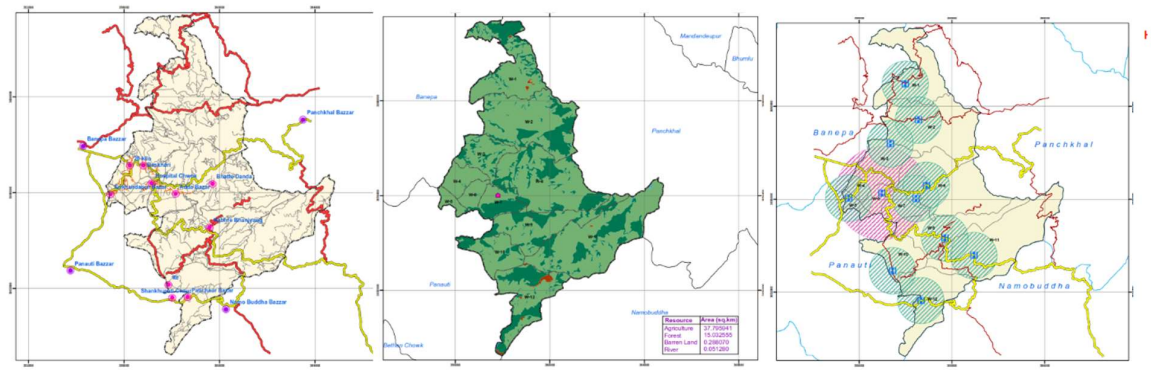
Government of Nepal

Dhulikhel Municipality

INTEGRATED URBAN DEVELOPMENT PLAN OF DHULIKHEL MUNICIPALITY

Volume 6 – Environment Management Plan

2019



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Version:

Version No.	Author	Checked by	Date
1 (1st Draft)	S. Paudel	L. Peterson for Dhulikhel Municipality	26 August 2018
2 (Consultation Draft)	S. Paudel and M. Gyawali	L. Peterson for Dhulikhel Municipality	25 January 2019
3 Final Draft	S. Paudel and M. Gyawali	L. Peterson for Dhulikhel Municipality	12 March 2019
4 Final Version		Adopted by the 4th Assembly of Dhulikhel Muncipality	9 April 2019

Acknowledgements

The Integrated Urban Development Plan for Dhulikhel Municipality has been developed in a true collaborative process between the Municipality and the consultants appointed to prepare the plan.

The consultant team would like to thank Project Coordination Office and involved Planners, Engineers, Architects and other staff for their constant support, appreciation, valuable suggestions and comments during the process.

The strategy would not be complete without the proper help of the Municipality. We would also like to thank the entire key informants for providing valuable information related to the municipality.

Similarly, the consultant would also like to express its appreciation to all the officials of various government institutions for their cooperation during data collection.

We are grateful to entire individuals who directly or indirectly helped us to prepare this field report and work on the field during data collection, analyzing, and workshop preparation.

Finally, the project team would like to express thanks to all staffs and colleagues of GOEC-GIDA-Next for their support for this study.

Executive Summary

The Integrated Urban Development Plan (IUDP) for Dhulikhel is a strategic response to the 20-year growth of Dhulikhel Municipality, which brings together infrastructure provision, environmental management, economic growth, disaster preparedness, municipal service delivery and mainstreaming gender equality and social inclusion. This "whole of Council" strategic plan will deliver on the long-term vision of Municipality:

A prosperous, well governed and model town Dhulikhel

based on culture, heritage, tourism and environmentally friendly sustainable development.

Located 30 kilometres east of Kathmandu, Dhulikhel Municipality to blessed with a diverse and vibrant community, high quality environmental assets including clean air and water, spectacular view, rich built and cultural heritage, major institutions with Kathmandu University and Dhulikhel Hospital, agricultural production and a burgeoning tourism industry.

However, the Municipality is facing a number of challenges. This includes: an emerging low density and scattered settlement pattern in the rural wards with poor access to essential social and physical infrastructure; rapid urban development at a rate that is not supported by key infrastructure; fragmented agricultural land which is becoming urbanized; and prioritization of infrastructure. Analysis of physical infrastructure indicate critical problems in water supply management and solid waste management which requires immediate attention.

Observations in the field reveal housing outside, or on the edge of, urban areas being constructed without the provision of constructed roads, drainage, water and sewerage services. This reveals a disconnect between development approvals and infrastructure planning.

It appears that, in many cases, development is not occurring in sequential and planned way and that the provision of infrastructure to support the development is being provided in a reactive way, which is expensive to the community and financially and environmentally unsustainable.

Through research and community engagement, the IUDP includes analysis, strategic policy and practical actions to improve physical infrastructure, social infrastructure, risk sensitive land use, environment management at town level with proposals for capacity building and institutional strengthening of municipal authority. The IUDP also focuses on improving the conditions of women, the poor and the excluded by undertaking a community development program and gender equality and social exclusion (GESI) activities through the Social Development Plan.

The IUDP, presented in 16 volumes, also covers institutional and technical issues. The report provides comprehensive details on: urban management, institutional development; physical development planning, social development planning, economy, environment, institutional and financial planning along with social impacts and poverty; gender and social inclusion; and the subproject resettlement plans and disaster risk reduction. Based on the immediate needs of the municipality, short term plans and long-term plans have been developed which will support Dhulikhel's growth.

In the preparation of the IUDP project, the most pressing needs of the Dhulikhel Municipality have been identified. Analysis was carried out for physical infrastructure, social infrastructure, economy and disaster management and provide priorities for short, medium and long-term needs of the Municipality.

While generally the spatial distribution of health and education facilities show good coverage, connectivity in rural wards needs to be improved through upgrading existing road networks. Likewise, disaster management is another critical issue demanding a strategic response.

Critically, the IUDP provides a new framework to manage the urbanization of Dhulikhel, while protecting its agricultural, environmental and cultural assets. This will be in the form of new processes for the Municipality, including land use zoning and by-laws, and clear processes to better link land development, community needs and the provision of infrastructure.

The IUDP:

- Sets out the planned urban expansion of Dhulikhel in three key areas to accommodate residential, tourism and commercial growth over the coming 20 years.
- Supports more intensive development around the commercial centres (chowks) that supports existing private and public investment.
- Identifies key road, water and sewerage infrastructure to support the growing community over the next 20 years.
- Identifies key road connections between the Rural wards (in particular Wards 1 and 2) to facilitate access to schools and health services.
- Establishes Land Use Zonings, based on economic, physical attributes and disaster risk management principles, which will support good decisions, guide development in strategically suitable locations and support Dhulikhel's agriculture sector.
- Identifies opportunities to support the growth in tourism and protection of heritage and environmental assets for existing and future generations.
- Identifies priority projects to be undertaken by the Municipality over the coming 5 years to support the delivery of the IUDP, supported by a financial plan.

The IUDP introduces new land use zoning and by-laws which provides for strategically-driven decision making and sustainable development of Dhulikhel into the long term.

Implementation of the actions within the IUDP from all part of the organization is critical to the success of Dhulikhel's future.

The IUDP consists of the following Volumes:

Volume 1	Background Report
Volume 2	Physical Development Plan
Volume 3	Land Use and Zoning Plan
Volume 4	Social Development Plan
Volume 5	Economic Development Plan
Volume 6	Environment Management Plan
Volume 7	Conservation, Culture and Tourism Plan
Volume 8	Municipal Transport Management Plan
Volume 9	Distaster Risk Reduction Plan
Volume 10	Consolidated Implementation Plan
Volume 11	Financial and Organisation Plan
Volume 12	By-Laws
Volume 13	Municipal profile
Volume 14	Feasibility Study – Waterfall Construction in Ward 1
Volume 15	Pre-Feasibility Study – Artificial Lake in Wards 7 and 8
Volume 16	Feasibility Study – Walking Trail in Wards 7 and 8

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1. Introduction

The Environmental Management Plan deals with protection and management of the physical environment, as well as planning for positive environmental health outcomes for the community of Dhulikhel Municipality. The focus of the Plan is to address issues that are currently degrading the Municipality's environmental assets and environmental issues that are compromising the health and well-being of the people.

The environmental conditions in Dhulikhel Municipality is determined by a mix of natural conditions, rural structure, economic activities, transport and ongoing social-economic processes. While the present environmental status of rural areas of Dhulikhel municipality is comparatively good compared with the Kathmandu Valley, there are many challenging environmental issues within the Municipality that require careful and consistent management.

2. Environmental Assets

2.1 Waterways and water bodies

The Municipality contains a number of rivers, streams, ponds and wetlands, both ephemeral (seasonal) and permanent supply of water. Ground water is also present within the municipality and is a common source of drinking water that communities rely on, as well as irrigation. These waterbodies are also important to the survival of native and domestic animals.

Degradation in the quality of water and sources of water is defined as water pollution. All the ponds and wetlands in the Municipality are neglected. There are many reasons why the water bodies in the Municipality are degraded. Quality of water in rivers like Punayamata River, ponds and wetlands in the Municipality are likely to be affected by:

- Sewerage and contaminated stormwater due to the fact that urban wards 4,5,6,7 in the Municipality lack proper drainage and reticulated sewerage systems.
- Contamination from human and animal waste;
- Litter (domestic, commercial and medical);
- Building materials in the form of sediment pollution; and
- Pesticides from agricultural land must be addressed to improve the conditions of the waterways.

Importantly, in December 2018 the entire Dhulikhel Muncipality was declared an Open Defication Free Zone, which will improve the environmental health outcomes for the community. Awareness regarding the role of the water bodies in the ecosystem must be raised.

Policy/Strategy

Objective: To have healthy waterways free of pollution.

- Creation of green corridors along riverbeds and roads; Punyamati river, Dhulikhel khola and major roads in the Municipality.
- Regulation of riverbeds in Punyamati river using natural materials in order to prevent floods
- Install fencing along waterways to prevent stock from eroding banks and defecating in the water.
- Apply a condition on all construction permits that construction material including gravel, cement and sand must be contained, and removed after the completion of the build, to the satisfaction of the Municipality
- The Municipality install litter traps in strategic locations.

Apply construction restricted areas and by-laws to the following areas:

- The blue conservation zone includes the river and 100m buffer from the river.
- The buffer of 10m around all the wet land, 3m buffer from main canal and 1.5m buffer from side canal on either side is also considered as the buffer area.
- Identified forest areas and wetlands should be addressed in the Building by-laws of the municipality.

(IUDP Links: Land Use Plan and Zoning, By-laws)

2.2 Forest Areas

Dhulikhel Municipality is abundant with Forest areas which provide habitat for native animals as well as a sustainable resource for the community.

Over the last 10 years (as shown in the Spatial Analysis in the Background Report – Volume 1), there has been significant encroachment of the forest areas for expanding the settlements and agriculture areas.

Policy/Strategy

Objective: Protect and manage Forest Areas for their habitat values and sustainable use

- Protect forest areas by applying the Forest Zone. The purpose of the zone is to protect the identified community and government forests in the Municipality.
- Apply by-laws effectively and consistently to ensure the sustainable management of the Forest.

(IUDP Links: Municipal Transport Management Plan, Land Use Plan and Zoning, By-laws)

2.3 Air and Noise Pollution

Degradation and/or deterioration in the quality of Air with harmful pollutants which may be injurious to living organisms is called Air pollution.

Air in Dhulikhel is relatively clean compared with the rest of Kathmandu Valley however dust and diesel fumes from heavy vehicles is still an issue that affects the whole municipality, especially in the areas near to highways and bazar areas. In addition, air pollution is present due to brick industry in ward 1.

The Municipality currently lacks the minimum criteria for pollution of water, air, and sound. The Municipality also lacks human resources to effectively deal with these issues.

In addition, it is essential that industrial uses are located in appropriate places and managed so that they do not degrade the amenity of the area where there are sensitive land uses nearby, such as schools, hospitals and residential areas. In addition, they should be managed in a way that minimizes their impact on the environment, including potential water, air, noise or visual pollution.

Policies/Strategies

Objective: To prevent noise and air pollution, and effectively manage the impacts:

- Reduce the amount of traffic in the central zones that causes excessive air and noise pollution.
- Reduce speed of vehicles within the urban areas by introducing speed controls to reduce vehicle noise in built up areas.
- Protect residential areas and other sensitive uses such as hospitals and schools by applying a buffer between industrial uses and sensitive uses.
- Apply zoning and effective by-laws that requires industrial uses to operate to minimise impact on water and air quality and upon the amenity of the area.

(IUDP Links: Municipal Transport Management Plan, Land Use Plan and Zoning, By-laws)

2.4 Soil Pollution

Soil pollution can be defined as the contamination of soil by human and natural activities which may cause harmful effect on living organisms. Soil or land can be polluted due to various causes. Soil pollution and degradation is significantly influenced by illegally constructed buildings due to the fact that they have been erected on fertile agricultural land and green areas and without adequate infrastructure. Some major strategies that can limit the pollution caused by above mentioned factors are as follows:

- ➢ Rational and controlled use of construction land;
- ➢ Protection of agricultural land against illegal construction;
- ➢ Reduction in the use of pesticides.

The location of future construction must be addressed in the Land Use Plan and Building By-Laws of the Municipality. The issue regarding the use of pesticides will be addressed through farmer education, National regulation and best practice. Farmer training on Integrated Pest Management and bio-organic fertilizers are expected to continue.

2.6 Domestic and Commercial Wastewater and stormwater

Sanitation and wastewater management, circulation and disposal is one the key factors that has an adverse effect on the overall health and hygiene of the population of the Municipality.

In higher density bazar areas proper drainage and sewerage systems are lacking, likely to contaminate the rivers and streams as well as drinking water system. Establishing Drainage Facilities where the population densities are high i.e. Ward No. 4, 5, 6, 7 is recommended. Targeting Bazar Area, Construction of integrated treatment plant for managing the waste is recommended.

A reticulated sewerage system (or pipe system) refers to the system of pipes, sewers and drains that are used to move sewerage from a property to a sewerage treatment plant. Maintenance of the pipes and the treatment plant is the responsibility of the Municipality.

Very few wards in Dhulikhel municipality have pipe system for sewerage. 95% of households within ward 5 are serviced with pipe drainage system. However presently no piped sewerage system service the other wards of the Municipality. The majority of premises in the denser areas of these wards are serviced by septic tanks with soak pits.

Septic tank and soakage pits-soakage pits are used to soak septic tank effluent in to the surrounding soil. Landowners are responsible to maintain their systems.

There is no municipal service offered for removing septage (septic sludge) from the septic tanks when they become full. Usually, households will contact a local contractor who will arrange to empty the tank manually.

Presently, where pipe sewerage is not available, new development is required to install a septic system. However, there is no assessment about the capacity of the land to be able to manage the sewerage and waste-water on-site. Factors to determine capacity include size of plot, soil characteristics, slope and number of occupants and bathrooms/kitchens. This issue is becoming more critical as areas are developed more densely and houses are now much larger, containing more bathrooms and a significantly higher number of occupants.

The solution

The existing problems of wastewater treatment in Dhulikhel can be solved using appropriate and viable technologies commensurate with the density and projected rate of development. In the case of Dhulikhel there are three characteristics of settlement:

- Urban with high and conventional density.
- Peri-urban and
- Rural

Suitability for wastewater management solutions depends on:

- The physical characteristics of the soil and topography
- The density of existing development
- The projected development; and
- The ability of the system to be managed and maintained.

Policies/Strategies

Objective: To reduce water and soil contamination by effectively manage the impacts of domestic and commercial waste water and stormwater.

1. **A Waste Water Analysis** is required to determine the appropriate solution to improve the poor wastewater management within the municipality, as follows:
   a) Identify areas where wastewater disposal or septic tanks are problematic, i.e. where septic tanks are overflowing onto land or into surface water drainage: e.g. due to:
   i) High water table;
   ii) Impervious ground;
   iii) No space for soak-pit;
   iv) No space for septic tank;
   v) Density of development; and/or
   vi) Prolonged seasonal flooding.

2. **Urban Development Masterplan** - Where areas are identified in the PDP and Land Use Plan for conventional residential development, infill areas or new growth areas, plan for strategic provision of sewerage infrastructure, considering:
   a. On-site septic tanks with soak-pit;
   b. Septic tanks with overflow to small bore sewerage;
   c. Conventional sewerage.

The above work is to be undertaken when Urban Development Masterplans are developed for these areas. It is recommended that the dense urban settlements require piped sewerage system. Where possible, growth areas should be designed to be serviced by a gravity-fed sewerage system, rather than a pumped system.

3. **Development Referrals to Environmental Health** – As part of the by-laws process, all development applications for the construction of dwellings or commercial premises that propose to use a septic tank be referred to Environmental Health Department. The Environmental Health department will determine whether the land has the capacity to deal with the waste water.

4. **De-sludging service** – The Municipality provide an annual de-sludging service to landowners.

(IUDP Links: *(IUDP Links: Municipal Transport Management Plan, Land Use Plan and Zoning, By-laws)*

Potential approach

For management of drainage and sewerage system in the Municipality, a detailed assessment of drainage especially in the bazar areas is required. When designing the future drainage system for the bazar areas, present drainage system and treatment plant in ward number 5 could be utilized. There exists possibility of upgrading existing treatment plant at Shrikhandapur for the benefit of surrounding urban areas. Other urban areas where there is no possibility of expanding the drainage system to the existing treatment plant requires another site-specific solution. It is anticipated that the most economical solution might be the installation of small-bore sewerage for the main commercial and high-density residential areas. This system would collect the overflow from septic tanks which would be connected to a decentralized effluent treatment (DEWATS) plant. A proposed wastewater drainage network map (see fig 43) is presented above.

When preparing Septage sludge treatment plant in Dhulikhel, anaerobic digestion technology can be considered as it is the most socially and environmentally acceptable option based on past experiences from the municipalities of Nepal. Even if biogas is not utilized fully, at least a quality compost product would be produced. This could be included as part of a bio-degradable component for solid waste management improvements. Operation of the Septage treatment plant could be assisted by the sale of compost fertilizer and utilization of biogas in agricultural zones of the municipality.

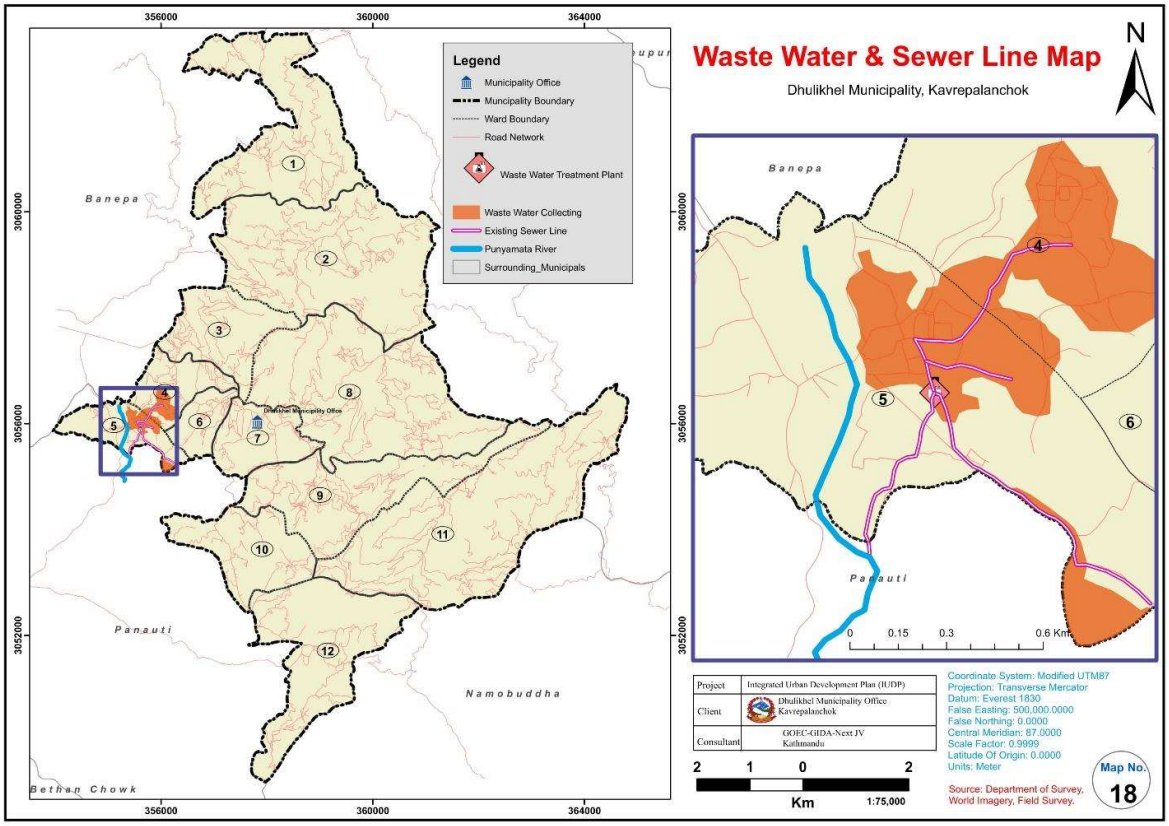

Figure 1: Existing/Proposed Wastewater Drainage Networks

2.7 Solid Waste Management

The waste materials that cause land pollution are broadly classified as Municipal Solid Waste (MSW, also called municipal refuse), Construction and Demolition (C&D) waste or debris, and Hazardous waste.

As per the data collected by IUDP team, there is no proper waste management within any wards of the Municipality. Service is mainly concentrated to bazaar areas. The waste of the entire municipality is currently deposited in Thakuri gaun in ward 8. According to the surveys undertaken for the IUDP project, waste management in wards 1, 2, 9, 10, 11 and 12 is perceived as poor as people of that area have paid for the service but the Municipality could not manage vehicle for collecting the waste.

According to Planning Norms and Standards 2013, 25% of solid waste should be collected and properly disposed. There should be Communal Collection i.e. one collection point/ container/ roadside pickup point that serves a radius of 200m. At collection point, waste is estimated to be 0.4 kg/person/day. A small sanitary landfill site should be provided that accommodates greater than 1tonne and less than 25 tonnes per day.

Management of the all solid waste from an entire municipality is a challenging task. It includes proper location of feasible landfill sites, analysis of different alternatives regarding solid and choosing the best alternative which can meet the requirements of the Municipality. Currently, the waste of the entire municipality is deposited in Thakuri gaun in Ward 8. Waste management in ward 1, 2, 9, 10, 11 and 12 is poor as people of that area have paid for the service but the Municipality has not been able to provide sufficient vehicle for collecting the waste. Although there is a single existing dumping site in the Municipality, there is possibility of several different dumping sites as alternatives which are listed below.

Composition of Household Waste in Dhulikhel Municipality

Municipal waste covers the solid waste generated from households, commercial and institutional establishments. According to a field survey undertaken in 2013, by ADB the average household and Municipal Solid Waste (MSW) generation in Dhulikhel were reported to be 0.12 and 0.15kg/capita/day. With these per capita waste generation rates and projected population for the year 2021, the total MSW generation from Dhulikhel Municipality is estimated at 9.6 tons/day. Some important data related to amount of waste produced in Dhulikhel region as described by ADB is tabulated below:

Average Household Waste (kg/day)	Average Household size (number of members)	Average per capita household waste (g/per capita/day)	Total Household waste (ton/day)	Total Commercial waste (ton/day)	Total Institutional waste (ton/day)	Average per Capita MSW (g/capita/day)	Total MSW Generation (tons/day)
0.64	5.59	115.16	1.87	0.55	0.08	153.54	2.50

Table 1: Solid Waste Production in Dhulikhel

As explained by ADB, municipal solid waste (MSW) produced in Dhulikhel is 0.15 kg/capita/day. With this rate and the population projected for Dhulikhel for 2031, waste production for Dhulikhel is estimated to be 9.6 tons/day. For 9.6 tonnes, sanitary landfill site having an area 17 ropanis is required.

Policy/Strategies

The following strategies for SWM in Dhulikhel will be considered:

The strategy ensures that the focus is on waste prevention (preventing the generation and minimizing the waste that is being generated) as a first priority. The strategic approach applied for the development of strategy is based on the internationally recognized waste hierarchy (below) which includes a systematic and rather general framework to overcome the present SWM related obstacles.

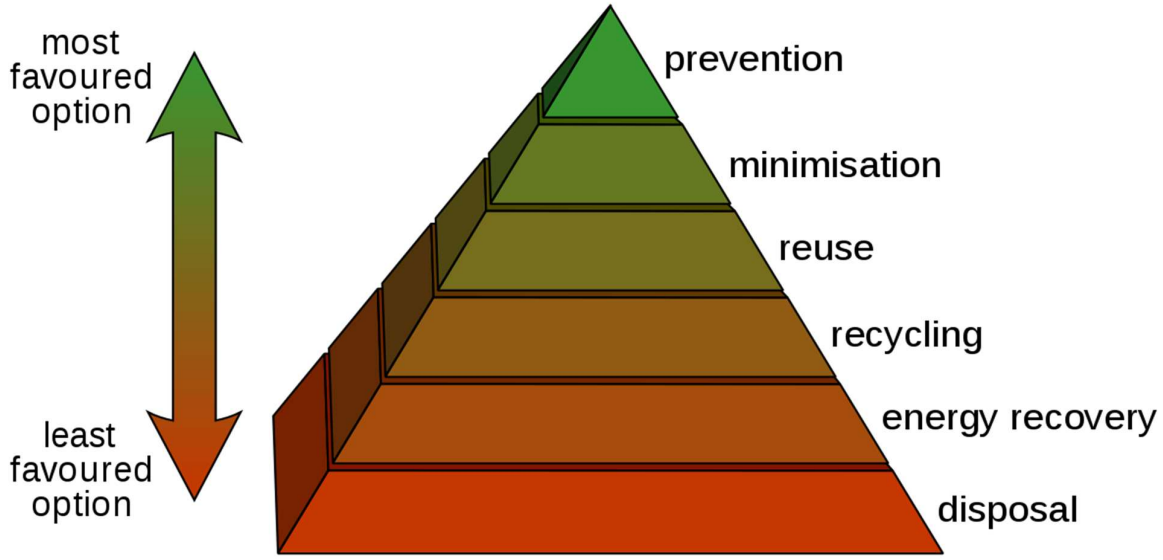

Figure 2: Strategic Waste Hierarchy

1) **Zero waste targets** - This shall be the ultimate target to be achieved through practicing the concept of reduces, reuse and recycle and extended producers' liability in a concerted manner.

2) **Ensuring People Participation** - Municipality alone cannot meet the challenge of keeping the city clean. To change peoples' attitude on solid waste and to minimize the waste produced including Plastic waste and facilitate sustainable waste management peoples' participation must be ensured. To change their attitude and behavior on solid waste, information, education and communication (IEC) programs throughout the municipality will be needed. Participation of communities, private sector enterprises and other stakeholders.

3) In addition to MSW processing, **septage (septic tank sludge) could also be treated and included in the composting stream**. Thus, Integrated Waste Processing Sites (IWPS) could be developed. These do not

necessarily have to be in one location. Small IWPS could be scattered around the municipality depending of waste sources plus environmental and social acceptability. In case of septage sludge treatment, an anaerobic digestion technology would be socially and environmentally acceptable option which generates biogas as well as producing quality hygienic compost fertilizer. Only the by-products (reject waste) would be transferred to the final disposal site.

4) It is expected that the fully functional requirements for integrated solid waste management (ISWM) system may be difficult to implement in the short-term project. Gradual improvement in waste management with associated public awareness and education is suggested for the planned transformation from open dumps to sanitary landfills.

5) The final disposal site (engineered landfill site/sanitary landfill site) as required will only accept rejects from the compost plant and residue from recycling plant / facilities and other unwanted wastes.

6) A number of alternative sites for **waste sorting/transfer station and final disposal** have been identified in Dhulikhel Municipality. These sites require a **feasibility study** to determine environmental impact (including waterways, amenity impacts, CO2 emissions and access), capacity, type of waste disposed and number of service years.

See below map that illustrates existing and potential land fill sites, subject to detailed site analysis and feasibility study:

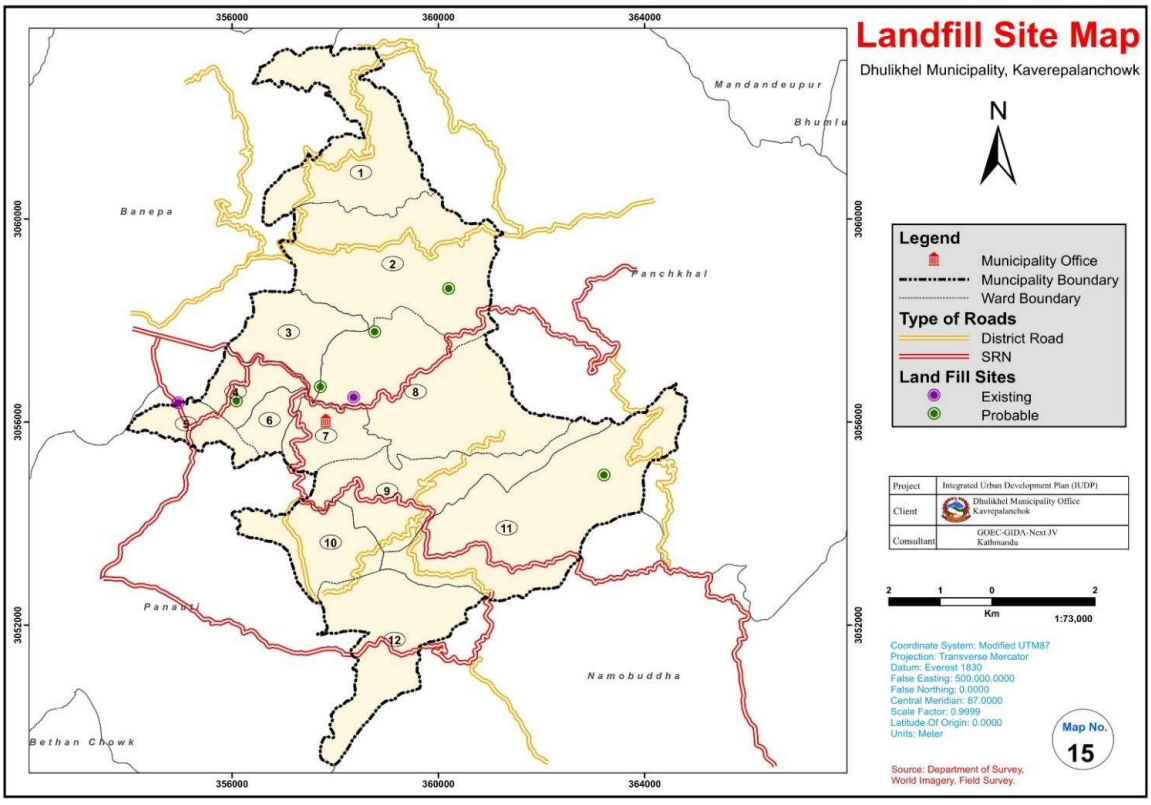

Figure 3: Land Fill site (potential and existing)

The potential waste disposal sites in Dhulikhel are described in the table below (See Table 29).

Probable Dumping Site Location	Description
Kota Bari, (Ward No. 2)	➢ Is connected to 24DR009 through village roads. ➢ A secondary option might be a new road i.e., Chaplati-Chamare road which connects to existing Panchakanya-Kutal-Rabi road and finally to SRN H03 to access the site from bazar area. ➢ Considerably far from rivers therefore no river training works required. ➢ Lower density settlement. ➢ Near forest area.
Naya gaun (border of 3 &8)	➢ Only a Few kilometres away from the primary centres and is accessible through Naya gaun road. ➢ In a near proximity to the forest. ➢ No Human settlement. ➢ River training and flood protection would be required as the site is located near Dhulikhel khola.
Bhandar Khal forest (Ward No. 8)	➢ Directly Accessible through Naya Gaunbato. ➢ Very close to the bazar area. ➢ No river training works required. ➢ Near the settlement. ➢ In the Forest area.
Bhavandol (Suwal Tol)	➢ Accessible through village roads which ultimately connects to SRN F73. ➢ No rivers around the periphery of the site. ➢ Settlements with higher population density.
Ratmate (Ward No. 11)	➢ Exactly accessible through Sunartole-Tinpiple road which connects to BP Highway. ➢ Near forest area. ➢ No sign of any rivers. ➢ population density Low.

Table 2: Possible Waste Disposal Sites

(IUDP Links: Background report, Land Use Plan and Zoning, By-laws)

2.7 Energy

Objective: Improvement of healthy and alternative energy will have improved the health of the residents.

All the newly constructed houses will have solar connections for light facilities as addressed in the Building bylaws of the Municipality.

SewerageBio gas plant will be encouraged in rural wards.
All the newly constructed houses will be orientated to maximise passive solar heating and light as addressed in the Building bylaws of the Municipality.

2.8 Governance and human resources

To manage environmental impacts and environmental assets effectively, the following is needed:

- Strong regulatory frameworks
- Consistent commitment to enforce environmental standards
- Delivery of infrastructure that mitigates the impacts of urban development.

Presently, the Municipality lacks the strong institutional mechanisms to address the environmental issues identified in this Plan.

A comprehensive Environment Department should be established in the Municipality to tackle these issues.

- Waste Management Officer
- Environmental enforcement/regulator
- Environmental officer to undertake strategic work

3. Environmental Management Implementation Plan

Summary of Environmental Management Plan is tabulated below. Along with the list of programs which supports the plans are presented.

Sectoral objectives for the Environment plan in Dhulikhel:

Sectoral Objectives	Measurement Indicators	Means of Verification	Important Forecasts
Forest and environment will be properly administered and Dhulikhel will be established as pollution free green city.	• Land use plan and policy will be implemented. • Water, air, and sound pollution criteria will be prepared and implemented. • Establishment of Environment Branch in Municipality.	• Land use Plan • Land use policies • Air, Water and Noise Pollution Norms and Standards • Organogram of the Municipality	• The assistance of District Forest and Environmental Development Office will be received.

Table 3: Sectoral Objectives and Key Performance Indicators

Implementation Plan:

	MAIN PLANS AND PROGRAMS	RESPONSIBILITY	SUCCESS INDICATOR
Waterways and water bodies			
To have healthy waterways free of pollution.	Creation of green corridors along riverbeds and roads; Punyamati river, Dhulikhel khola and major roads in the Municipality.	Local Community User Groups Environment Department *(IUDP Link: Organogram)*	
	Regulation of riverbeds in Punyamati river using natural materials in order to prevent floods	Planning Building approvals *(IUDP Link: Organogram)*	Zoning and by-laws applied
	Construct and conserve more recharge ponds.	Water Department Local Water Committees *(IUDP Link: Physical Development Plan)*	More recharge ponds will be constructed and conserved.
	Install fencing along waterways to prevent stock from eroding banks and defecating in the water. Encourage active participation of Tole Lane Organisation (TLO) sanitation campaign plantation program and pond conservation activities.	Landowners Local Community User Groups Environment Department *(IUDP Link: Organogram)*	Ownership of the community will be ensured through their involvement in pond and park construction and conservation.

			Public land will be protected by plantation.
	Apply a condition on all construction permits that construction material including gravel, cement and sand must be contained, and removed after the completion of the build, to the satisfaction of the Municipality, and ensure compliance (Through site inspection) with this condition at "Temporary Build Certificate" Stage, "Permanent Building Certificate" Stage and "Finished Certificate" Stage.	Planning Building approvals	100% of Certificates comply with the "construction materials control condition"
	The Municipality install litter traps in strategic locations.	Environment Department Engineering	Litter traps installed
	Apply Forest and Protection Zones (construction restricted areas) and by-laws to the following areas: • The blue conservation zone includes the river and 100m buffer from the river. • The buffer of 10m around all the wet land, 3m buffer from main canal and 1.5m buffer from side canal on either side is also considered as the buffer area. • Identified forest areas and wetlands should be addressed in the Building by-laws of the municipality.	Planning	All the lakes, ponds and wet lands are protected and addressed in the Building By-laws of the Municipality.
Forest Areas			
Protect and manage Forest Areas for their habitat values and sustainable use	Protect forest areas by applying the Forest Zone. The purpose of the zone is to protect the identified community and government forests in the Municipality.	Planning *(IUDP Links: Land Use Plan and Zoning, By-laws)*	TBC
	Apply by-laws effectively and consistently to ensure the sustainable management of the Forest.	Planning *(IUDP Links: Land Use Plan and Zoning, By-laws)*	TBC
Air and Noise			
To prevent noise and air pollution, and effectively manage the impacts .	Reduce the amount of traffic in the central zones that causes excessive air and noise pollution.	Engineering *(IUDP Links: Municipal Transport Management Plan)*	Number of vehicles within town does not increase. Communal carparks at the town edges are established
	Reduce speed of vehicles within the urban areas by introducing speed controls to reduce vehicle noise in built up areas.	Engineering	Speed limits applied within towns

		Local Municipal Police *(IUDP Links: Municipal Transport Management Plan)*	
	Protect residential areas and other sensitive uses such as hospitals and schools by applying a buffer between heavy industrial uses and sensitive uses. Include a "buffer distance" provision in the by-laws	Planning *(IUDP Link: Physical Development Plan, Land Use/Zoning)*	By-laws include a "buffer distance" provision between sensitive uses and heavy industrial uses
	Apply zoning and effective by-laws that require industrial uses to operate to minimise impact on water and air quality and upon the amenity of the area.	Planning *(IUDP Link: Physical Development Plan, Land Use/Zoning)*	Zoning aand by-laws applied
	Regularly monitor air, noise and water in strategic locations Respond to complaints within 7 days	Environment Department	Air, Water and Noise pollution will be reduced to 90%
Soil health			
	Continue to support farmer education on Integrated Pest Management and bio-organic fertilisers	Agriculture Department	TBC
Domestic and Commercial Waste water and Stormwater			
To reduce water and soil contamination by effectively manage the impacts of domestic and commercial waste water and stormwater	**Undertake a Waste Water Analysis** to determine the appropriate solution to improve the poor wastewater management within the municipality, as follows: Identify areas where wastewater disposal or septic tanks are problematic, i.e. where septic tanks are overflowing onto land or into surface water drainage: e.g. due to • High water table; • Impervious ground; • No space for soak-pit; • No space for septic tank; • Density of development; and/or • Prolonged seasonal flooding.	Environmental Health Planning Sewerage and Water Department *(IUDP Link: Physical Development Plan, Land Use Plan)*	Clean and hygienic drinking water consumption
City will have increased drinking water and sanitation facilities.	**Urban Development Masterplan** - Where areas are identified in the PDP and Land Use Plan for conventional residential development, infill areas or new growth areas, plan for strategic provision of sewerage infrastructure	Planning Engineering Sewerage and Water Department *(IUDP Link: Physical Development Plan, Land Use Plan)*	Establishing Drainage Facilities where the population Densities are high i.e. Ward No. 4, 5, 6, 7

			Construction of treatment plant in one of the wards with higher population density i.e. Ward No. 5,6,7
	Development Referrals to Environmental Health – As part of the by-laws process, all development applications for the construction of dwellings or commercial premises that propose to use a septic tank be referred to Environmental Health Department. The Environmental Health department will determine whether the land has the capacity to deal with the waste water.	Planning Building approvals Environmental Health *(IUDP Link: Physical Development Plan, Land Use Plan)*	100% of Households will use toilet
	Public toilets will be installed in main Bazaar areas, major tourist locations and cultural locations	Engineering Drinking water and Sewerage Department	Toilets will be installed Support of drinking water and sewage department will be received
Solid Waste Management			
To Minimise the impact of waste and litter	Land Fill and Waste Transfer sites – Undertake a **feasibility study** of potential sites (listed in this Plan) to determine environmental impact (including waterways, amenity impacts, CO2 emissions and access), capacity, type of waste disposed and number of service years. Construct sanitary landfill site	Environment Department Waste Management Officer Planning and Engineering *(IUDP Link: Physical Development Plan)*	
	Develop a Recycling Program and implement across the Municipality	Environment Department Waste Management Officer	
	Encourage Recycling organic waste products in rural wards to generate organic Fertilizer.	Environment Department Waste Management Officer	
	Install litter and recycling bins in all tourist locations and within strategic locations in the town centres	Waste Management Officer Engineering	Litter bins and recycling bins installed
	Undertake a regular education and anti-litter campaign	Waste Management Officer	
Renewable energy			

Improvement of healthy and alternative energy will have improved the health of the residents.	All the newly constructed houses will have solar connections for light facilities as addressed in the Building bylaws of the Municipality.	Building approvals *(IUDP Link: By-Laws)*	
	SewerageBio gas plant will be encouraged in rural wards.	Engineering Sewerage Department Assistance of Alternative energy development center.	
Governance and Human resources			
To provide a safe environment for the whole community and reduce security risks	Resource a comprehensive Environment Department including a: • Waste Management Officer • Environmental enforcement/regulator • Environmental officer to undertake strategic work	Council/Executive *(Refer to IUDP Organogram)*	Environment department in the Municipality will be established.
	Council to adopt measurable Environmental Standards	Council Environment Department	

Table 4: Environment Management Plan Implementation Plan

3.1 Monitoring and Evaluation

This plan should be reviewed annually (prior to the preparation of the Municipal Budget). The annual review will set out 12 month priorities.

The progress of the Implementation Plan should be reported to the Mayor on a monthly basis.

A new Plan should be developed after 5 years (2080). This process should include an assessment of the progress of the Plan and the physical, economic and social impacts of the Plan.