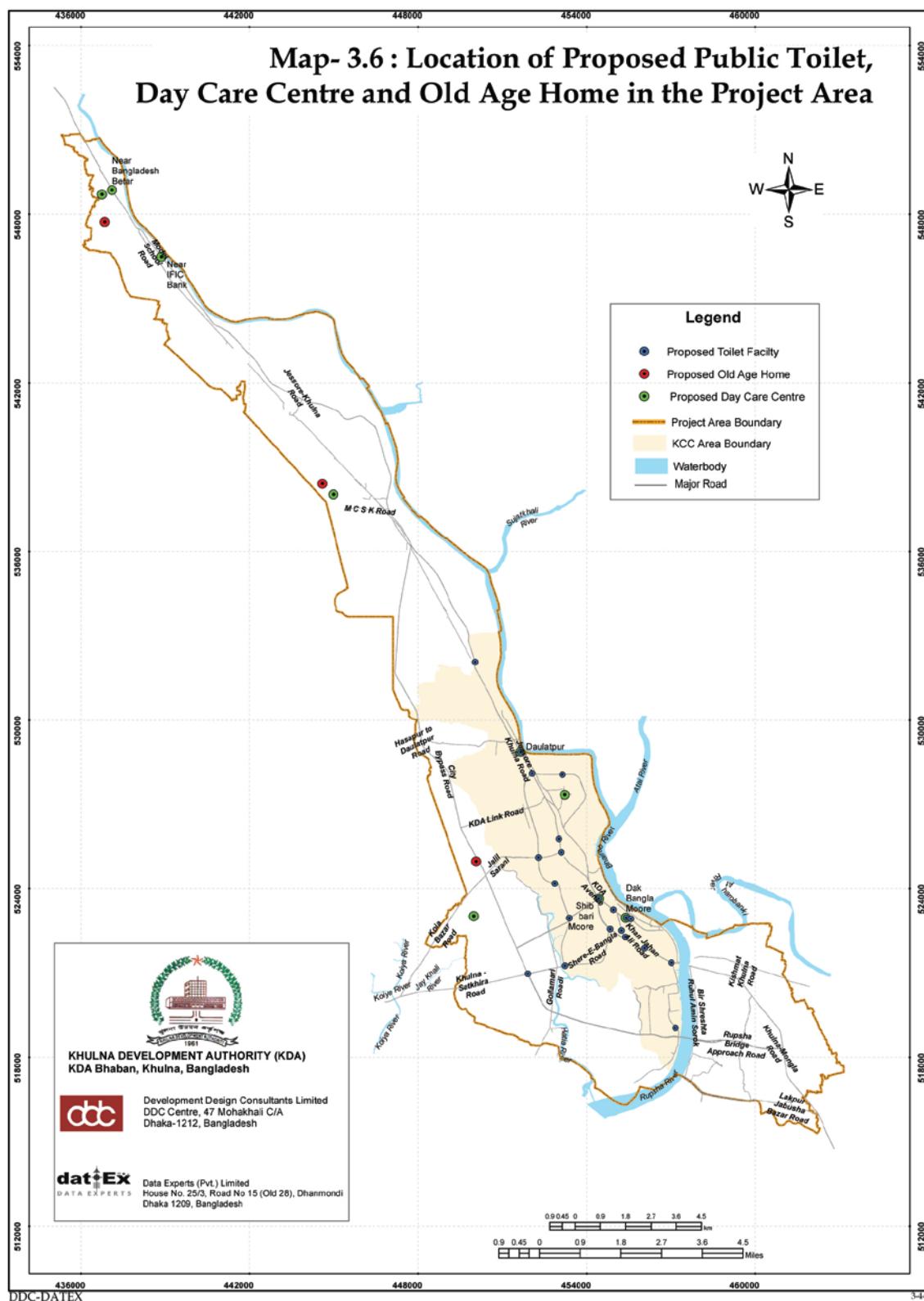
Table-3.18: Design Standard for Toilet

Design floor space (sq. m.)	No. of toilets (equally distributed between male and female)	No. of urinals (for male only)
500-750 (~ 15 shops)	2	2
751- 1250 (~ 30 shops)	4	4
1250-2000 (~40 shops)	6	6
>2001	1 for every 500 sq. m.	1 for every 500 sq. m.

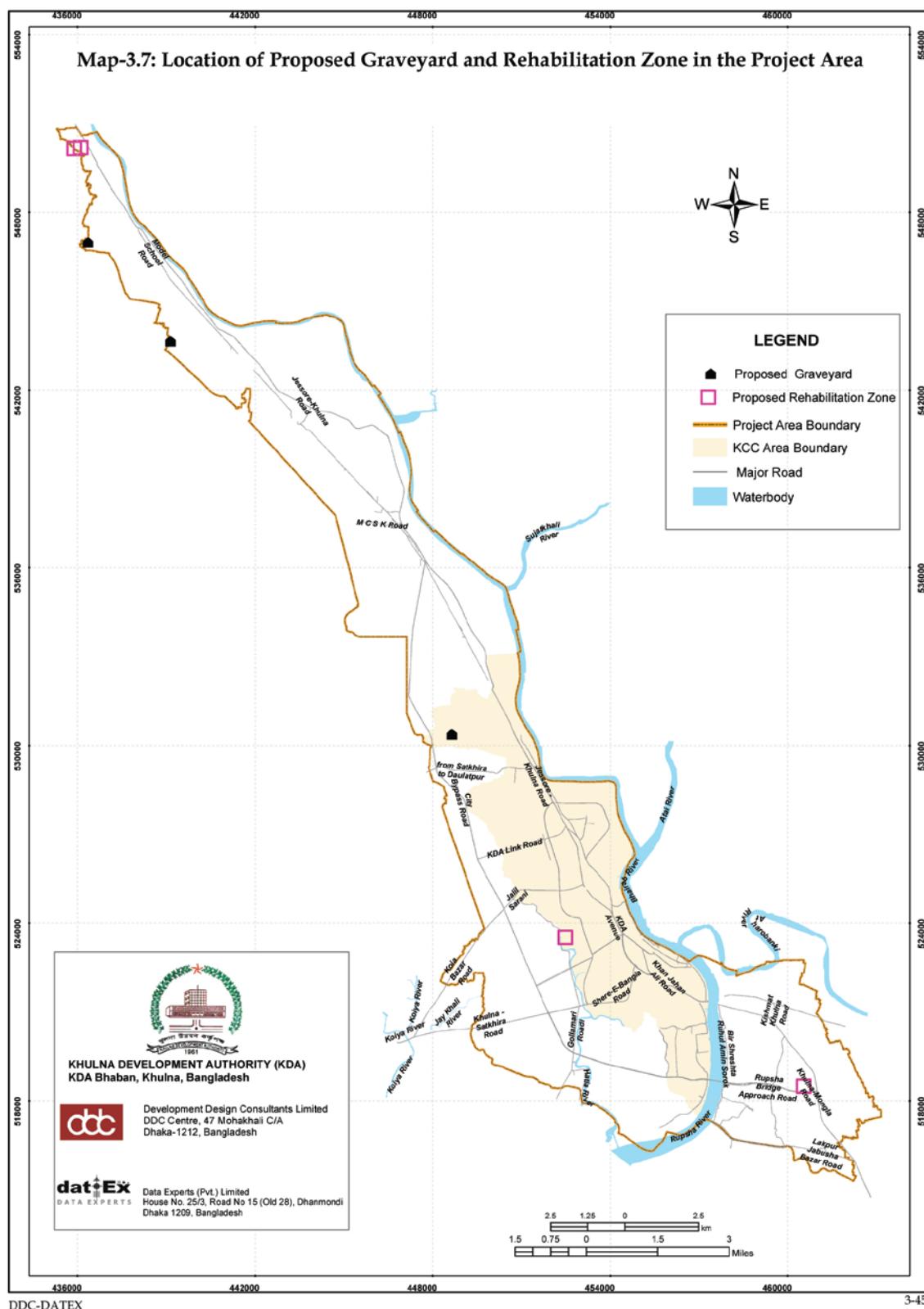
Source: Analysis derived by Consultants

- Because of adverse climatic events, the project area may face severe pressure of rural migrants. Thus it can be assumed that the number of floating populations will increase significantly. The consultant proposes to construct bathing facilities at some specific places where the concentration of these people is high. These bathing facilities can be tagged with the previously prescribed package.
- Many of the big ponds located in the project area are leased out for commercial use. These ponds were previously used by the common people for bathing and washing cloths and utensils. As their access to these ponds is restricted now, more pressure is created on the supply water. The current DADP suggest preserving the natural water bodies over 0.40 acre and keep them open for the public usages.

Map- 3.6 : Location of Proposed Public Toilet, Day Care Centre and Old Age Home in the Project Area



Map-3.7: Location of Proposed Graveyard and Rehabilitation Zone in the Project Area



3.4.6 Open Space

a. 2001 Master Plan Review

Khulna Master Plan 2001, in total, proposed 1970.70 acres of recreational and other green spaces in the present project area. These comprise, park, play field, green space, urban forest, etc. Among its proposals were two metropolitan parks, one playground/stadium, river front and road side green and extension of existing zoo cum park. In total 197.70 acres (80.83 ha) of land was proposed as park.

A sports complex was recommended at Gilatala mouza in Khanjahan Ali Thana, on an area of about 50 acres. This was aimed to train the local youths in different games and sports to acquire skill for participating in national and international competitions. However, lately a BKSP has been developed by the City Bypass west of **Khulna City**. Therefore, this proposal may be withdrawn.

b. Future Need Assessment

For providing open space recreation, the 2001 Master Plan recommended 2.71 acres of open space for every 1000 population as the standard. But none of the open space proposals was executed. The consultant believes that this standard is too ambitious and the development authorities will not be able to preserve the open space according to this standard. The consultant, therefore, thinks that the standard should be lowered. It is proposed to bring down the standard to 0.45 acres of open space for every 1000 population. According to this standard 798 acres of land will be needed to be preserved as open space and recreation by the year 2023 for 16,62,294 populations. Currently, there exist 179 (72.47 ha) acres of recreational open space in the project area. Therefore, additional 619 acres of open space of different categories will be needed to serve the projected population of year 2023 of the project area.

c. DADP Recommendation

DADP prepared a plan to provide parks at two levels, local level and metropolitan level. Local level parks are provided zone wise. One park has been proposed for each planning zone. But in a few zones, adequate vacant land is not available to provide park. In the same way, play field have been provided for each zone. The zone, where free land is not available, provision of play field has been avoided. Each park comprises minimum 5.12 acres, while the area of each play field amounts to minimum 6 acres. In seven zones no park and play field have provided due to non-availability of space.

Three metropolitan level parks have been provided **Table-3.19**. Almost all of these parks are located in the south and south-western periphery of the project area. Other parts of the project area are either not suitable for park or adequate space is not available. As the south and south-western periphery are the most potential for future urbanization, emphasis has been given to those areas.

Additionally, the consultant proposes to open up all the playgrounds located within school premises to the local public after school hours. This will ensure greater access of the local people to the open space.

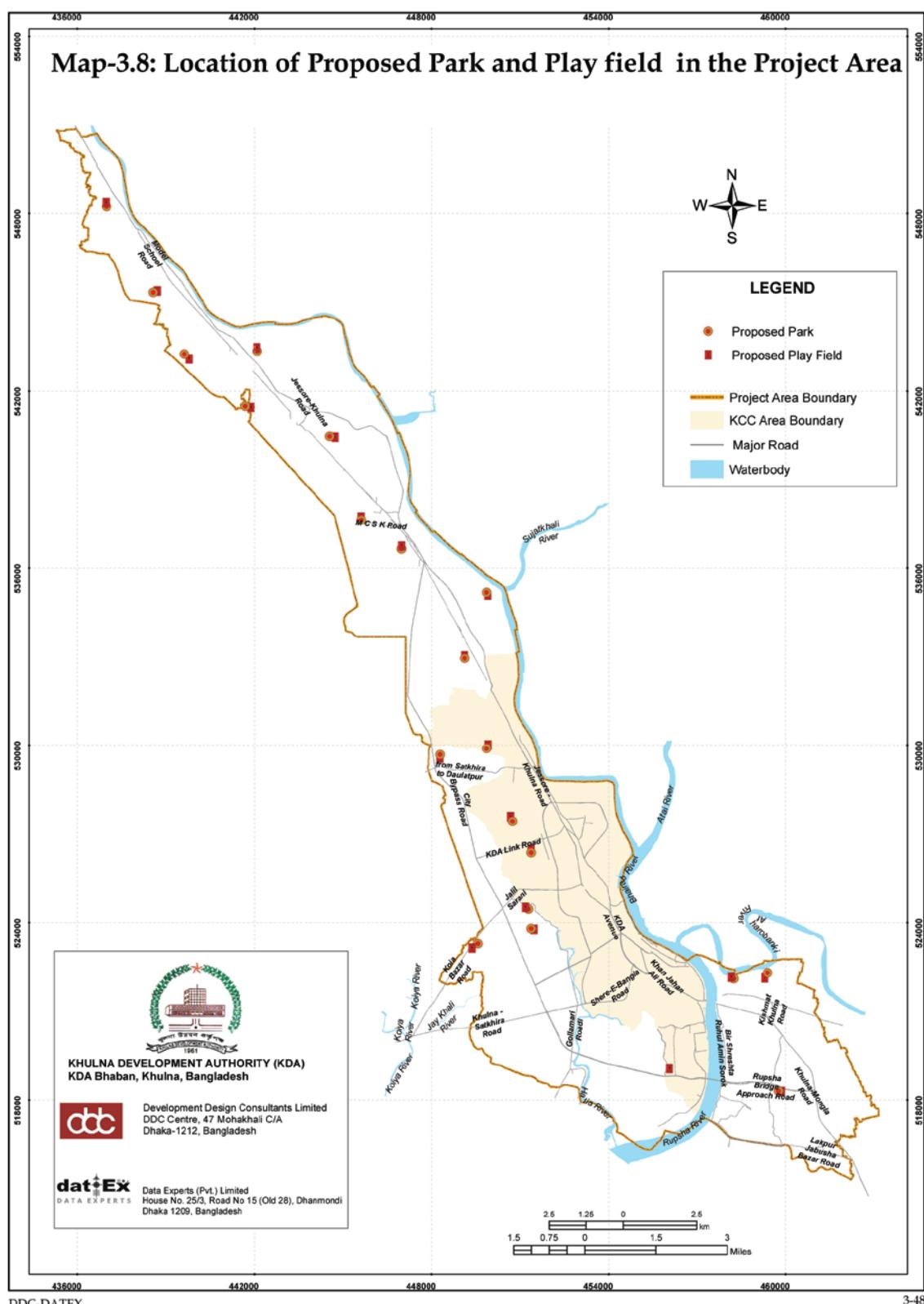
Table-3.19: List of Metropolitan Parks and Play Field

Type of Open Space	Mouza	Area (Acre)
Local Level Play Field (21)	Various	112.88
Local Level Park (20)	Various	114.39
Metropolitan Park	Dighalia	44.24
Metropolitan Park	Jalma	173.57
Metropolitan Park	Gutudia	176.86
Total		621.41

Source: Analysis derived by Consultants

Metropolitan Park will cover a total area of 394.67 acres, while the local level park will take a total land of 226.74 acres. All parks and play fields together (Local Park-114.39 acres + Metro Park-394.67 acres + Play Field-112.88 acres) accounts for about 621.41 acres of land. Adding existing 135.83 acres gives a total open space as 757.24 acres. This satisfies the standard. A list of local level parks and play fields has been provided in **Appendix-3.3.** and **Map-3.8** shows the locations of the proposed parks and playfields.

Map-3.8: Location of Proposed Park and Play field in the Project Area



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3.4.7 Rehabilitation Zone

If the DADP is implemented there will be some displacement of existing settlers. To rehabilitate the evicted people and the land owners, the consultant has suggested an area of about 104.71 acres as rehabilitation zone in three places as shown in **Table-3.16**. These locations are, Gutudia, Naihati and Ward no. 01 (Noapara). Please see **Table-3.16** and **Map-3.7** for details.

3.4.8 Guide Wall, Embankment and River front Road

Guide wall have been recommended along the Bhairab river. A 54.40 km long protection embankment is proposed along the Rupsha-Bhairab River. A road can also be developed on this embankment to ease future traffic movement. Roads have been proposed on both sides of the Mayur river. This is to attain two purposes- to stop river encroachment and to allow enjoyment of the river site by visitors.

3.4.9 Town Centre Development

The town centre or city centre is the nerve point of activities of any urban area. Usually, town or city centres develop spontaneously based on a market place, but they can also be created deliberately to revitalize a city. 2001 Master Plan also made such an attempt to create some town centres. But none of them was executed. In DADP, another attempt has been to create some new urban centres discarding 2001 Master Plan proposals. A town centre will be provided with commercial and cultural activities, shopping, games and sports, cultural and religious congregation facilities. It will provide many urban services that are only available in the core parts of a city.

Because of close proximity of the Sundarbans, **Khulna City** can be the host city for tourists providing accommodation and other services. This will create a symbiotic relationship between Sundarbans and **Khulna City**. Considering this, the consultant proposes to establish tourist information center and hotel facilities at each of the proposed town centers.

Town centres are justified on the following grounds:

- a. They will provide functions to attract people;
- b. They will serve as the focal points for generating economic and social activities and will thus decentralizing urban activities.
- c. Create of agglomeration of economic and social activities to promote local economy through better interaction of buyers and sellers and help generate employment.
- d. Make some urban services and facilities better accessible to the fringe area people.
- e. As demonstration effect they will promote private sector developments in and around town centre and will help grow settlements.

a. 1961 Master Plan Review

The Khulna Master Plan of 1961 also provided town centre in the plan for which 0.28% of the total project area land was earmarked. The town centres were, Daultalpur and Khulna.

b. 2001 Master Plan Review

2001 Master Plan earmarked space for 4 town centres within the current project area, with area varying area from 8 acres to 40 acres depending on the potentiality of growth of the area. The plan

altogether set aside 85.64 acres of land for town centres. But so far, none of these proposed town centres have been executed. All these proposed town centres fall within the project area.

c. DADP Recommendation

i. Hierarchy of Centres

Determination of hierarchy of existing centres within the project area is a cumbersome task. There are two methods of determining the hierarchy of existing centres- from the size of population of the administrative unit where the centre is located and for which population data is available, second through survey of the type and number of existing service sector enterprises in the centre. The prevailing centres in the project area do not maintain any specific administrative boundary for which population data is available. The ToR does not keep provision for conducting any survey to determine the hierarchy of existing centres. Therefore, the consultant is unable to determine the same within the project area methodically.

From visual observation and experience, a number of existing centres of different sizes, within the project area can be observed. Many centres are at the stage of emergence. Dak Bangla and the surrounding area is the largest centre or CBD of the project area. The second largest is the Daulatpur area, followed by highway corridor of Noapara. The smaller centres are, New market area, Gallamari, Nirala intersection, Shib Bari Intersection, Rupsha Ghat area, etc.

iii. Town Centre Development Proposal

The consultant proposed only four new town centres in the project area, and those have been located in most potential areas. Since the town centres have not been proposed throughout the project area the idea of maintaining hierarchy was found not necessary.

Discarding the town centre proposals set by the 2001 Master Plan, the consultant proposes some new town centres considering their potentiality of the project area. Many town centres proposed in 2001 Master Plan were in rural areas that did not have the potentiality to develop as town centres.

So the number has been cut down to half in the DADP and the new town centres have been placed on better places where there is better prospect of development. All the selected areas are on the western periphery of the city. These locations are potential because the city, from Noapara to Khulna will expand west. In total, four town centres have been proposed in the plan as stated in Table-3.20.

Table-3.20: Location of Proposed Town Centres

Town Centre	Area (acre)	Reference Sheet No. (1:3960 scale)	DADP Zone	Mouza / Ward/ Union
Town Centre-1	18.46	B12	DADP-02 GOAKHULA	Ward-6
Town Centre-2	8.92	F06	DADP-12 DEANA	Aranghata
Town Centre-3	19.84	H02	DADP-22 KRISHNANAGAR	Jalma
Town Centre-4	38.43	G04	DADP-14 BEEL PABLA	Gutudia

Source: Analysis derived by Consultants

The town centres will accommodate such facilities as, Shopping, business office, games and sports, cultural activities, food court, Cineplex, religious and cultural congregation, etc. All activities are aimed to attract visitors to the town centre to render make the area and its surroundings a hub

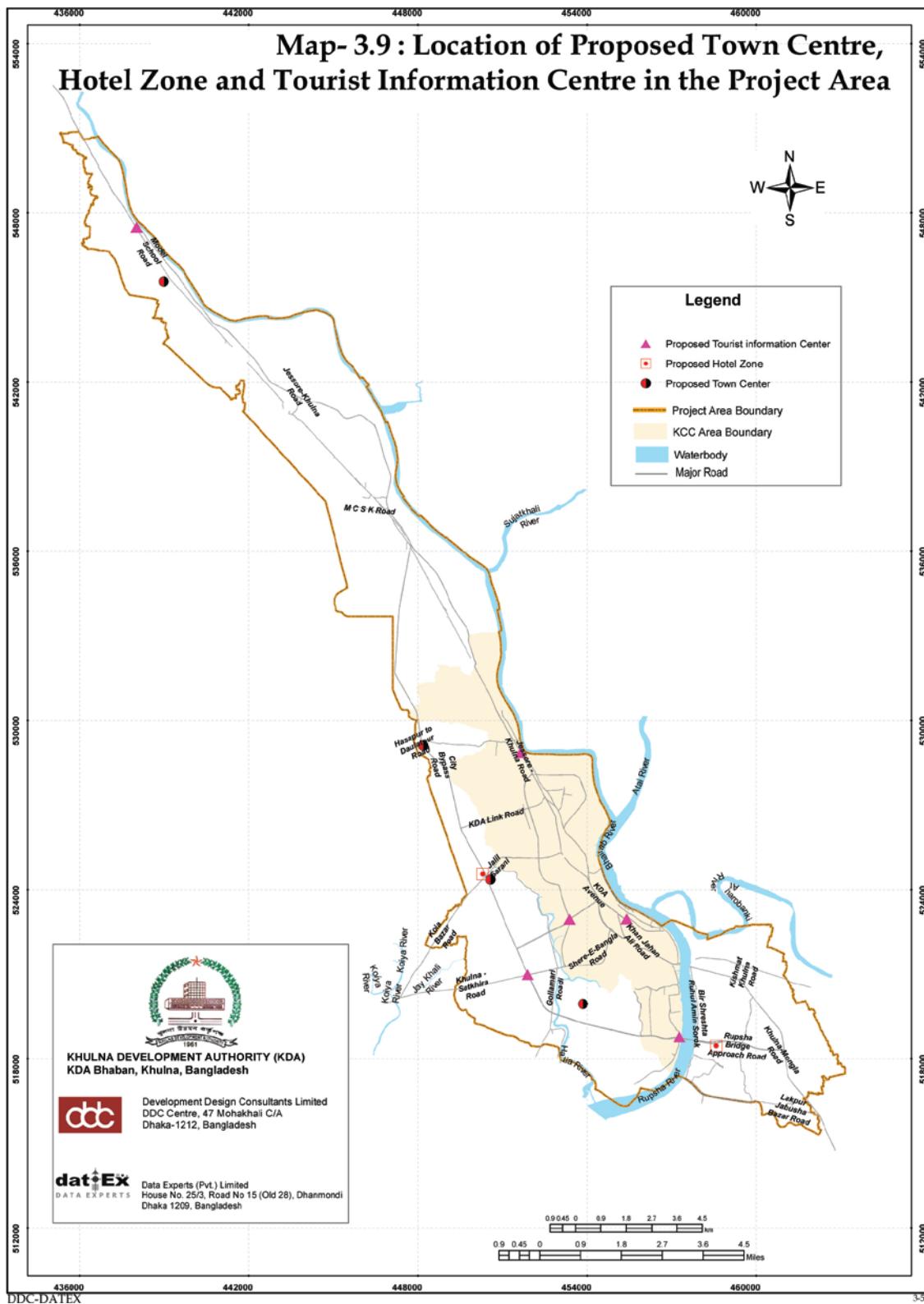
of multifarious activities. The town centre site will have wide roads around for easy traffic movement and parking. They will have good connectivity with the main city and places around the sites. A detailed urban design will have to be prepared for this purpose. **Map-3.9** shows the locations of the town centers.

3.4.10 Hotel Zone and Tourist Information Centre

Two sites have been recommended as hotel zone. These are, one site is near Rupsha Khan Jahan Ali Bridge under Noihati Union and the other in Mostofar More near Boyra. Both the places are potential for city expansion. A total of 8.32 acre land has been allocated for this purpose.

Five places have been selected for setting up tourist information centre. These are, beside Bengal Textile Mills in Noapara, suitable place at Daulatpur, Sonadanga Bus Terminal, any place in Dak Bangla Intersection, near Haque Super Market, Rupsha and Zero Point. Booths may be set up in these places by Tourist Corporation in future to guide tourists coming for visiting **Khulna City** and the surroundings.

Map- 3.9:Location of Proposed Town Centre, Hotel Zone and Tourist Information Centre in the Project Area



3.4.11 SOLID WASTE MANAGEMENT

a. 2001 Master Plan Review

The Master Plan recommendations about solid waste management were as follows:

- Provide additional garbage truck (open/covered body), handcarts, communal bins, tractor trailer, and incinerator. It also called for institutional development i.e. re-organization of the solid waste management service for increasing efficiency through training on solid waste management.
- Introduction of door to door collection system all over the city and storing of solid waste in the nearby dustbins placed at different locations on the basis of distance and households.
- Creation of transfer stations and dumping sites.
- Treatment of medical waste by classifying waste into two groups, hazardous and non-hazardous. Hazardous wastes should be treated by the Incinerator and then disposed off. Hospital or clinic should have its own Incinerator or the City Corporation should have one or more incinerators at different places to treat the hazardous medical waste on payment of charges by the users. Non-hazardous wastes should be disposed of by the City Corporation.
- In the face of expanding city, the plan proposed five new additional dumping sites e.g. Rajbondh (beside the existing dumping site), Aronghata, Chachibunia, Phultala and Karnopur.

The plan also suggested a few scientific and hygienic methods for disposal of solid waste like, controlled dumping system, sanitary land fill system, separation of clinical and hazardous waste from normal waste, waste recycling.

To make solid waste management effective, the Master Plan recommended the following measures:

- Create separate solid waste management organization structure;
- Procure new vehicles for waste collection;
- Procure transport for supervision staff;
- Ensure health and safety of workers engaged in waste collection and disposal operation;
- Community participation and public awareness campaign;
- Management privatization by awarding solid waste management services to NGOs/CBOs;
- Formulation of new legislation on solid waste management.

In the project area, **Khulna City** Corporation area is the main solid waste generator, where about 520 tons of solid waste is generated per day, of which, KCC can dispose of only 275 tons. There are 155 transfer stations spread all over the City Corporation area, wherefrom waste is collected by KCC for final disposal. This waste is carried in containers, trucks and other transports to the dumping site at Rajbandh. The city Corporation has limited capacity to handle all the garbage produced each day. Door to door collection system operates in 28 wards out of 31 KCC Wards. The situation is similar in Noapara Paurashava. The separate disposal system for clinical waste no more exists. **Khulna City** Corporation is currently executing a sanitary land fill project at Matha Bahnga mouza of Batiaghata Upazila under Urban Public Health Sector Development, over an area of about 25 acres. Another land fill project will be at Krishna Nagar Mouza near Gallamari

over an area of 2.50 acres. The third will be developed at Rangpur Mouza of Dumuria Upazila on an area of about 17 acres.

b. Future Assessment of Solid Waste

Master Plan set the standard of 0.50 kg solid waste generated by each person each day in urban areas. Considering the projected population of 16,62,294 persons in the project area in 2023, the total daily solid waste to be generated in the project area will be 8,31,147 kg or 811.47 tons.

c. DADP Recommendation

While KCC is unable to manage currently produced 520 tons of solid waste daily in the city, it would be extremely difficult to manage over 900 tons of solid waste in 2023. Considering situations of solid waste management in two urban local government areas, following recommendations are made:

- Execute all the Master Plan proposals for solid waste management in KCC and in Noapara Paurashava;
- Create effective door to door collection system involving local residents and increase coverage;
- Create more transfer stations, both, in Noapara and in KCC area;
- Increase capacity of the urban local governments with financial resources, logistic and manpower for better handling of increasing solid waste;
- Promote participation of private sector in solid waste management operations.

The capacity of KCC in handling waste has been increased since 2001. It has now 19 transfer stations throughout the city. It is working on two dumping sites. But more effort is needed to face the future challenge of solid waste management. Considering the future need, the consultant proposes a new solid waste dumping site at Noapara Paurashava on 07 acres of land (DADP Zone-01, Noapara mouza, Reference sheet number (1:3960 scale, grid-A13). Apart from this proposal, the current DADP also proposes four new solid waste dumping sites considering the spatial distribution of population and waste generation points. These sites have been placed in such a way so that transport cost is reduced and without hampering the living environment of the surrounding area. These sites should be used as flexibly as possible. Because potential impacts of these sites on public health, water table etc. have not been done under this project. Area of influence should not be taken as a rule of thumb of 500 meters. Based on the air flow direction, geological condition, this area would vary. The consultant suggests establishing waste-processing facilities, broad-based transportation facilities, urban forestry, grave yard etc. A list of these solid waste dumping sites is given in Table-3.21 and Map-3.10.

Table-3.21: Solid Waste Dumping Sites and Recycling Centers

DADP zone	Area (acre)	Sheet reference no (1:3960 scale)	Union/Ward
DADP-01	7.00	A13	Ward-4, Noapara
DADP-05	11.34	C10	Phultala
Adjacent to Project Area	6.92	C11	Savhar Para. Ektarpur
DADP-08	9.99	E08	Atra Gilatala
DADP-21	16.62	G02	Jalma
DADP-24	9.83	JO1	Khajura

Source: Analysis derived by Consultants

DADP recommends that the following method solid waste management should be adopted in Khulna for scientific and hygienic solid waste management. These methods were also recommended by 2001 Khulna Master Plan.

- **Controlled Dumping System**

In controlled dumping method wastes are compacted in layers and covered regularly with 15 to 20 cm thick soil on top each layer of the wastes and finally closed up by a thick layer (1 m approx.) of soil to control and reduce the, odor, breeding of flies rats, insects, etc., scavenger birds, animals, rag-pickers/scavengers, smoke from fires, wind borne litter, and pollution of groundwater aquifers /surface water by leachate/effluent seeping out of the wastes.

- **Sanitary Landfill System**

As an alternative method of solid waste management the Master Plan suggested sanitary land fill. In this method the wastes are spread and compacted in thin layers within small cells having a maximum depth of 1.50 m. to 20 m. and comprising plastic membrane or water tight lining all around the cells to prevent leachate (formed by leakage of rainwater into the wastes) from polluting the surface water and ground water aquifer. Cells filled up with wastes are covered with a layer of soil, which is spread uniformly and then compacted. Thickness of soil cover ranges from 15-20 cm. A final cover of about one-meter of soil is placed over the fills and compacted when the filling reaches final or desired elevation to prevent burrowing of filled up wastes. The plan recommended introducing 'Sanitary landfill' system as a pilot project in Khulna, before going for a regular system.

- **Separate Clinical and Hazardous Wastes Management**

The plan recommended handling clinical waste separately. It recommended installing 'Incinerator' which is the safest way to dispose of hospital and clinical wastes containing pathogenic bacteria and harmful substances. Industries producing hazardous wastes should be treated by themselves and disposed of these wastes safely without causing any environmental pollution and for this purpose work should be coordinated with the Department of Environment.

It suggested installing a common or packaging type incinerator for disposing hazardous and clinical wastes from hospitals and clinics and charging the beneficiaries to recover service charge.

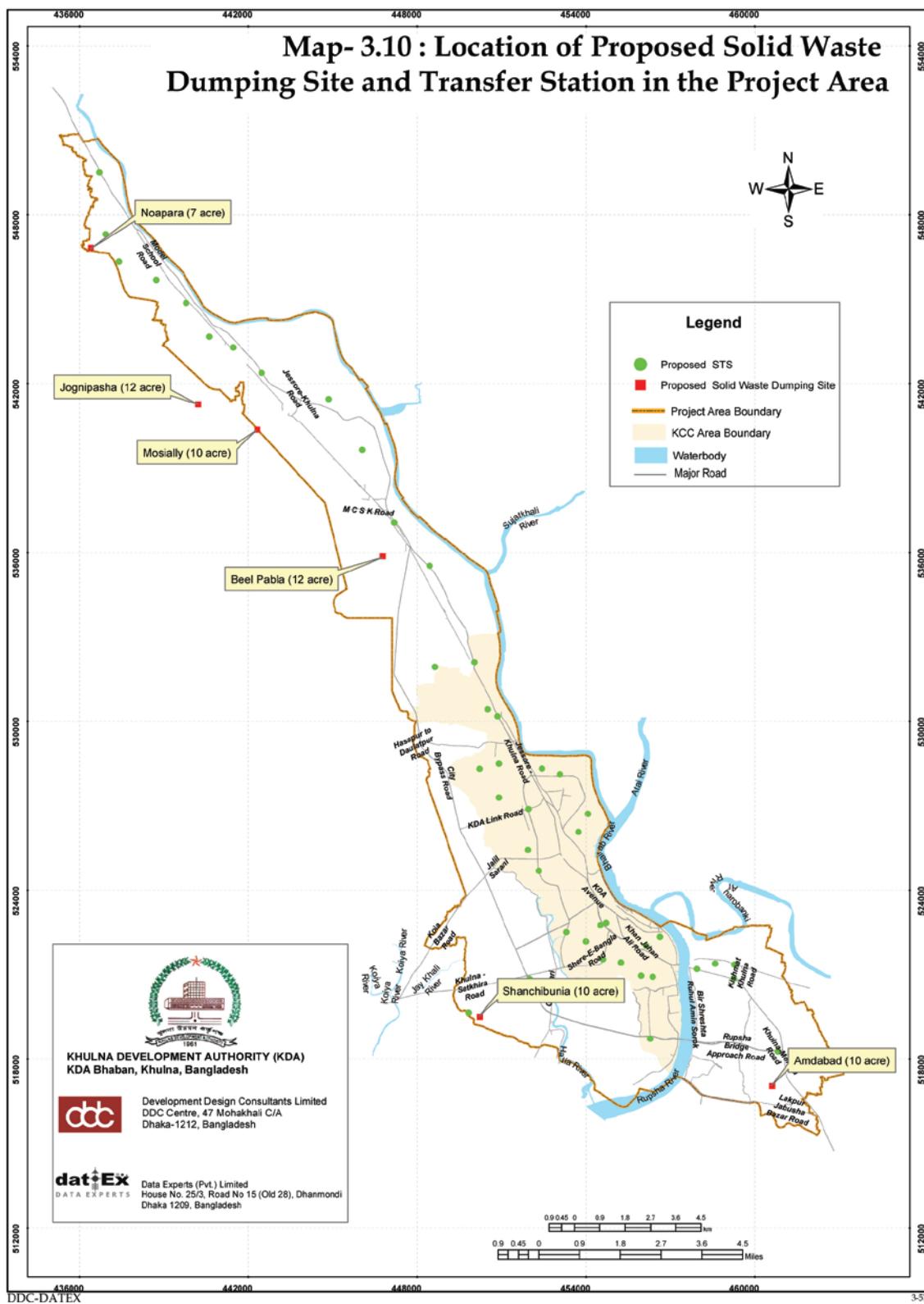
- **Waste Recycling**

Resources can be generated by separation of reusable and recyclable wastes e (e.g. glass, tin, iron, aluminum, wood, papers, cans, plastic and rubber materials, etc.) at initial stage of primary

and secondary collection points or at disposal sites. This method will accrue the following indirect benefits:

- it will generate source of income for poor rag-pickers/scavengers,
- reusable/recyclable materials may be recovered which will reduce the volume of wastes and extend the life of the disposal site,
- vegetable waste may be composted in composting plant to produce manure for agricultural firms and gardens,
- Methane and carbon dioxide gases may be produced from the wastes and can be used for local domestic cooking and heating purpose in small scale.

Map- 3.10: Location of Proposed Solid Waste Dumping Site and Transfer Station in the Project Area



3.4.12 WATER SUPPLY

3.4.12.1 Khulna City Corporation

a. 2001 Master Plan Review

The Master Plan made the following recommendations about future water supply:

- The plan expected that extension of water supply through pipe system, public and private hand tube wells within KCC area. It called for investigation on new groundwater sources and potential surface water resources as future water supply system in and around **Khulna City** e.g. exploration of potentialities of new sources of shallow and deep aquifer, collection of surface water from river during monsoon season and transfer to the **Khulna City** water supply system
- Use of surface water from Beel Dakatia near **Khulna City** as a storage reservoir and transfer to the **Khulna City** water supply system.
- It was proposed to construct one Surface Water Treatment Plant using water resources from rivers and storage reservoir/retention basin.
- The plan proposed extracting sweet water from Majitkhali River and carries it up to Gilatala across the river Bhairab and builds two treatment plants for supplying fresh water to meet future water demand of the city.
- It was proposed to build one retention basin at or near Alutala regulator. It expected to release and re-circulate into the city water supply networks, the vast quantity of drainage water through the regulator.
- Explore potentialities of rainwater and its usage.
- Creation of an independent body like Dhaka and Chittagong WASA with proper organizational set-up to handle a sophisticated and highly technical work related to water supply.
- For extended area, the supply to be largely based on individual hand tube well for some time. In case the density increases fast, a production well based network system can be developed with the help of DPHE.
- Noapara Paurashava was recommended to develop package type pipe water supply system with production tube well.
- Package type piped water supply system has also been proposed in Fultala and Rupsha area considering them as growth centres, rapid growth of population and expansion of **Khulna City** and demand for potable water.
- Surface water Treatment Plant at Shiromoni, using surface water from the nearby rivers was proposed, to treat the surface water and feed into the KCC water supply network.

b. Existing Condition Assessment

At present, the percentage water supply for Khulna is mainly from ground water source drawn from both deep & shallow tube wells. The depth of shallow aquifers varies from 0 to 100 meters. The deep aquifers are generally available from 150 to 300 meters. Shallow aquifers are recharged

annually by rainfall and flood water at or near the point of abstraction. As future water supply policy, therefore,

- Present water supply in **Khulna City** is drawn from ground water, both shallow and deep aquifers. The shallow aquifers are extended towards north and well developed to the west of Dumuria. The depth of shallow aquifers varies from 0 to 100 meters, while water in deep aquifers is available from 150m to 300m. In some places shallow aquifers show salinity intrusion. Water from deep aquifers is better and drinkable. Arsenic concentration in the ground water is below the admissible range. However, iron and manganese concentration in some places exceed the admissible range. The deep aquifer ground water resources in Khulna and its vicinity is very rich and potable. The area contains large volume of ground water which is recharged annually. The recharge is estimated to be (a) 80 MLD plus an undermined deep ground water flux from west and (b) 159 MLD in December 2010 (IWM Study as a part of ADB TA Project No. 7386). Both KWASA and private owners of Tube wells shall keep the present abstraction flow in future.
- KWASA shall take care of necessary facilities for necessary water resource development to meet the future water demand
- The Rupsha and the Bhairab are the two perennial rivers that supply surface water to the project area. Salinity in the rivers increase during dry season. Rupsha has long been subject to salinity intrusion, which is gradually penetrating deep into the inland threatening the Bhairab. Survey points, around Khulna reveal chloride concentrations exceeding the standard value of 100mg/l continuously up to the middle of June. In Rupsha the highest Chloride (mg/l) was found 9,000 in April, 2010 and the lowest was 5,200 in the same month of the year (JAICA Study Team Salinity Monitoring Result, 2010).

As long term policy to meet increasing water demand KWASA has undertaken a mega-water supply project for Khulna at a cost of Tk. 25.58 billion. Under the project, water would be brought to the **Khulna City** by pipe from the river Modhumoti at Mollahat. A water treatment plant would be constructed with a capacity of 110 million liters per day at source. Besides, 11 water reservoirs and 5 underground reservoirs would be constructed in different places of the city. About 750 kilometer distribution and connecting lines of different sizes would be installed. The project will also connect 75,000 domestic subscribers. The project is expected to be completed by 2017. "Khulna Water Supply Project" will cost of Tk. 25.58 billion, with Tk. 22.84 billion funded by JICA, Tk. 52.3 million by ADB and remaining Tk. 7.5 billion would be provided by the government.

c. Future Need Assessment

KWASA estimated per capita domestic water demand for **Khulna City** in 2020 as 105 lpcd. Since the DADP expires in 2023, we assume the per capita daily water consumption for that year as 106 lpcd. Considering this standard, the demand for water in **Khulna City** in 2023 is estimated to be 13.76 million liters per day for its projected population of 12,95,787.

d. DADP Recommendations

- The water supply systems for **Khulna City** and adjoining areas should be from both the sources: Ground water and Surface water. Development of both these sources should be continued.

- The Long Term Development Plan consisting of new surface water Treatment Plant (capacity: 110 MLD) along with Intake at Mollarhat at Modhumati river, Impounding reservoir, Raw & Treated water Transmission pipes which under implementation with co-financing JICA, ADB and GoB should be completed as scheduled.
- Long Term water supply Development should be planned to meet the water demand beyond the year 2025 & for the year 2050.
- Metering of all connections should be introduced as soon as possible to minimize the water wastage.
- Awareness Campaign should be carried out by KWASA, KCC to motivate people not to waste drinking water.
- As per estimation there will be a demand of 251 million litre in 2023. KWASA can presently supply 102 million litre, and 110 million additional supplies will come from the new project. These together will provide 212 million litre of water each day. There will be a gap of about 39 million litre, which can be met by hand tube wells. So the new surface water project will substantially solve water supply problem in the city. Moreover, this will be a sustainable source of supply. It will also reduce withdrawal of ground water leading to quick recharge of the water table.
- Mayur River is the most important and the largest water reservoir in the city. It is urgently needed that this resource is preserved for an alternative source of drinking water, a breathing space and a place of recreation for the city dwellers. Appropriate measures are necessary to prevent pollution and sedimentation of the river, apart from encroachment by the riverside land owners.
- With the continuous extraction of ground water, its storage will be in a vulnerable state in future when the demand from increased population cannot be supported with this only source. Because in all big cities the rate of extraction of ground water is more than the rate at which it is extracted. As the run off area in the urban area increases with the increased rate of urbanization, sufficient rain water cannot penetrate into the aquifer to recharge it. Therefore, it is wise to look for alternative ways to meet increased water demand, instead of depending on ground water only. This can to some extent reduce pressure on the ground water. In Dhaka it has already been made mandatory to keep provision for rain water harvesting in high rise apartments. Similar measure may also be taken for **Khulna City**. Provision for rain water harvesting in apartments 10 storied may be made mandatory in Khulna. This may be executed through incorporation of the provision in the 1996 Building Construction Rules.

3.4.12.2 Noapara Paurashava Water Supply

3.4.12.2.1 Existing Water Supply Review

The source of Noapara Paurashava water supply is groundwater. The existing water supply system consists of -

- two production deep tube wells with submersible pumps one each at Bengal gate with approximate specific yield 16 cubic meter per hour of each,

- distribution of pipe line 13.5 km (200 mm dia: 0.558 km, 150 mm dia: 4.689 km, 150 mm dia: 8.245 km), 38 mm hand tube wells (HTW): 5200 nos. and deep tube well (DTW) 76 nos. The piped water supply generally covers ward no 4, 5 and 6 only.
- Limited Coverage of Piped Water Supply and no overhead Tank in the system

3.4.12.2.2 Future Water Demand Assessment

Taking 100 lpcd as the standard domestic water consumption daily, in 2023 the total water demand for Noapara's projected population of 108 and 44 will be 10.80 million liters each day.

3.12.2.3 DADP Proposal for Improvement

Following are the recommendations for improvement of Noapara water supply:

- Piped water supply should be extended to the most of the areas of Paurashava.
- More production deep tube well, distribution pipe line & overhead tanks should be provided to cater for future water demand.

3.4.13 DRAINAGE

3.4.13.1 2001 Khulna Master Plan Review

The Khulna Master Plan 2001 observes, about 68% of the household have no planned drainage facilities in and around their premises and only 32% have some sort of drainage facilities. The existing drains in KCC area discharging into the nearby Khals, rivers, low-lying areas and beels. The road between Rupsha Bus Stand, embankment along the Rupsha at Shipyard and Labonchora area serve as a town protection embankment which protects the eastern area of KCC from river flood. BWDB constructed 6 regulators and 8 sluice gates and, one 10-vent sluice gates located at Alutala which helps to drain out storm drain for KCC area.

The plan divided the entire KCC area into ***five drainage zones*** and identified ***nine water logging areas*** were identified in the Master Plan. These are Natun Bazar, Rupsha, Tuatara, Shipyard areas, East Bania Khamar, Boyra, RayerMohal, Khan-a-Sobur road (in front of KDA building), Nodal point of Khan Jahan Ali & KDA Avenue (nearby and surrounding Royal Hotel).

The ***reasons of water logging*** as mentioned in the Master Plan are:

- Improper operation & maintenance, and, blockage of Khals, drains,
- Absence of integrated network comprising secondary and road-side drains,
- Haphazard expansion of the regional settlements which obstructs the natural drainage system,
- Uncontrolled and haphazard disposal of solid waste into the drainage system,
- Siltation in the drainage channels with consequent reduction of discharge capacity.

3.4.13.2 Major Recommendations of the 2001 Master Plan

- Preparation of a comprehensive Drainage Master Plan for the city. This Master Plan should include: survey of existing drain and culverts, assessment of extent and frequency of flood damage to the flood affected areas, design of primary, secondary drains and retention areas required, feasibility of the proposed drain works, planning of implementation phases including

funding mechanisms for construction phases as well as operation & maintenance of the system, and, selection of realistic return periods.

- Taking mitigating measures against sulage flow, septic tank effluent and other locally contaminated water through awareness campaign; provide better sanitation to low income groups through construction of pit latrines, protection of outlet drains by providing oil and silt trap, trash racks and sumps in some of the main drains.
- Drainage system to be designed based on gravity flow & pumping should be avoided as far as possible.
- Future drainage system to be west wards and towards Khulna-Jessore drainage rehabilitation project area.
- Any proposed drainage improvement plan to be justified technically, economically & socially. Priority program should be recommended for implementation.
- Improvement in respect of solid waste management and household sanitation. KCC should take immediate steps to remove the unauthorized structures like earthen barriers, small culverts etc. from drainage paths/Khals and ensure clear right of way.
- KCC should be the Implementing agency for drainage improvement project. A high degree of close co-ordination with DPHE, BWDB, LGED and PDB and other utility organizations should be maintained during project implementation stage. Cost of drainage improvement project should be founded as grant to KCC or by Aid Giving Agency. Lay pipe drain where road is narrow, and, where there is no space for road side drain.
- The widths of some khals have been reduced due to rampant disposal of waste and encroachment by khal side land owners. Surimarkhal and Motirkhal are the examples. The responsibility of protecting these khals can be rest with KDA or KCC.

2001 Master Plan recommended for the preparation of a Comprehensive Drainage Master Plan for KCC. It also mentioned about the existing drainage system, drainage problems, and made some recommendations for its improvements. This Drainage Master Plan was prepared by KCC in 2011. Some of the projects based on this Master Plan have already gone for implementation. Hope this will solve many of the city's drainage problems.

3.4.13.3 Existing Drainage System

Khulna City has developed in linear pattern running north – south and parallel to the Bhairab-Rupsha Rivers running parallel to the main built-up areas. The city drains both to the east and the west with the water shed being provided by railways embankment and Khan Jahan Ali road. On the eastern side, a long narrow strip of land about 9 sq. km. drains directly into the Rupsha / Bhairab River. The major part of the City, however drains westward into the Hatia / Mayur River and Khudir Khal. The change in the elevation between the railway embankment and the Mayur River is an average of 2 meter PWD above MSL.

The existing drainage system of **Khulna City** consists of major outlet channels such as Hatia River, Mayur River, Khudir Khal, Rupsha / Bhairab River & 13 nos. link canals (Khals) such as Charichara Khal, Motiakhali Khal, Khatrokhali Khal, Haringhata Khal, Tamuzuddin Khal, Nirala

Khal, Mandar Khal, Taltala Khal, Batkamari Khal, Rayermohal Khal, Bastuhara Khal. The drainage system also consists of nine control structures/Sluice gates such as Custom Ghat, Fish landing, Rupsha Ghat, Matiakhali, Labonchora, Alutala.

The existing drainage network consists of about 1166 km drain of which about 1124 km is pucca and 41.48 km katcha. Almost all of the pucca drains are made of reinforced concrete, and a few are made of brick. The width of the drain varies from 0.50 m to 5 m and mostly from 0.50 to 1 meter. The existing drainage system is not adequate to meet the present need, and the drainage coverage is low. It is only 57% of the city area.

3.4.13.4 Drainage Zone, Pattern of Drainage and its Problems in KCC Area

The 2011 Drainage Master Plan of **Khulna City** Corporation divided the whole KCC area into six drainage zones based on topographical features, existing internal network of khals and river system. The pattern of drainage and the drainage problems are illustrated below.

Zone-1: Long and Narrow Strip of Flat Highland along the Bhairab and Rupsha River (Right Bank)

Drainage Zone-1 is a long and narrow strip of flat high land along the right bank of Bhairab and Rupsha rivers stretching along north-west to south-east directions. This zone consists of core and urbanized area containing 15 wards (2, 3-part, 5-part, 6-part, 7, 8, 9-part, 10, 11, 12, 13, 14-part, 15, 16-part, and 21). Total drainage area under this zone is about 12 sq.km.

Topography of this narrow strip can be described by elevation decreasing towards west and south direction. The range of elevation in this zone lies between 4.2 m and 2.7 mPWD above MSL. The drainage water is discharged into the adjacent rivers (Bhairab and Rupsha) through BWDB sluices/regulators lying on the embankment cum road. General slope of the area is from east to west and lateral slope is from north-west to south-west direction. Several Jute mills, other industries, educational and residential areas are located in this zone.

Most of the areas of the zone are subject to flooding, particularly, Ward Nos. 7, 10, 11, 12 and 15 are mostly flooded during high tide and monsoon. The drainage coverage is only 40 % in Ward No. 2. Drainage coverage is in between 45% to 60% in other wards. Reasons of flooding are, inadequate internal drainage, siltation of outlet drains/channel to the Bharab / Rupsha River, poor maintenance of sluice gate. Due to these reasons, during high flood water from adjacent river enters in this zone and causes flooding.

Zone-2: Western Central Part

This zone is on the central west part of the city with a total area of about 16 sq.km. This zone has more pucca drains in the relatively urbanized eastern part, adjacent to Drainage Zone-1, while the western part of this zone is low marshy land that covers Ward No. 4, 5, 6, 9, 14, 16 and 17.

Topography of this zone includes low lying areas with as low as 0.3 m PWD above MSL to as high as 3.6 m PWD above MSL. Drainage water is discharged into the Mayur River through some khals. New Market, Boyra-Mohila College, Divisional Stadium and BDR camp are important establishments in this drainage zone. This zone has large areas of flooding like, Deayana Pashimpara in Ward No. 04, Choto Boyara and Rayer Mahal in Ward No. 16; Mujgunni Housing and Bastuhara area in Ward No. 09 and western part of Ward No. 16 adjacent to the Mayur River.

Bastohara khals located in this zone and is connected to Khude Khal via Pabla. This khal is being silted up and gradually losing its capacity. Main reasons of flooding are siltation of major channels such as, Khudiar Khal and the Mayur River and lack of drainage maintenance. Ward No. 16 has only 40% drainage coverage, while Ward Nos. 5 and 6 have 55% and 50% drainage coverage only.

Zone-3: North Western Part

Zone-3 consists of two Wards-Ward No. 1 and 3. This zone extends up to the **Khulna City** By-pass road and comprises areas, like, Moheshwar Pasha, Telegati and part of Beel Dakatia.

Topography of this area can be described by consisting areas with elevation 3.90 m and 0.30 m as highest and lowest zones. The area drains its water to Beel Dakatia through some canals. KUET, Agricultural College, TT College, Mohsin College are the major establishments within this zone.

Area is 23 sq.km. Ward No. 1 and 3 are located in this zone. This zone comprises, Maheswarpasha, Telegati and part of Beel Dakatia. These areas drain into Beel Dakatia through local khals. The drainage problems of this zone are caused by siltation of existing khals, like, Boroitala and local katcha drains. Drainage coverage is 35% and 60% in Ward No. 01 and 03 respectively.

Zone-4: South Central Part

This zone is located on the south of Zone-02 and covers one of the most urbanized areas of KCC covering Ward No 18, 19, 20, 23, 24, 25, 26 and 27. This Zone has a good network of pucca drains. Elevation of this area varies between 2.7m to -1.2 m PWD above MSL. General slope of the area is from north-east to south-west direction, which means, the drainage water ultimately goes into the Mayur river through various drainage canals. Gross area of this zone is about 3.5 sq.km. Drainage water flows into Mayur River on the western through various drains and channels such as Nirala Khal, Charichara Khal, etc.

This zone also has flooding problem during monsoon. Major flooding areas are, Gallamari in Ward No. 24, Nodal point of Khan Jahan Ali Road and KDA Avenue (nearby and surroundings Royal Hotel) Tutpara, West Tutpara, Tutpara, Monirbari khal par , East Bania Khamar. About 38% of the households of the Ward No. 20 experiences short term water logging, though this ward is well protected by embankment. Siltation of the Mayur River, outlet khals like, Nirala and Charichara khals and others, blockage of out let channels and drains and improper maintenance are the main reasons for flooding.

Zone-5: South-Eastern part

This zone is located on the southernmost part of KCC area. This zone accommodates important establishments, like, Shipyards, Rupsha Bus Stand, Rupsha Bridge, City Corporation, Zila Parishad, High Court, and Zila School. The zone has many pucca drains. Wards Nos. 21, 22, 23, 28, 29, 30 and 31 are located in this zone. Gross area of this zone is about 10 sq.km.

Elevation of this area is between 2.7 m and 0.5 m PWD above MSL. The general slope is from north to south. Drains mainly discharge into the Rupsha River. This zone has some water logged areas in Nuton Bazar, Rupsha and Toot Para.

In this zone the primary drainage channels are not functioning properly due to siltation and improper maintenance. The sluice gates are also not functioning properly due to poor maintenance. Major flooding areas of this zone are, Natun Bazar, Rupsha, Bari Band area, Rupsha Shipyard area, Labonchora. In Ward No. 30 and 31 about 94% of the households are affected by water logging. During rainy season drain water cannot be discharged into the Rupsha River from most of the areas of this zone due to the river water back flow. Back flow is caused by mal functioning of sluice gates. Drainage coverage fairly good in this zone.

Zone-6: A Strip on the Western side of KCC (Extended Area)

This zone mostly covers the extended area of the project area. This zone is along the eastern side of **Khulna City** By-pass road and mostly on the right side of the Mayur River and its branches. Khulna University Engineering and Technology is a major establishment in this zone. Other areas are Gilatala cantonment, Gilatala Zoo, Shiromoni Cable factory, Beel Dakatia Area. Part of Bastuhara khal, Bil Pakkha, Taltala, Narikalbari Khal and Harintana khal are located in this area. Most of the area is low and un-developed marshy or cultivated land. Elevation varies from 1.2 m to 0.3 m PWD above MSL. Gross area of the zone is about 14 sq.km.

This zone also has large water logged areas. The major drainage problems of the zone are, lack of pucca drains, siltation and encroachments of natural khals.

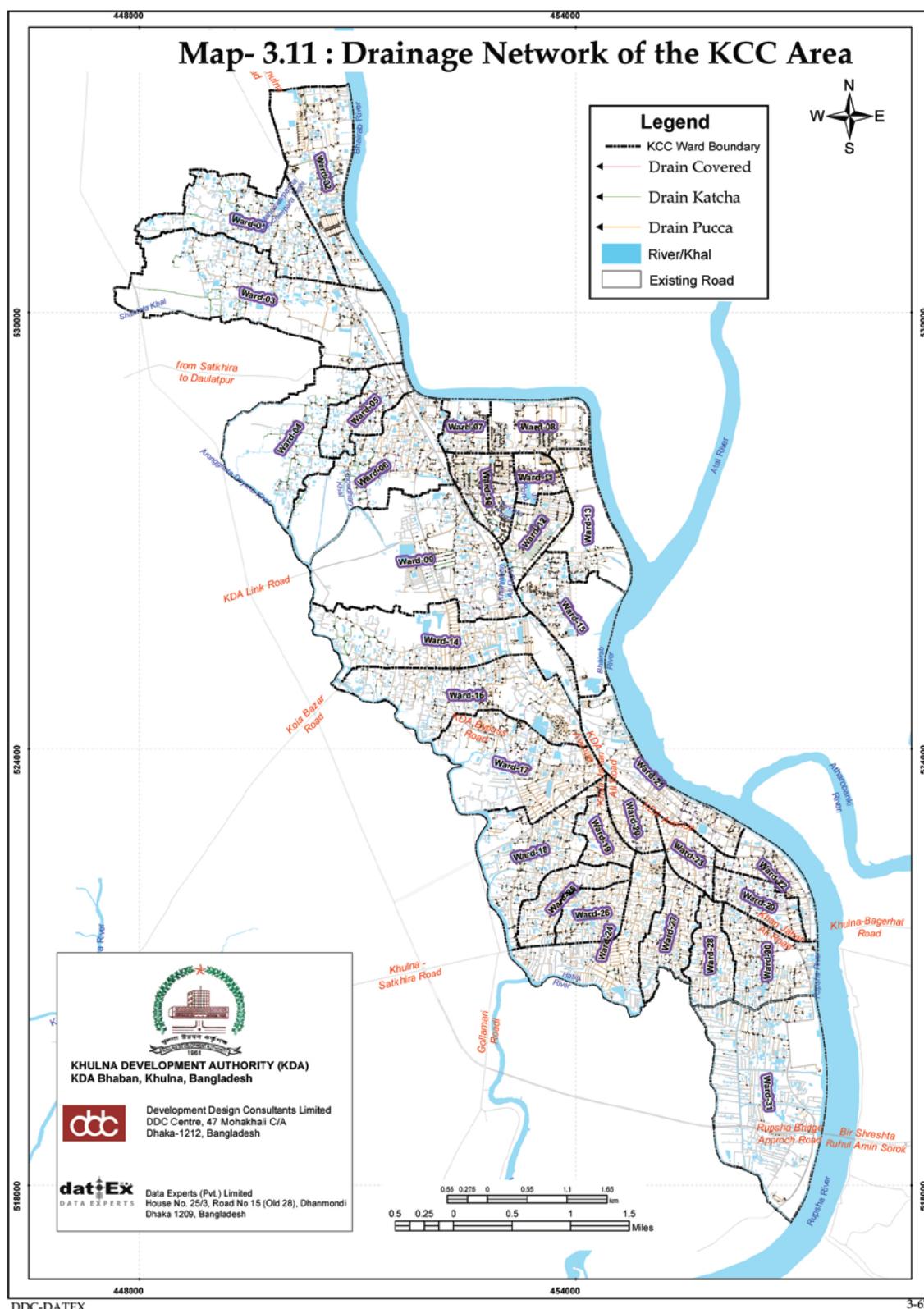
3.4.13.5 Existing Natural Outlet Channels and Interlinked Canals

Natural drainage areas include marshes, water bodies, natural canals, beels, baors and other selected undeveloped low lying areas. Some areas may be retained with little or no modification, while the ecological condition of other natural areas may require considerable alteration. These are Hatia river, Mayur river, Rupsha river, Bhairab river, Khudir Khal, Charichara Khal, Matiakhli Khal, Shurimari Khal, Bagmara Khal, Mistiripara Khal, Tootpara Ghat Khal, North Khal, Harintana Khal and Batkimari Khal, Khatrokhali Khal, Lobonchara 1 no. sluice gate Khal, Lobonchara 2 no. sluice gate Khal, Nirala Khal, Taltola Khal, Bastohara Khal etc.

The Mayur River is one of the major outlet drainage channels through which a large volume of water, both, from urban Khulna and adjacent Beelpabla and Beel Dakatia areas is discharged into the river Rupsha. The Mayur River is the main drainage channel for the eastern part of Polder 28/2, via a 10-vent sluice at Alutola. Moreover, a number of interlink outlet channels connect to this river. So this river drains out excess water from most of the urban area as well as from the vulnerable Beel Dakatia.

Most of the existing outlets& linked channels are not functioning properly. Significant portion of these channels are encroached by the land grabbers. A full-fledged dredging, re-excavation and bank lining are essential to continue the natural flow of the channels to open up them and serve effectively as drainage channels and to meet the drainage needs of the area. Unplanned physical development activities are causing encroachment on these water bodies, water courses and rural drainage, reducing retention basins and the drainage capacity. Unplanned development activities are also creating obstacles to natural drainage capacities of the existing khals and water bodies causing long-lasting flood in inland areas and creating ecological imbalance. The peripheral water level in the Rupsha-Bhairal is also one of the major causes of drainage congestion.

Map- 3.11: Drainage Network of the KCC Area



3.4.13.6 Water Logging/Flooding

The lack of the comprehensive and integrated approach to drainage and flood management in **Khulna City** and the other urban area within the catchment area of the Rupsha-Mayur-Hatia-Bhairab river system has led to a large part of Khulna being susceptible to regular flooding. This includes most of the built-up area in between the river of the Rupsha and Mayur including the much of the commercial core and many of the residential area which experience regular and extensive flooding during monsoon season.

Major inundated areas associated with drainage congestion are: Maheshwarpasa (Ward No. 03), Deayna Paschim Para (Ward No. 04), Mujgunni Housing, Bastuhara (Ward No. 9), Choto-boyra, Rayer Mahal (Ward No. 16), Natun Bazar, Rupsha Beribadh area (Ward No. 22), Gallamari (Ward No. 24) nodal point of Khan Jahan Ali and KDA Avenue, Tutpara, West Tutpara, Tutpara Manir Bari, Khan Para, East Baniakhamar (Ward No. 27), Rupsha Shipyard area, Labanchora (Ward No. 31), (KCC Drainage Master Plan, 2011).

Altogether some 70% of the city is identified as prone to flooding and 9% being flooded more than 10 times every year (STIFFPP-2). The Khulna Master Plan (KDA March, 2001) identified the entire Khulna Sadar and large parts of Khalishpur Thana being prone to regular flooding with almost two thirds of households having no proper drainage in and around their premises. 40% of slums households experience severe or regular flooding.

The impact on Khulna's drainage condition was assessed by the Study, "Adapting to Climate Change strengthening the Climate Resilience of the Water Sector Infrastructure in Khulna Bangladesh (ADB TA No. 7197 BAN, 2008)". According to the assessment of the study, water logging is expected to become more serious with climate change due to increased rainfall intensity and increased out fall water levels causes by rising sea levels. As a first step in this study impacts on Khulna's drainage conditions were assessed by two assumptions: a) Future economic development, b) No improvement in the drainage system.

According to this assessment, the water logging area with damaging water depth (higher than 30cm) increases from 29% and to 34% for the year 2030 and to 54% for the year 2050 for a 1 in 10 year flood event. The average water depth in the area of damaging floods increase for 41cm in the base case to 49 cm in 2030 and 63cm in 2050 under the 1 in 10-year flood event.

Capacity and gravity of existing drainage channels are not sufficient to carry out the excessive rainwater that usually occurs during the monsoon. Besides, inadequate drainage sections, absence of inlets and outlets, absence of drainage outlets, lack of proper maintenance hampers the natural flow of water. Water remains stagnant for long time on roads and built-up areas creating water logging. Most of the katcha drains are close ended without any outlet. The reasons for water-logging have been identified as following: (i) improper operation and maintenance of khals/drains. (ii) blockage in the existing khal/drains, (iii) absence of integrated network comprising secondary and roadside drains, (iv) haphazard expansion of the settlements which obstruct the natural drainage system, (v) uncontrolled and haphazard disposal of solid waste into the drainage system, (vi) siltation in the drainage channels with consequent reduction of discharge capacity. (vii) Construction of structures in areas lowers that the peripheral water level. (viii) High water stages in the outfall Rupsha especially during the monsoon.

3.4.13.7 DADP Recommendations

a. Operation & Maintenance of Drainage System

KCC drainage maintenance is handicapped by difficulties in gaining access to major drains due to large concrete slabs; lack of excavation of the major out flow canals; the poor condition of many existing drainage; filling due to indiscriminate disposal of solid waste and limited institutional capacity. The maintenance operation of drainage can be improved significantly undertaking the following measures by KCC.

- Enhancing the management and productivity of its current workforce.
- Ensuring that material removed from drains is removed quickly.
- Ensuring that collection from secondary solid wastes disposal sites do not result in rubbish being left in the road.
- Mobilizing local communities to participate in drain cleaning operations and reduce the indiscriminate of solid waste.

b. Awareness Programme and Capacity Building

The awareness campaign should be carried out periodically by KCC to make residents understand the,

- importance of not dumping the solid waste in the drainage system;
- not encroaching drainage channels/cannels areas.

KCC should undertake extensive motivational & educational campaigns that may include:

- Communication of awareness programs
- Understanding the negative aspect and illegality of dumping solid waste in & around the drainage system.
- Understand the negative aspect & illegality of encroachment of drainage channels.
- The relevant approaches to be made to the residents regarding proper disposal of solid waste (use existing door to door collection system).
- The design of leaflets, pamphlets and other devices to ensure maximum impact to the residents.
- Periodical door to door campaigns with leaflets.

c. Capacity Building of KCC

Capacity building is needed in human resource, organizational development and institutional and legal frame work. However, specifically the capacity building initiative for drainage may include:

- Drain Survey and Mapping
- Technical feasibility and implementation planning
- Detail Design
- Procurement & Contract management
- Operation & Maintenance
- Storage management

- Basic & applied Computer skills

For drainage supervision:

- Drain cleaning
- Topographical maps.

d. Completion of Ongoing Projects

The on-going drainage project, that is dredging, re-excavation of lining of major outlet channels, link canals, re-construction, new construction and repairing of control structure, sluice gates and drainage network (estimated cost: USD\$ 27.726 million) and mostly financed by Asian Development Bank should be completed as scheduled (by June 2016).

e. Prevention of Khal Encroachment

One of the major problems of drainage system is encroachment and blockage of drainage channels by the residents. All these activities should be dealt with severe action by the concerned authority. All existing khals in the vicinity of the City should be preserved for future drainage. A Committee named "Mayur Rakkha Committee" was formed to assess problem regarding illegal encroachment of existing outlet drainage channels of link khals with specific proposals to mitigate the problems of drainage. The **Khulna City** Corporation should take immediate necessary actions to implement the suggestions in order to improve the present drainage system. KCC should also take necessary actions to prevent dumping of solid waste in around drainage network.

f. Door to Door Solid Waste Collection

Door to door collection of house hold solid waste should be improved and disposal of solid waste should in sanitary landfill. This will discourage people disposing waste into the drains.

g. Site Elevation

Building Control regulation should incorporate the condition to raise building site to minimum allowable, plinth elevation, requirement of septic tank and soak pit to avoid flooding during monsoon.

h. Execution of 2011 Drainage Master Plan

KCC should take effective steps to execute the drainage Master Plan it prepared. It should also prepare a long term drainage improvement plan for the year 2050 to cater for drainage needs and to reduce flooding.

3.4.13.8 Noapara Drainage

a. Existing Situation

The Bhairab river, Amdanga Khal, Bhabadaha Khal, and the Railway borrow pits are the four drainage discharge channels of Noapara Paurashava. Bhairab River is flowing from north-west to south-east. The Amdanga Khal originating from Bhairab River outfalls into Bhababata Beel. The Bhabadaha khal starting from Beel Zickra outfall into Taka River. About 60% drainage discharge from Noapara is directed to outfall into Bhairab River, 30% discharge into railway borrow pit and 10% discharge into Bhabadaha and Amdanga Khal. There are 8.54 km of existing drains out of

hich 5.61 km is secondary and 2.93 km tertiary drains. There is no danger of flood water intrusion into this Paurashava as ground level is higher than the high tide level of the Bhairab River.

The core area of Noapara Paurashava is slightly elevated. It is not generally affected by floods from the adjacent river. But it is affected by rainfall runoff due to inability of the existing secondary and tertiary drains to drain out the runoff efficiently. Due to inadequate drainage system some of the areas are subjected to water logging during intensive rainfall in the monsoon periods. The water logging areas are: Balia Danga, A.R. Cement Mill site, Himalaya Cement Mill site, Mokka Cement Mill road site, Akterpur, Taltola, Sirajkathi, Noapara College area, Sorkhola, Sabujbag, Sardarpura, Noapara Model Girls Primary School, Dhropadi, Laxmipur, Noapara main Bazar, Kapasihati and Vangaget Bazar area.

The inundation spots are estimated to be of 725 ha. Depth of maximum inundation ranges from 0.50 to 0.55 meter and duration varies from 15 to 20 hours from place to place.

The following are the reasons for water logging:

- Absence of planned drainage system;
- Absence of integrated network of secondary drains and road side drains;
- Blocking in the existing drains with small discharge capacity;
- Lack of timely operation and maintenance system;
- Uncontrolled and haphazard disposal solid waste into drainage system; and
- Construction of houses/infrastructures under the flood level.

b. Main Problems of the Existing Drainage System

Drainage facilities have not been provided with the growing urbanization and expansion of Paurashava as per requirements. With increase of population, other additional infrastructures have not been also provided. As a result, efficient and quick drainage of rainfall runoff into their outfall is not taking place. The Bhairab River which collects runoff directly from a good number of drains is influenced by high tide levels of this river. Tidal lockage will occur when the high tide levels in Bhairab River are higher than water level of drains at their outfalls. Moreover, indiscriminate disposal of all types of solid waste is minimizing the flow capacity of existing drains. The existing tertiary drains and newly proposed primary, secondary and tertiary drains need to be planned and constructed for efficient and quick discharge of storm water to the outfall.

c. Drainage Development Proposals

i. Design Criteria & Approach

The existing drains are not adequate to drain out most of the areas particularly during monsoon period. Hence, new constructions of tertiary and secondary drains are required to create an integrated storm drainage system. The drainage system should be designed to handle the average runoff for 1.1-year recurrence interval for tertiary drain and 2 years' recurrence interval for secondary drains.

The drainage channels should be designed to handle the average annual runoff from peak storms with 100 mm free board for tertiary drain & 150 mm free board for secondary drain against

overtopping. Three types of drainage sections may be designed such as, lined brick work, lined RCC and lined katcha drains.

ii. Non Structural Measures

Noapara Paurashava should adopt some procedures and policies for efficient operation and maintenance of drainage system to minimize water logging. The recommended non-structural measures are presented below:

- Paurashava should have adequate budget for operation & preventive drainage maintenance program.
- Existing legislation should be properly enforced in preventing unauthorized development and encroachment in the drainage system.
- Awareness campaign should be carried out to motivate people not to dispose of house hold solid waste in & around drainage system.
- Measures should be taken by the Paurashava and the district administration to prevent unauthorized occupation, encroachment and filling of khals.

iii. Improvement of Internal Drainage System

The existing drainage network may be improved and different parts of the Paurashava should be linked into overall integrated drainage system. Hence adequate numbers of new drains are to be constructed. The existing brick line drains and RCC drains suffer from long term neglect & blockage. The existing drains should be incorporated into the proposed system to achieve a viable drainage system for the Paurashava.

iv. UGIIP Proposals for Drainage Improvement

Drainage improvements have been recommended in the Drainage Mater plan prepared for Noapara under Urban Governance and Infrastructure Improvement Project (UGIIP) of LGED. The improvement has been divided into the priority programs namely 1st Priority & 2nd Priority: 1st Priority consist of a total 28.2 km drainage (primary: 1.56 km, Secondary: 27.95 km & Tertiary: 10.85 km) and estimated cost is: Tk. 121.57 million. The second priority work consists of secondary drainage: 15.65 km with estimated cost: 59.95 million taka (Drainage Master Plan of Noapara Paurashava, UGIIP).

Recommendations in the Detailed Area Plan are:

- Paurashava should take immediate steps to implement the recommendations of Drainage Master Plan that is to implement both 1st priority and 2nd priority of the construction drainage system to reduce water logging.
- Paurashava should take effective measures to carry out regular & preventive drainage maintenance program for the proper functioning of the existing and proposed drainage system. The Paurashava should have adequate fund, manpower & equipment's.
- Drainage integrated network's connection to the outfall should be ensured.
- Indiscriminate disposal of all types of solid waste which is minimizing the flow capacity of existing drainage should be prevented by adequate and effective door to door collection of solid waste and disposal to landfill.

- Community awareness campaign should be carried out to motivate the people not to dispose of solid waste in to the drain & to make them understand the effect of this (health hazard and water logging)
- Construction of control structure/sludge gate to the outfall at Bhairab River should be considered if flood water level of this river is higher than the invert elevation of drainage of adjacent areas of Paurashava during monsoon period.

If all the recommendations are carried out, water logging of Noapara Paurashava will be minimized.

3.4.13.9 Extended Area Drainage

The Extended part of the project area is served by many tributaries and interlinked canal system. These water courses carry the storm water runoff into the Rupsha-Kazibaccha River. Therefore, the Extended Area is free from water logging. BWDB made a few flood protection embankments on the western part of **Khulna City**. But as the upstream water has substantially reduced, these embankments have virtually become redundant. Due to reduction in the flow of water, most rivers and canals in the area have silted up. Many water course links have been cut creating lagoon like water body. Many water retention areas, used for farming have turned redundant due to water logging caused by siltation of outlet channels.

a. DADP Recommendation

- All the existing rivers and khals in the Extended Area should be preserved from encroachment and filling and unauthorized occupation.
- There should be regular excavation of the natural drains that are subject to filling.
- Roads, bridges and culvert development should be done carefully that they do not block free flow of water through the khals.

3.4.14 URBAN AREA LAND MANAGEMENT

Past experiences visualize that urban development authorities like, KDA are not fully capable of implementing any significant share of a development plan, not only for lack of resources but also because they are not equipped with adequate institutional set up, including manpower, to undertake huge development initiatives. As a result, urban infrastructure development always lags behind the demand created over time. Sufficient development of infrastructure at appropriate locations can foster urbanization bringing prosperity to the urban centre through more employment and income. In view of the lack of response from public sector development agencies, only through involvement of the private sector, that development in urban areas can be speeded up. Upper level plans, in the past, made recommendations about various techniques of participatory development involving the land owners.

2001 Master Plan Policies

The Structure Plan component of the Master Plan laid down some policies regarding urban area land development, particularly relating to housing.

Structure Plan, in its housing part proposed the following policies relevant to housing area land development.

Policy - 01	the development authorities to play the role of facilitators of housing development apart from their existing role.
Policy - 02	providing assistance to the government agencies in the development of housing schemes.
Policy - 03	providing assistance to undertake housing schemes under the private sector.
Policy - 05	providing necessary infrastructure to facilitate land and housing development.
Policy - 06	planning interventions in the spontaneously developed areas.
Policy - 07	Promotion of participatory development process in the housing sector.

2001 Master Plan Proposal

Khulna Master Plan, regarding residential area development, proposed to adopt the techniques of participatory development, like, Land Readjustment, Guided Land Development, various Public-Private Partnership approaches for residential area development to meet the growing demand for residential space. But there is no evidence that KDA took any initiative in this regard following the recommendations of the Master Plan. Since preparation of Khulna Master 2001, KDA did not undertake any new residential area development. Lately, it has got a residential project approved by the government. It took about 10 years to undertake a residential project, while its execution might take another 8 to 10 years. However, in the meantime it did not take any promotional activity regarding execution of participatory and public-private partnership land development techniques recommended by the Master Plan. These non-land acquisition based area development techniques could solve urban housing problems in a much better way by means of organized land development including provision of all urban services with no money spent by KDA.

In the light of the policy recommendations of the Structure Plan, Master Plan made specific recommendations about urban area land development as stated below.

- **From Provider to Facilitator**

About this issue, in line with Structure Plan Policy, Master Plan (2nd tier) recommended KDA to follow the principle of facilitator in housing development, instead of provider of housing. Bu so far, KDA did not adhere to this policy or recommendation.

- **Public-Private Partnership**

2001 Master Plan following Structure Plan policy, called KDA to promote programmes of public-private partnership in housing area development. The plan report proposed to facilitate housing programmes of the private sector or private individuals under partnership development programme. "This can be done," the report said, "by helping the private formal sector in identifying, planning and development of site and infrastructure for housing so that the private sector, apart from its profit motive, can serve people with appropriate standard, specified in the Master Plan." Thus, before finalizing a housing project by any private sector developer, it may contact KDA for the selection of site and seek its assistance for planning and approval. During approval KDA will see whether the appropriate standards have been maintained in the project. KDA was also advised to

devise ways and means to realize infrastructure development costs from the beneficiaries. But no step in this regard has been taken by KDA.

- **Development of Sites and Services Project for the Low-Income People**

The 2001 Master Plan recommended to develop site and services projects for disadvantaged groups. This was intended to help the low-income people who are not able to purchase serviced plot from the private sector. It was recommended that KDA would develop site and services project for the poor. It necessary, supply land at subsidized rate. It was proposed to design the low-income housing areas in such a way so that the upper middle and middle-income households do not show interest in such projects. These low-income housing sites can be developed near the major employment centres from where the residents can easily commute to their respective work places. The present 2001 Master Plan suggested several sites for such projects, such as in Rupsha Ferry Ghat area (East), Labanchara, near Fulbari gate, and in Noapara. But KDA did not undertake any such project to facilitate low income housing of the urban poor of **Khulna City**.

DADP Recommendations

Past experiences visualize that urban development authorities like, KDA, are not fully capable of implementing any significant share of a development plan. Not only that they are constrained by resources, but also because they are not equipped with adequate institutional set up, including manpower, to undertake huge development initiatives. As a result urban infrastructure development always lags behind the demand created over time. Sufficient development of infrastructure at appropriate locations can foster urbanization bringing prosperity to the urban centre through more employment and income. In view of the lack of response from public sector development agencies, only through involvement of the private sector that development in urban areas can be speeded up, particularly, in the fringe areas. There can be many ways of public-private partnership projects. Authorities should take initiatives to develop appropriate innovative ideas of public-private partnership residential area and infrastructure development to expedite urbanization.

Khulna Master Plan 2001, regarding area development, including residential areas, proposed to undertake the techniques of participatory development, like, Land Readjustment, Guided Land Development for residential area development to meet the growing demand for residential space. But there is no evidence that KDA took any initiative in this regard following the recommendations of the Master Plan. Since preparation of Khulna Master 2001, KDA did not undertake any new residential area development. Lately, it has a residential project approved by the government at a site recommended by the Master Plan 2001. It took about 10 years to undertake a residential project, while its execution will take probably another 10 years, as the experience shows. However, in the meantime it did not also take any promotional activity regarding execution of participatory land techniques like, Land Readjustment and Guided Land Development. These non-land acquisition based area development techniques could solve urban housing problems in a much better way by means of organized land development including provision of all urban services with no money spent by KDA. It did not undertake site and service projects for the poor, nor any attempt was taken for execution of town centre development as recommended by Master Plan (2nd tier).

Based on the current development experience, the consultant thinks that zero point area is going to be the most congested area in the coming decade. If the development of this area cannot be controlled at this moment, this area is going to be the most problematic zone of the study area. This area is highly potential for future commercial dominated mixed development, because of the intersection of two major highways (e.g. Khulna-Satkhira Road and Khulna by-pass), close proximity to Khulna University and proposed Ahsanabad planned residential area. Considering importance of the site, the consultant proposes an area with half kilometer radius to be incorporated for future guided land development programmes. Some guidelines for development of the zero point area have been provided in Appendix-3.5.

The proposals of the Khulna Master Plan 2001 were timely, rational and suit to the conditions of the **Khulna City**. They are still valid proposals for future development of **Khulna City**. Consultant strongly recommends executing the recommendations of the Khulna Master Plan 2001 regarding urban land development.

3.4.15 CLIMATE CHANGE IMPACT ON KHULNA CITY

3.4.15.1 Urban Poverty in the Face of Climate Change

Climate change is a global phenomenon and its local impact is sometimes overrated. This is because of inability of the climate models to predict the impact of climate change even for large delta like Bangladesh. In a report of International Institute for Development and Environment, Khulna is stated as one of the top three vulnerable cities in South Asia. It is also included in the top 13 vulnerable cities of the world due to climate change (IIED and CLACC 2009).

Because of climate change and climate variability, the vulnerability urban poor is increasing rapidly. Although many literatures are available on the impact of climate change on the urban poverty, but there is significant lack of the authentic scientific evidence. Nonetheless, a report of Brooks World Poverty Institute divided the impact of climate change on the urban poor community into following three types (Roy, Jahan et al. 2012).

Rapid-onset Events (floods, cyclones and catastrophic river erosion):

Often these kinds of events are more regional than local (urban). For example, severe cyclones like *Sidr* and *Aila*. Several destruction of rural livelihood increases rural poverty. The result short-term displacement and long-term migration to urban areas. The displaced households face a drastic fall in their earnings; at the same time, they need more money to pay for basic needs in urban areas. While men may quickly become engaged in some unskilled daily labourer jobs, women find it harder to be economically active.

Slow onset event (e.g. coastal erosion, sea-level rise, salt-water intrusion, rising temperature, changing rainfall patterns and drought)

Soil and water salinity is shattering rural ecological footprint aggravating the rural poverty situation. Because of shrinkage in supply of traditional building materials (bamboo and *golpata*) due to climate change, numerous people were forced to change their profession engaged in construction of traditional dwellings. Health issues because of increasing heat stress (sleeplessness and

difficulty at work, respiratory diseases, gastro-intestinal problems and fatigue) and severity of cold waves (cold and flu, and respiratory diseases) are increasing significantly.

Cascade effect

This effect implies a chain of events due to an act affecting a system, such as environmental degradation, increased urbanisation, reduced human security and local and international migration. In Khulna it is one of the major reasons for widespread urban poverty. This urban disadvantaged people are forced to live in slums and squatters in a degraded human condition.

Because of climate change, **Khulna City** would face multifaceted problems. Climate variability would disturb the traditional livelihood pattern of the rural people. This may result **Khulna City** to become the destination of large scale climate refugees. This would create pressure on the existing job bank, number of slums and squatters would increase leading to deterioration of law and order situation. To minimize the adverse impact, DADP proposes the following-

- Informal economic activities must be promoted to create employment for the unskilled labour forces.
- Slum Improvement projects (SIPs) should be bolstered to ensure healthy living environment for the poor.
- To tackle the temporary unemployment and underemployment crisis of the poor people, microcredit facilities should be made more poor friendly.
- Road arboriculture should be promoted to minimize the heat island effect in the city. At the same time, use of heat absorbing and reflective materials should be discouraged for building construction.
- Roof top gardening should be promoted along with the use of solar panel as a source of green energy.

3.5 LAND USE REVISION

3.5.1 Criticality of Land Use Revision

There has not been expected economic growth in **Khulna City** since 2001 and hence the spatial development of various land uses proposed in 2001 Master Plan remained unimplemented. The recent land use survey by the consultant shows commercial land use as 0.74% of the study area, but Master Plan 2001 projected the commercial land use as 1.09% of the study area to be developed by 2010. Such discrepancies will be wide spread in case of other land uses as well. So, it is necessary that 2001 Master Plan (2nd tier) land use zoning should be revised as already 10 years have elapsed after preparation of the Master Plan. Terms of Reference (ToR) also call for revision of the 2001 Master Plan land use provisions. But there is one major problem with such revision. KDA has already approved many building plans based on 2001 Master Plan land use zoning. So, it might create a problem in maintaining consistency with the previous zoning if any major change is brought about in existing land use zoning. Consultant feels that any change in the zoning should be carefully decided. Before reaching to any decision to change, it should be carefully looked upon if there will be any inconvenience or side effect of the decision to the existing building owners and the plan approving authority. Again, any unwanted change may also lead to

detrimental environmental consequences to residential areas already developed as per previous zoning plan. Another problem might arise regarding keeping consistency of the project area land use with the of the 2001 Master Plan area adjacent to the project area.

3.5.2 Review of 2001 Master Plan Land Use Provision

Before embarking on revision of the existing zoning, it is necessary to have a closer look into the 2001 Master Plan zoning provisions. 2001 Master Plan divided the entire Master Plan (2nd tier) area into 17 land use zones in order to streamline and organize spatial development. The highest amount of land was allotted for residential purpose. Apart from marking existing residential areas the plan also delineated under residential land use, those agricultural areas which offered the greatest possibility of spatial growth in future. Residential areas were also proposed to accommodate certain ancillary services for the sustenance of the residents. Mixed land use was allotted to those areas that were most potential for quick spatial growth. The important reason behind mixed use was to ease building plan approval. Among other major land uses, the plan proposed 1311 acres as mixed use **Appendix-3.3.**

Apart from existing commercial areas, the 2001 Master Plan marked new commercial areas in those places where possibilities of commercial growth were assumed greater. These include city centres and adjacent area, proposed major road intersections, town centres, established market places. A total area of 2,225.41 acres (3.86%) was earmarked for commercial use inclusive of existing commercial areas.

Khulna already has a number of established industrial agglomerations, apart from those, the plan marked new industrial sites at Labanchara, Rupsha, Dighalia and Noapara. A total of 3,032.57 acres (6.77%) was proposed as industrial land use in the plan including the existing ones.

The Master Plan proposed 23,679.53 acres as residential land use which was 52.87% of the total planning area. About 872.26 acres (1.95%) was proposed for open space and urban green that include park and play ground, roadside and riverside greenery.

For existing large areas of land under storage and warehouse, a new land use was created encompassing 125 acres. For existing and future public administration, an area of 769.26 acres was earmarked in the central areas of the city (See **Appendix-3.3.**).

Education facilities for various levels are scattered all over the Master Plan area. The plan recommended about 1,087.92 acres for this category that include 287.92 acres of additional lands for new education facilities. Area for health facilities proposed by the plan covers an area of about 307.43 acres with 140.17 acres of additional land for new facilities (See **Appendix-3.3.**).

Municipal and community land use covers all categories of existing facilities and establishments of public use, like, utility services installations, religious establishments, indoor recreational facilities, etc. The proposed land for this category including existing facilities is about 87.50 acres (See **Appendix-3.3.**).

Transportation land use includes roads, railway alignments, transport terminals and stations, etc. The plan estimated as 4,664.30 acres (8.15%) under this category including existing facilities. There are some large defense and security establishments of Army, BDR, and Police that cover

about 425.42 acres. All these facilities have been marked under defense and security. The plan earmarked about 239 acres of land for graveyard in Khulna and Noapara (See **Appendix-3.3.**).

The existing large brick field areas around the city were marked under brick field category with an area of about 512 acres. There exist scattered fish farms within the city environs. The plan marked under fish farm an area of about 439 acres.

Water bodies within the 2001 Master Plan area cover all categories of ponds, khals, water channels except rivers, beels, etc. The total land under this category has been found 656.05 acres. Over three fourths of the existing agricultural land went to various proposed urban use. Remaining land (18.30%) was put under agricultural use with an estimated area of 29,884.80 acres.

Please refer to **Table-2.2** and **Chapter-2**, where comparison of 2001 Master Plan survey (1998) and current survey (2012) have been provided. It shows that agricultural land has reduced by about 40.41% in last 14 years, which indicates that other urban land use has grown occupying agricultural land. The current survey found commercial land use increase by 56%, but it failed to achieve the objective of 2001 Master Plan target of 119.20%. Similarly, the 2001 Master Plan projected 2707 acres of land for industrial use. But the consultant (2012) found 1125 acres as industrial land use, which is significantly below the proposed land use for industries. This also is an indication of the sloppy condition of the local economy. On the contrary residential area increased significantly, which implies that urban areas are expanding with very low density. However, projected mixed land use was very close to the existing figure. But commercial land use failed to reach target by large margin, which is the indication of poor performance of the local economy of Khulna.

3.5.3 Recommended Land Use

Despite land use provisions of 2001 Master Plan, there have been huge developments in the informal sector within the Master Plan area ignoring the land use zoning. It is hardly within the capacity of KDA to impose control on these unruly developments. Considering this reality, the current plan during its land use review accommodates almost all the land uses that developed deviating the 2001 Master Plan land use provision. However, in many cases, changes have initiated considering potentiality of the areas in particular land use development. The revision of land use has been made based on current land use survey and review of the 2001 Master Plan land use. The consultant has made utmost efforts to maintain the land use standard as much as possible. However, because of the congested built up environment and sprawl, standards cannot be achieved for all land uses.

3.5.4 Restructuring of Proposed Land Use

DADP makes a revised land use provision under the current project to replace the land use zoning provision made in the 2001 Master Plan. The land use zoning is intended for three purposes:

- development control;
- preserve environmental quality and;
- to preserve the urban land price.

The new land use re-structuring have been done on review of the 2001 Master Plan land use and the land use survey done in 2012 under the current DADP Project. In the 2001 Master Plan there were 17 categories of land uses. The land use survey (2012) categorized land uses into 18 classes.

The 2001 Master Plan land use classification was intended to delineate the future land use of the Master Plan area, while DADP land use survey was done to assess the current land use of the study area. In the proposed land use zoning of DADP, the consultant has brought down the land use categories to 12. This is shown in Table-3.23. The re-structuring has been done in the following manner.

In the existing landuse survey, there ar` e two transport related classes, Circulation Network and Transport and Communication. They are actually, vey related land uses. So, both have been merged to make a single class called Transport. There are three similar classes called, Community Service, Non-government services and Service Activity. They have been merged as Service Activity. Urban Green, Recreation including Park, Play Field and Stadium have been merged and renamed as Recreation and Open Space. Miscellaneous land use has been merged into Mixed Use. They are very similar land uses. The consultant feels that merging them together will make land use clearance and development control easier, both for KDA and for the permission seekers.

The existing survey map has identified abnormally high number of ponds. Data of other waterbodies (Khals for example) has also shown abnormal growth. The consultant proposes to preserve all water bodies including ponds and ditches with more than 0.40 acre. This is because (1) these water bodies would act as the retention pond and (2) importance of these water bodies as carbon absorber cannot be overlooked. The smaller water bodies would serve the purpose of urbanization. Thus, with the increasing densification of the urban areas, these ponds will be lost. However, other than the water bodies shown in the CS/RS mouza, all other water bodies are deleted from the proposed database as it was demanded by KDA.

3.5.5 Future Requirement of Land for Selected Uses

From the discussion in Section 3.5.3, it is evident that the city failed to meet the expectations of 2001 Master Plan by large margin in most cases. In one hand, residential land uses expanded with very low density, on the other hand commercial and industrial land use failed to stand up to the expectation of 2001 Master Plan. From urban planning's point of view, both are indication of several kinds of problems. The current DADP further attempts to identify land requirement for the year 2023.

a. Residential Land Use

In 2001, the population density was 75 ppa. Projection of population for 2012 shows density as 97 ppa, which means 22 ppa has increased over 11 years that is each year increase of 2 ppa. If the increase follows the same trend, then by the year 2023, the density would be 119 ppa. More optimistically we can assume that by 2023 the density would be 150 ppa.

Under this assumption the projected 16,52,854 populations for the project area would need 11,019.03 acres of land for residential purpose. But survey by the consultant (2012) reveals that

the project area already has 16,549.05 acres' land under residential use including the rural homestead. So, there is no additional land need to be provided for residential use. However, considering the future growth potential of the city, the consultants generously proposed extension of residential land use to 23,119.55 acre. With this extension, the consultant also proposes the following restrictions on the land uses:

1. No extension of residential use should be allowed outside the project area.
2. Agricultural area and water bodies should be declared as development protected areas as soon as possible.

Considering the poor and very congested residential condition, the consultant proposes a total of 13.73 acre land to be allocated for low-cost housing [(DADP zone 25, Naihati mouza, Reference sheet no. (1:3960 scale), J03]. A detail of this low-cost housing area is provided at **Chapter-5**.

Additionally, the consultant allocated 139.57 acre land for development of planned residential area at Jalma union [DADP Zone 21, Reference sheet (1:3960 scale) no H02] to be developed by KDA after finishing the on-going Ahsanabad residential area project.

b. Commercial and Manufacturing Processing Land Use

Future requirement of commercial and land for manufacturing and processing is dependent on future economic activities. There are many factors that determine the growth of future economic activities. But how these factors will perform in future is extremely difficult to predict. The factors that dominate most are the economic growth, the number of employment likely to be created, the number population likely to migrate to the city due to poverty and unemployment in the country side. These factors are again dependent on many socio-economic conditions. Since these conditions cannot be controlled by any means, it is very difficult to make a precise projection of future requirement of commercial and land for manufacturing and processing land. Then how to determine future commercial land requirement? To solve this problem, we have devised a simple thumb rule of commercial land allocation based on proportion of population.

Table-3.22: Determination of Commercial and Industrial Land Requirement

Population and Proportion of Land	Year	
	Existing Land	Required Land
	2013	2023
Project Area Population	13,65,805	16,52,854
Proportion of Commercial Land	371.62 acres	408.782acres(Adding 10% to 371.62 acres)
Proportion of Industrial Land	449.72 acres	494.69 acres(Adding 10% to 449.72 acres)

Source: Analysis derived by Consultants

In 2013, the estimated study area population was 13,65,805, while the land under commercial use during the same period, found by field survey was 424.89 acres.

If we consider the same proportion of land will be needed in 2023 for commercial purpose, then for its projected population of 16,52,854, the proportion of land comes to 449.72 acres. The consultant feels that with the development of Padma Bridge and Railway communication with Mongla, there will be increase in economic activities that will lead to increase in the purchasing power of the

people. Therefore, there will be need of additional land for commercial use. The consultant, therefore, proposes additional 10% increase in the estimated proportionate land for the year 2023. This gives 494.69 acres as land requirement for commercial land use in 2023. In reality, the consultant proposes only 491.24 acres of land for absolute commercial use. Because the consultant feels that (1) these is ample scope of densification of the existing commercial land use, and (2) commercial use will have scope of development within mixed use. It is to be noted here that the consultant proposed 4,736.08 acres of additional land for mixed use which will be mainly dominated by residential and commercial use. In the same way, manufacturing and processing land use for 2023 have been determined as 3,032.57 acres.

b. Education and Research

The plan provided 22 new primary schools on an area of 40.61 acres. These primary schools are proposed as a package with Local Park and playground. The consultant suggests that these schools will become secondary schools by the end of this project period. Considering this, all these schools are allocated an area of about 1.65 acre (same as the secondary schools).

Twelve secondary schools have been provided on an area of 20.25 acres. One college at Sirajkathi takes 5.36 acres, a Technical Training Institute at Sirajkathi on an area of 5.05 acres and Religious Institute at Damodor on an area of 2.89 acre. Three schools are proposed for the disabled on an area of 5.75 acre. Three different zones are allocated for development of primary universities on an area of 51.58 acre. Thus, this plan proposes to add altogether 159.57 acres of new education and research land use. With the existing 689.08 acres that give a total land for education and research category as 827.44 acres. In reality, the consultant proposed 942.49 acres of land for education and research. These proposed educational facilities can either be developed by KDA or other such organizations or it can be developed by private entrepreneurs.

e. Service Activity

Additional land is proposed in DADP for new health and health related facilities, solid waste dumping sites, graveyards etc. adding this to the existing facilities of 328.53 acres gives a total 628.18 acres as service activity. The new facilities also include two general hospitals, one mental hospital, two graveyards and one nurse training institute.

f. Recreation and Open Space

The proposed new open space covers 20 local level parks and 21 play fields and 3 metropolitan level larger parks. With each having an area of about 5.12 acres, the 20 local parks account for about 114.39 acres of land. Additional three metropolitan parks are proposed that occupy 394.66 acres. Twenty-one local play fields account for about 112.88 acres of land. Each play field has been allotted about 6 acres of land. After proposal all recreational open space account for about 872.26 acres of land.

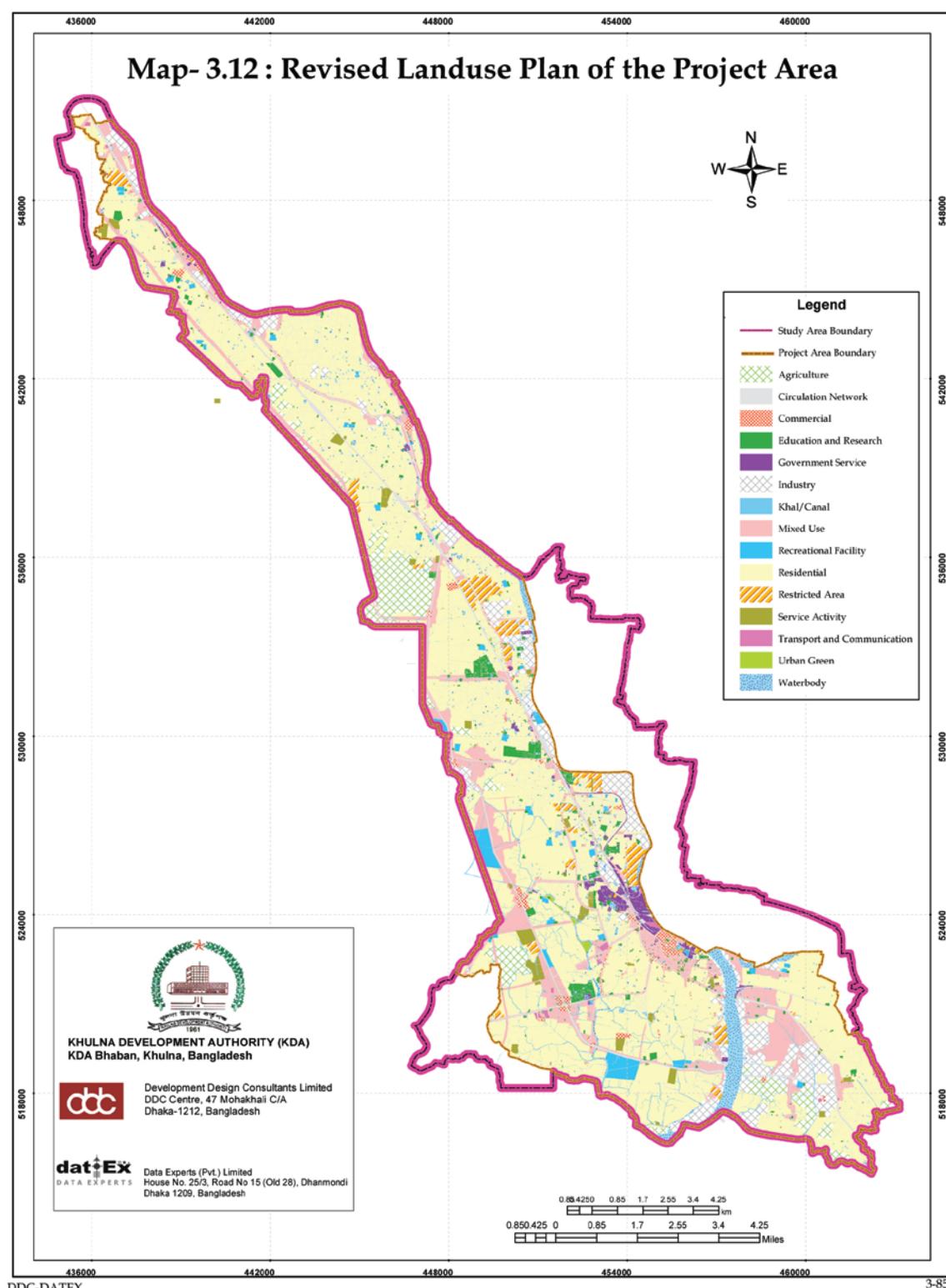
Table-3.23: Proposed Revised Land Uses of the Project Area

Landuse Type	Proposed Landuse		Existing Landuse	
	Area (acre)	Percentage	Area (acre)	Percentage
Agriculture	2,557.34	5.71	15,415.97	34.42
Commercial	494.17	1.10	370.67	0.83
Education and Research	942.50	2.10	689.08	1.54
Government Service	483.65	1.08	130.23	0.29
Industry	3,032.58	6.77	1,742.44	3.89
Mixed Use	4,736.08	10.57	506.94	1.13
Recreation and Open Space	872.26	1.95	956.05	2.13
Residential	23,679.53	52.87	16,231.91	36.24
Restricted Area	1,062.02	2.37	967.37	2.16
Service Activity	628.19	1.40	328.53	0.73
Transport and Communication	3,488.21	7.79	3,404.84	7.60
Waterbody	2,813.22	6.28	4,045.46	9.03
Ground Total	44,789.50	100	44,789.50	100

Source: Analysis derived by Consultants

*This figure includes Urban Green, Vacant land and pure Recreational facilities including Park, Play Field, and Stadium etc. Only 135.83 acres of land is available for pure recreational purpose.

Map- 3.12: Revised Landuse Plan of the Project Area



3.6 INTEGRATED PLAN

The integrated plan has been shown in **Map-3.13**. This map shows all the DADP proposals in an integrated manner. In the integrated plan attempt has been made to devise a plan aiming at the future need of people and potential development areas. Recommendations have been made for economic re-vitalization of the city. Therefore, it has been recommended to remove all the impediments to investment in Khulna region. DADP stressed on local area development through development of mainly road infrastructure. Education, health and open space proposals will help to make the future city livable. It is strongly recommended to implement the development proposals of the DADP.

3.7 ZONE WISE PRESENTATION OF DADP PROPOSALS

To make DADP implementation easier the entire DADP area has been classified into 27 DADP Zones. Zone wise development proposals have been presented in **Appendix-3.4**.

Map-3.13: Integrated Plan
(Please find it in the attached folder)