Urban Liquid Waste Management: An Appraisal of Sewerage System in Dharamshala, Himachal Pradesh

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Abstract- Dharamshala, a hill city with natural beauty and seasonal tourist attractions. A Fluvial Himalayan Glacier serves this region for the water source as well as aesthetical rich landscape with snow capped mountains. Part of Himalayas, McLeodGanj located in the Upper Dharamshala within the Planning Boundary and it has the highest elevation of 2800m above MSL in this city. It has a great trekking route from Dharamkot to Triund Peak which is been known for adventurous destiny. There are many Buddhist monasteries, temples, famous cricket stadium which attracts people from various places. Perhaps footfall of tourism is increasing gradually and also city expands due to urbanization and globalization. This city also selected for development under SMART Cities mission.

Sanitation is one of the important aspect to be considered for the urban development. It deals with the waste management, sanitary factors like toilets, sewage, solid waste, drinking water in qualitative and quantitative. This paper mainly focuses on the Sewerage Management in Dharamshala. It analyzes the existing situation of liquid waste management and inculcates the possible practice methods with the recommendations. In fact there are no industries established in this city and this acts as an positive factor to scrutinize that the human sewage become a biggest threats to rivers and natural streams. So it is very important to appraise the gap of infrastructural services and to sustain the surrounding clean, better and more viable.

Index Terms- Sanitation, Liquid Waste Management, Sewerage System, Waste water, Health

I. INTRODUCTION

Sewerage system is a physical infrastructure being governed by the urban local body of an area. In Dharamshala, Irrigation and Public Health & Municipal Corporation are the two responsible agencies for this system and they have a key role to assess the household connections, suitable disposal methods & compatible technology. Every city should have a Sanitation Plan (Development Plan) to detail out the framework and agenda for the waste management. It is a statuary plan prepared with respect to approved perspective plan of a particular region. According to WHO, Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces.[1] This city has a natural cover of dense forest of 36% of a total planning area and it compels this study to be more sustainable than a existing status.

Aim of this study is to appraise the existing scenario of Sewerage condition and to manage its impacts. Objectives are 1) To assess the existing sewerage network and household connections, 2) To optimize the treatment technology and disposal methods, 3) To consult the stakeholder and public regarding this sewerage management and 4) To analyze the gaps and to propose the needful for the betterment of a city. Scope of this study tends to transform Dharamshala into a totally sanitized, healthy, and to sustain good public health and environmental outcomes for all the citizens with a special focus on hygiene and affordable sanitation. Limitations are considered for being a hilly area might have restrictions in implementation and climatic conditions may influence this output. This study approaches its extent through CPHEEO guidelines, CSP Toolkit and Case Study of Shimla.

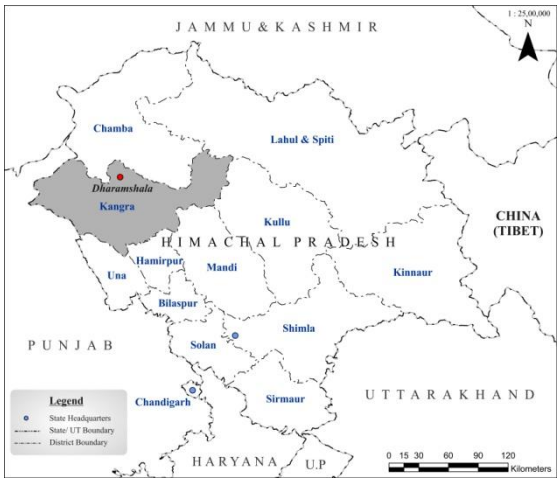
II. METHODOLOGY

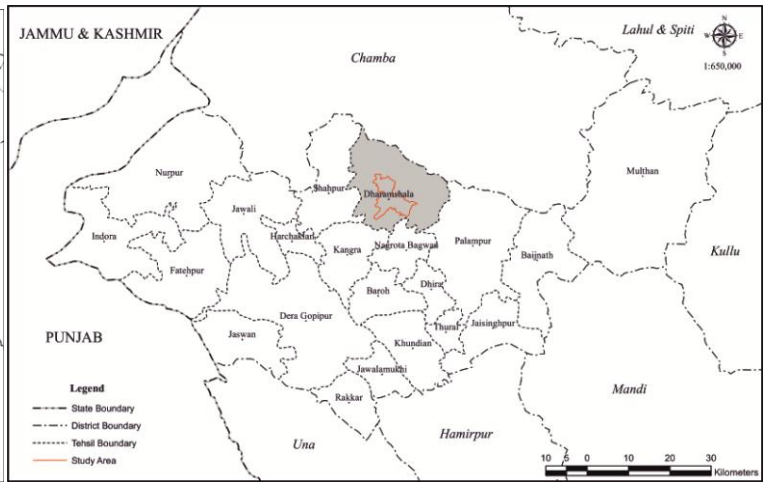
Sample Design & Size This study has been carried out with primary survey on site of an area and interviewing the nodal officers. The designated areas are filtered and buffered through high density of settlements in villages of Dharamshala within the planning boundary. This has been done so that the sample could achieve the original status of population size. It is based on the judgment sampling so that the mixed economy of people would be engaged. An equal number of 20 samples has been surveyed to represent their status of each village. Secondary data were collected from case studies, journals, and concerned government offices.

III. Study Area

Dharamshala is a tehsil, also an district headquarters of Kangra district and it has the role of administration of a district from a statuary place. It has a population of 53,543[2] and the demarcated study area in (Fig 2) is an Planning Area Boundary for the future development.

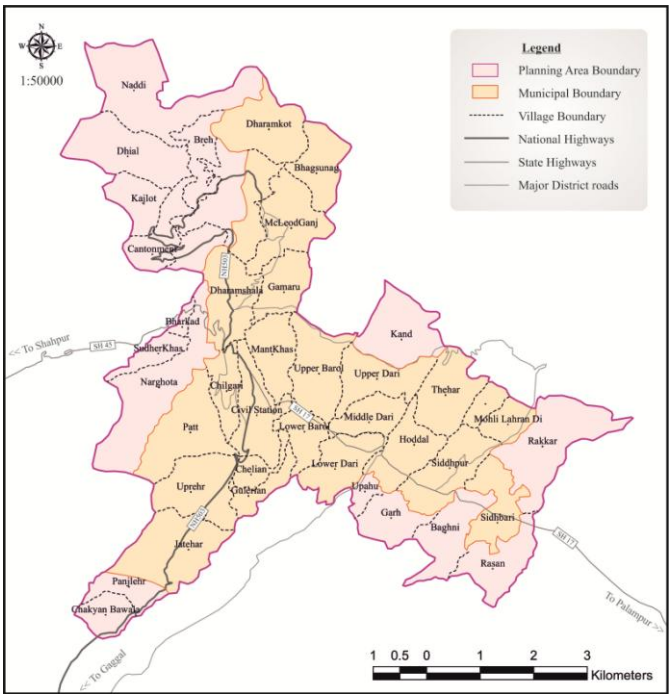
Fig 1: H.P State Map showing Kangra District **Fig 2: Kangra District Map showing Dharamshala Tehsil**

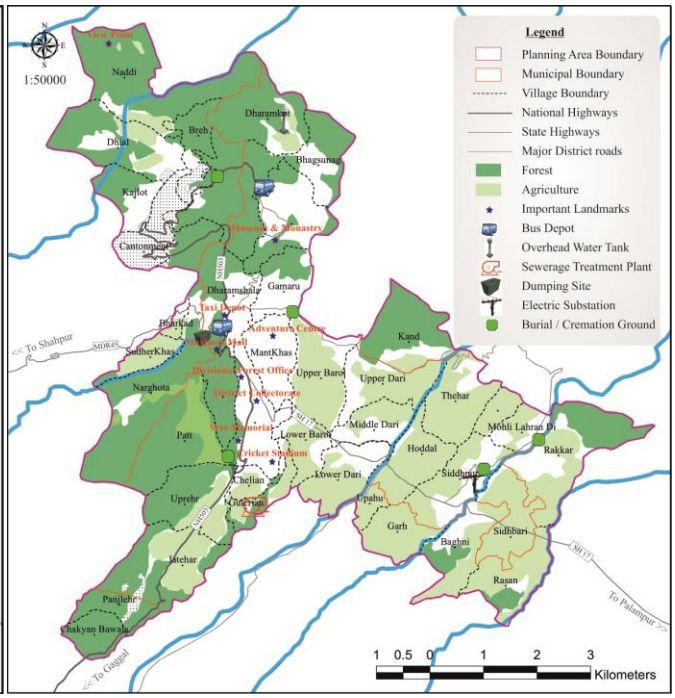




Source: GIS Mapping based on Himachal Pradesh State Map series and Aerial Imagery- Google Earth.

Fig 3: Jurisdiction/Administrative area **Fig 4: Topographic features and major landmarks**





Source: GIS Mapping based on City Development Plan, Dharamshala 2035.

It is a town in the upper reaches of Kangra valley and is surrounded by dense coniferous forest consisting mainly of state Deodar Cedar Trees.[2] The Suburb includes McLeodganj, Bhagsunag, Dharamkot, Naddi, Forsythganj, Kotwali Bazar, Kachehri, Adda, Dari, Ramnagar, Sidhpur and Sidhbari etc. (Fig 3) shows the jurisdiction of Dharamshala Planning Area which is of 41.63 Sq.Km and Municipal Area is of 27.60 Sq.Km. There are totally 17 number of wards in a municipal area and 33 villages including revenue villages in total boundary area. Orange color depicts the urban area and pink represents the rural area.

IV. City Profile

Dharamshala doesn't have railway connectivity or network but nearest railway station is in Pathankot which is of 93 Kms away from the city. The city is accessible through NH 503, SH 17, and MDR 45 and other local roads. Major cities connected through Dharamshala are Palampur, Mubarikpur, Pathankot, Mcleodganj etc. Buses ply daily between Dharamshala and major cities such as Chandigarh, Delhi, and Shimla. [2] Dharamshala can be reached by Gaggal airport, about 15 Kms from the town.

Fig 5: Regional Connectivity

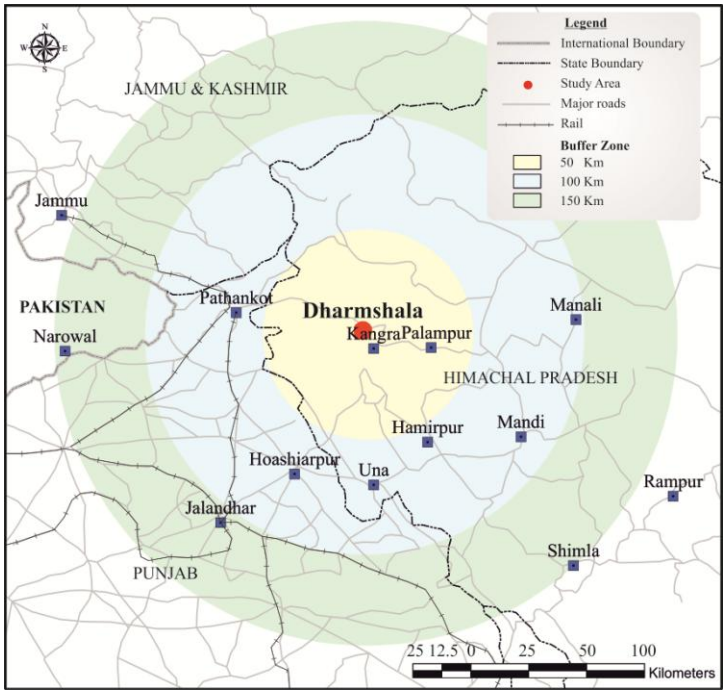
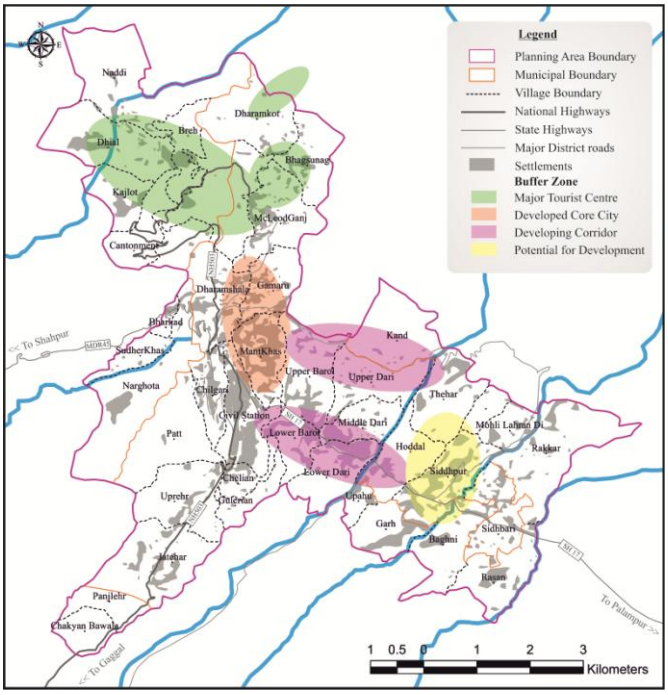
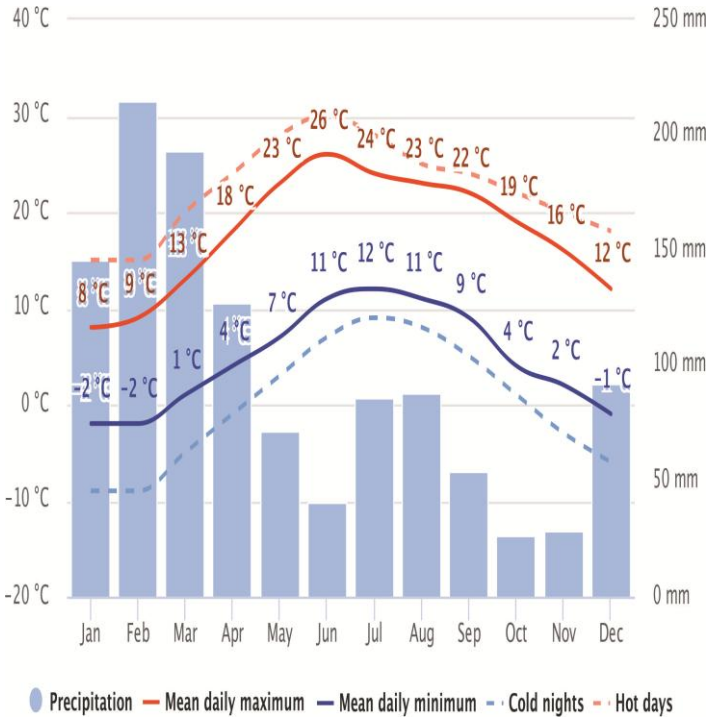


Fig 6: Development Pattern



Source: GIS Mapping based on City Development Plan, Dharamshala 2035.

Fig 7: Climate (2018)



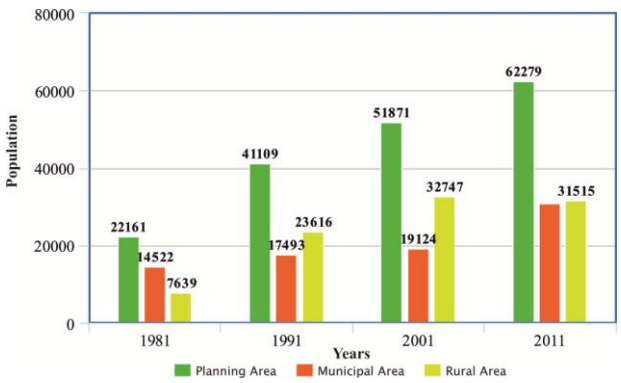
Websource: www.meteoblue.com/dharamshala.aspx

Fig 8: Aerial Imagery-Google Earth 2016

The development of dharamshala takes place from core part to periphery. Due to steep slope and hilly area, certain places are restricted for development including forest, low line areas etc. Fig 6 shows the buffer zone of Major Tourist Centre, Developed Core area, Developing corridor and Potential for development. Rainfall is the major source of groundwater recharge, apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas, whereas discharge from ground water mainly takes place from wells and tube wells; effluent seepages of ground water in the form of springs and base flow in streams etc. [2] Kangra District is having six types of soils out of which Alfisols (sub mountain) soil is found in the Planning Area. [2]

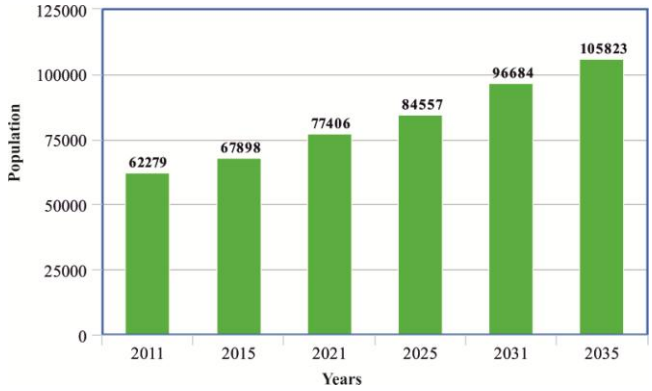
V. Demography & Socio Profile

Chart 1: Trends of Population



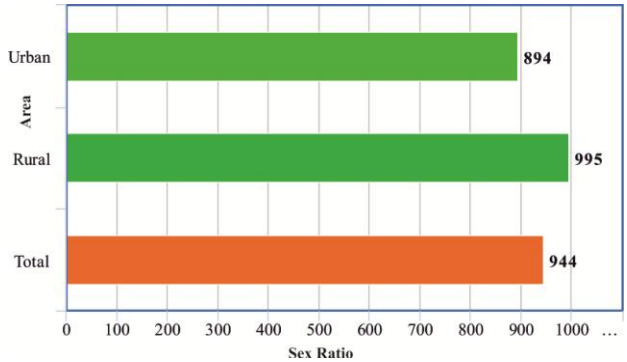
Source: Census of India, 2011

Chart 2: Population Projection



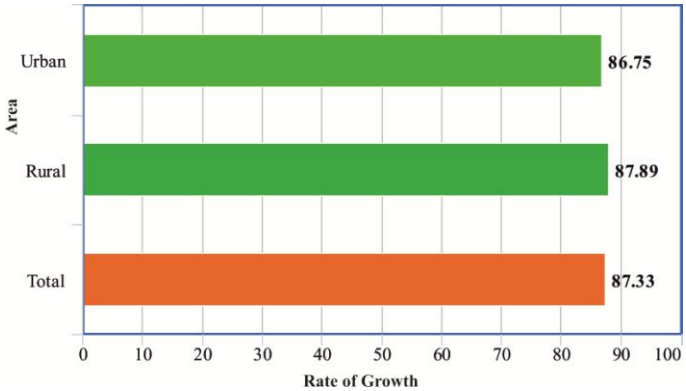
Source: City Development Plan, Dharamshala 2035

Chart 3: Sex Ratio



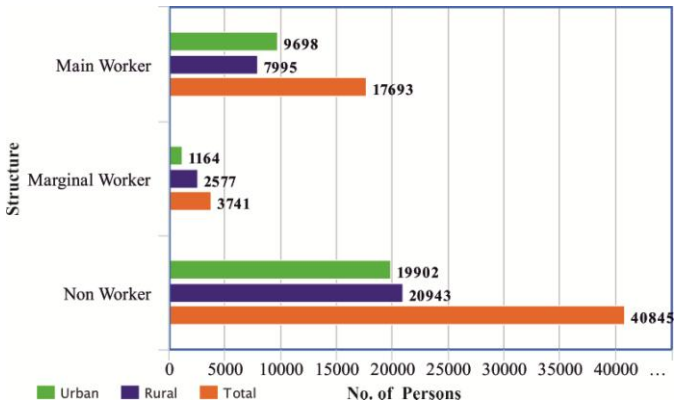
Source: Census of India, 2011

Chart 4: Literacy Rate



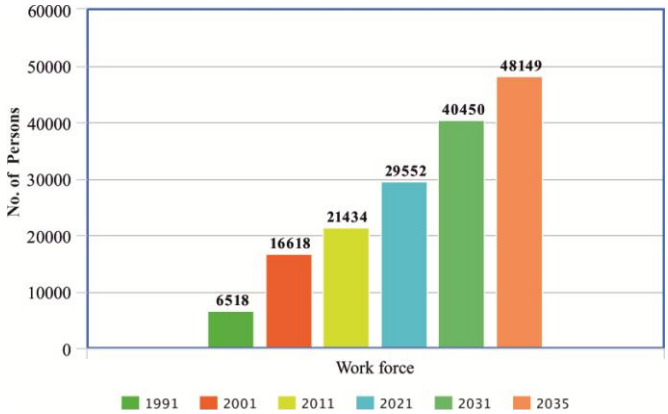
Source: Census of India, 2011

Chart 5: Current Workforce



Source: Census of India, 2011

Chart 6: Projection of Workforce



Source: City Development Plan, Dharamshala 2035

Area has shown a positive development in the past and growth has taken place rapidly which resulted in the up gradation of Municipal Council to Municipal Corporation.[2] The instances of relatively rapid increases in population and share of urban population to total population of the Planning Area were mainly caused by villages and outgrowth areas being added to the municipal area.[2] Unemployment is one of the serious problem in India, Chart 5 shows that there are 40845 non workers and there chance of economical impacts. According to the workforce projection Chart 6, there is a need of employment by 2035, so that the city could do efficiently in GDP share too. With high influence of tourism which is considered as a floating population, it is expected that the attraction of the people for the city will increase. Sex ratio of the city is 944 and literacy rate of growth is counted to be 87.33.

VI. Health Facility & Educational Institution

Fig 9: Coverage of Facility centre

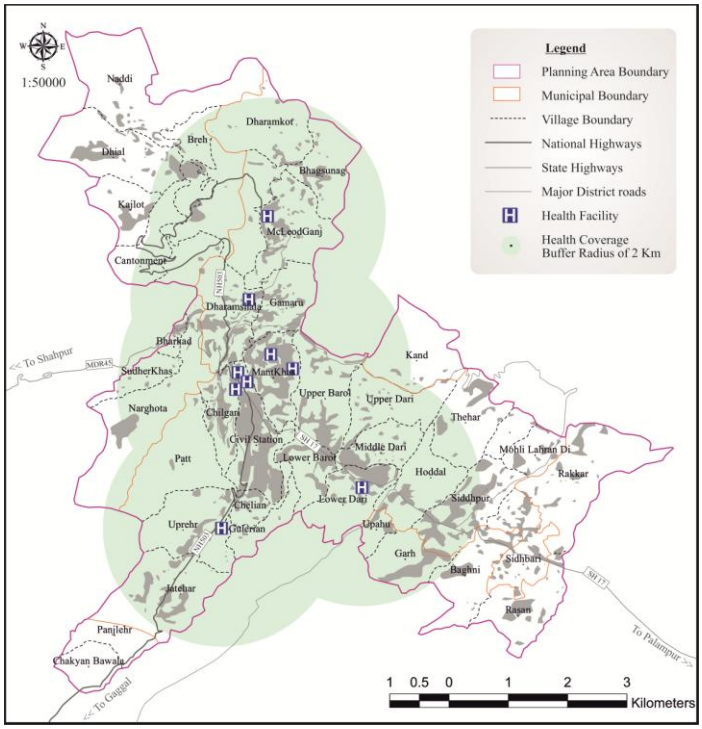
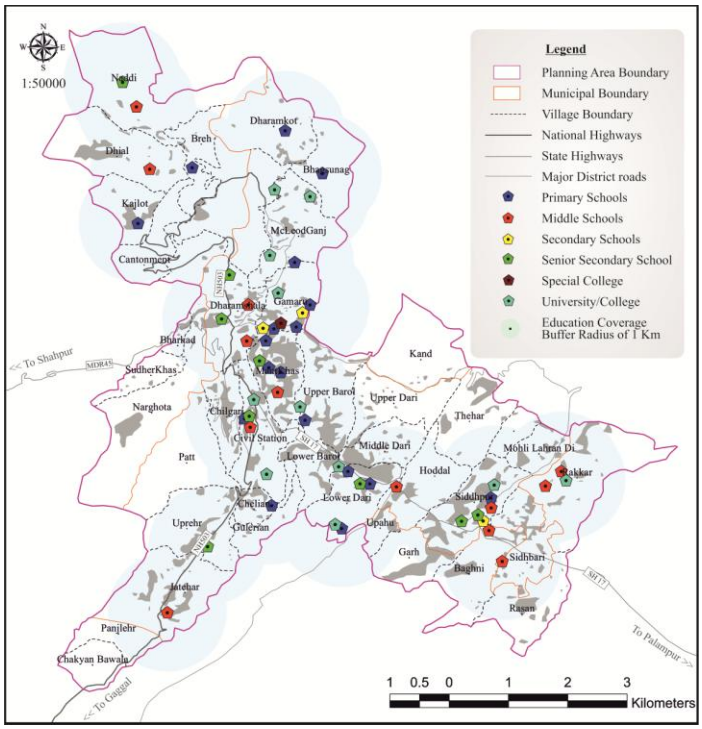


Fig 10: Coverage of Schools or Institutions



Source: GIS Mapping based on City Development Plan, Dharamshala 2035.

Health Facility & Schools has a strong relationship with sanitation factors in view of social aspects. It is very much important to undertake this study for the Sanitation. The poor sanitation of surrounding caused by inadequate facility (Physical Infrastructure) may lead to people illness. Mainly it should be focussed on Institutions, because the average of one from each house is engaged in this. Proper Water supply, Toilets, Waste Management and Health facility should be maintained for the projected size.

There are number of medical facilities present in the city to cater to the city population along with the hinterland population. A government hospital of 300 beds and Apart from that there are small hospitals, dispensaries, welfare centres etc. in the city. [2] 70% of the area facilitated with the proximity of 2 Km. There are 69 government and 41 private educational facilities of different hierarchy in Planning Area and almost 80% of the area facilitated with the proximity of 1 Km. It is focussed because the Schools/Institutions could be source for illness due to inadequate sanitation facilities and Health facility centre is considered as an destination to tackle the illness of people and it becomes a cycle practically.

For example, a person from one of the institutions affected by germs because of improper maintenance due to lack of water supply, inadequate sewerage management leads to lag of waste water on surface. Probably all these leads to water borne diseases, increases vitality of micro organisms. Hence the affected person belongs to one area of that region and that area is considered for threat and person will be rehabilitated through facility centre. This can happen for the half of the catered population as a cycle. There is a need to stop this cycle towards hygiene.

VII. Land Use

Fig 11: Existing Land Use 2017

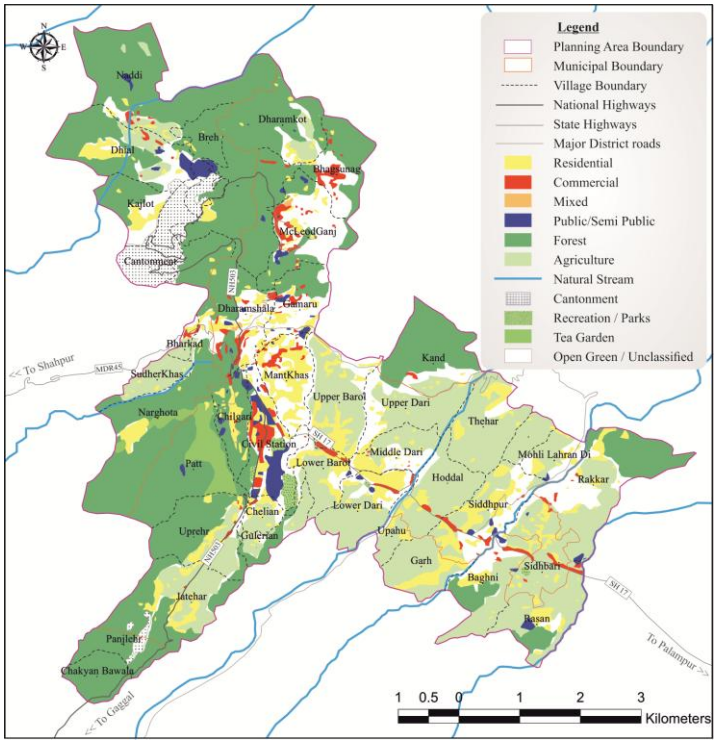
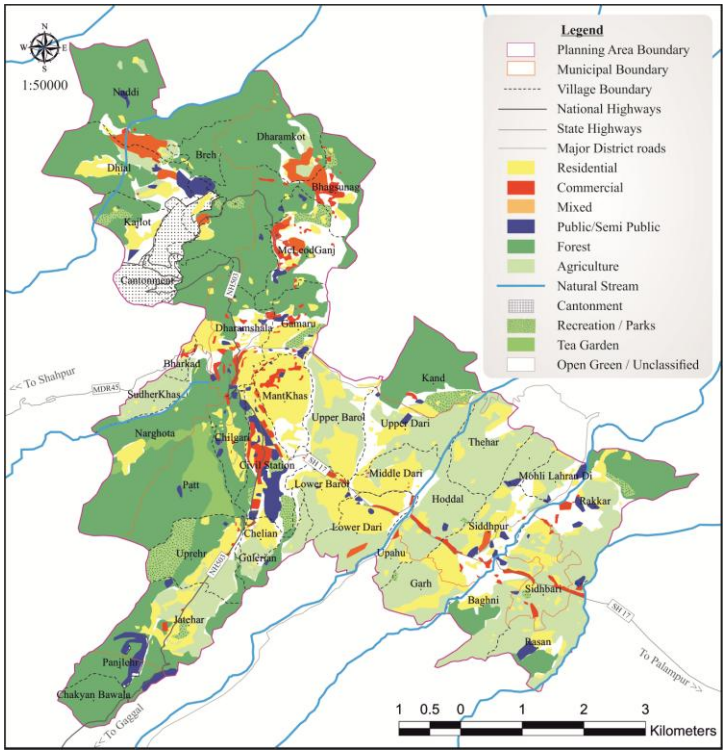


Fig 12: Proposed Land Use 2035



Source: GIS Mapping based on City Development Plan, Dharamshala 2035.

Chart 7: Existing Land Use Share

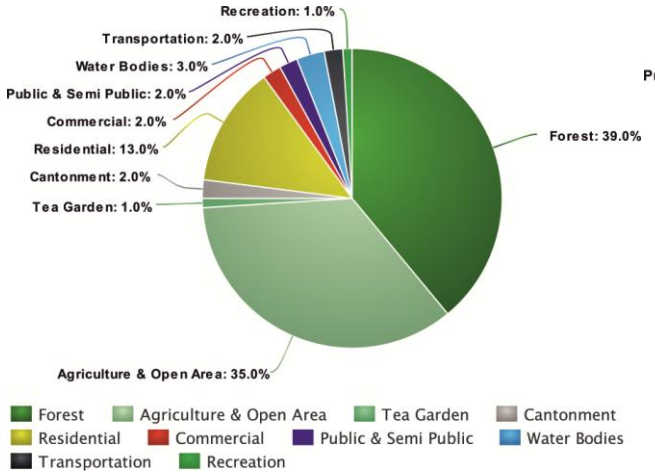
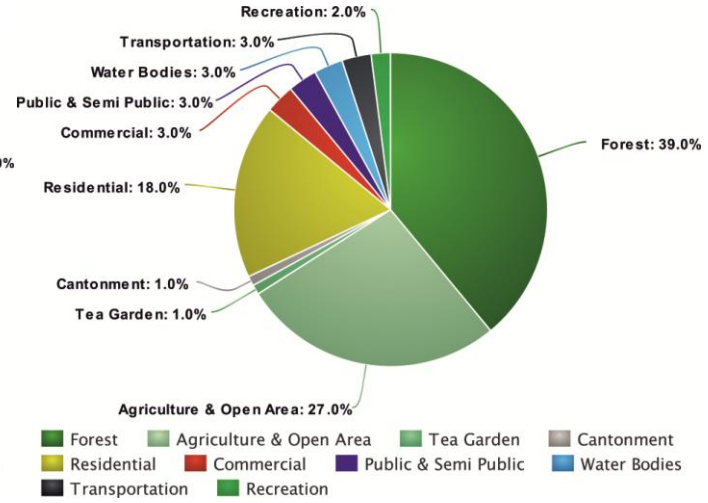


Chart 8: Proposed Land Use Share



Forest occupies majority of land use in total planning area. Comparatively Chart 7 and Chart 8 there is no change in land use of forest. There is a change of Agriculture land reduced to 27% from 35%, Residential land increased to 18% from 13%, Commercial increased to 3% from 2% and others follows. As per URDPFI guidelines, green space for a city should be between 15 to 18%, but it is 2.81% of developed land and is much lower in comparison to the percentage prescribed for recreational land use for medium sized hill town (15 to 18%).[2] Land use is been analysed for the land suitability of sanitation projects. It is very important to take care of other elements and linkages to make it more sustainable.

VIII. Contour & Elevation

Fig 13: Contours

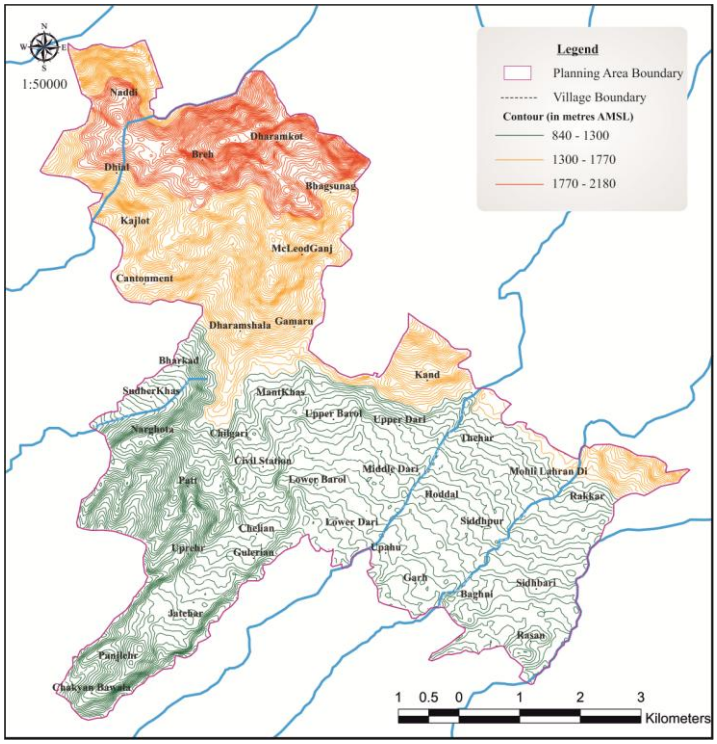
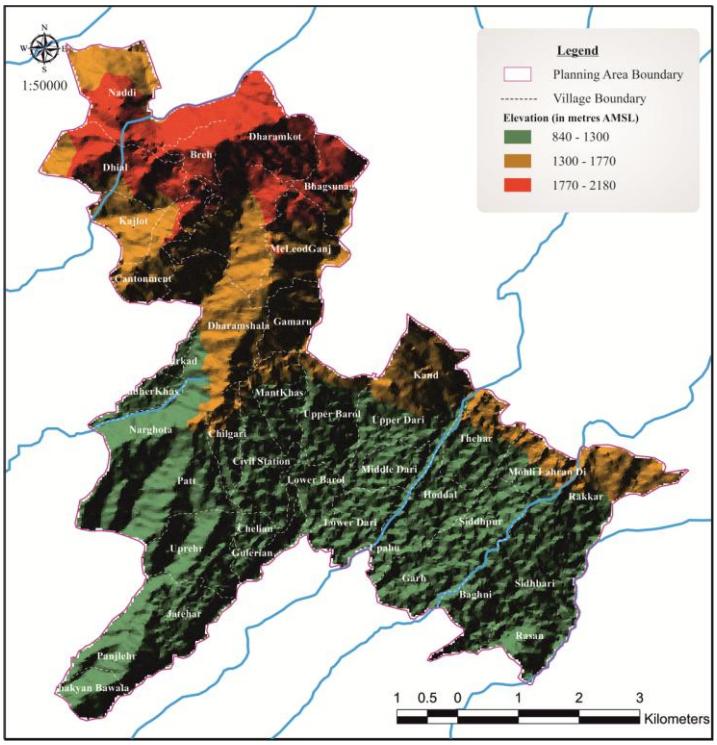


Fig 14: Elevation



Source: AsterDEM Global, The Product of META & NASA.

Terrain of the entire area is undulating and slope of the planning area is in the north to south direction. North is having steep slopes of more than 25% whereas central and southern parts are having comparatively less slope of below 10%. Fig 13 shows the contours of study area to understand the section of geographical features. Fig 14 show the elevation of study area which is an digital elevation model classifies the heights based on satellite imagery. These helps in this study to synchronize the ideas feasibly for the sanitation project. Moreover the flow of water and inceptor installations can be assessed through these analysis.

IX. Data Analysis: Liquid Waste management

In Municipal Corporation area, the sewerage system has a total length of 72.8 km with an area coverage of 60% and population coverage of 67% through almost 3000 household connections.[2] The city has a sewage treatment capacity of 5.15 MLD at Chelian. A large number of households (2000) are also served by septic tanks.[2] Treated waste water does not meet international standards and is currently disposed in nallahs/drains.[2] I&PH department, is responsible for treating sewage generated in Municipal Area. Existing sewer network needs to be strengthened since it is degraded at places.[2]

Chart 9: Duration-Septic tank cleaning

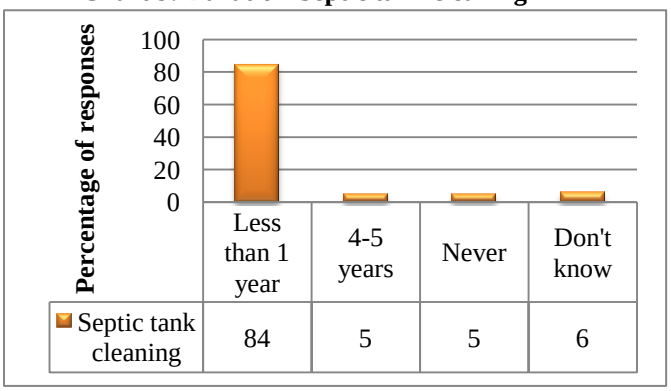
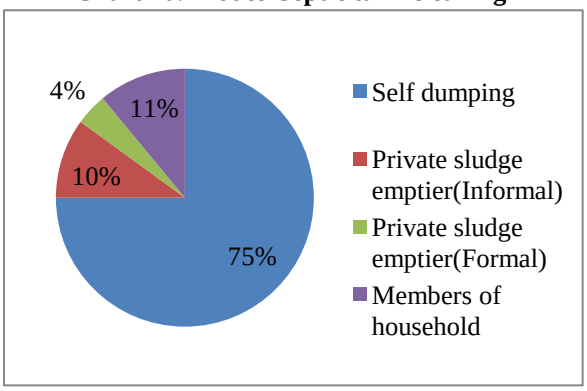
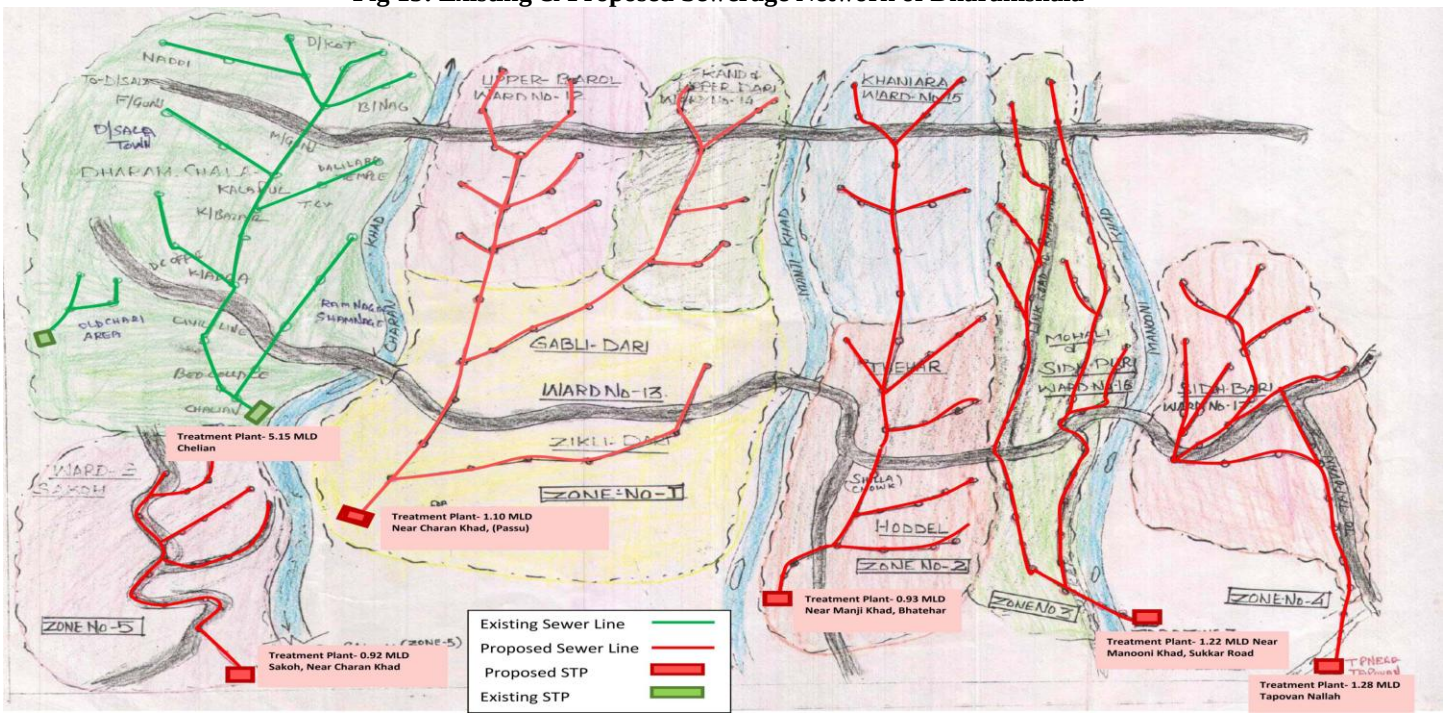


Chart 10: Modes-Septic tank cleaning



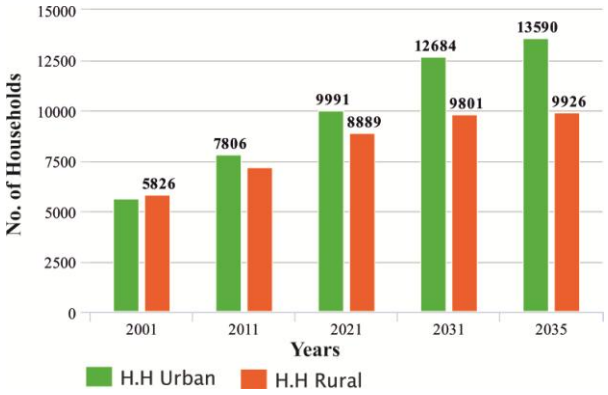
Source: Primary Survey conducted on 1st of March, 2019.

Fig 15: Existing & Proposed Sewerage Network of Dharamshala



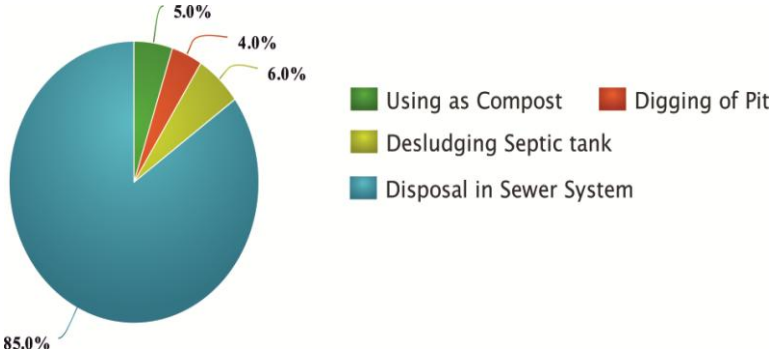
Source: I&PH Department, Dharamshala.

Chart 11: Projection of Households



Source: City Development Plan, Dharamshala 2035.

Chart 12: Disposal Methods in Planning Area



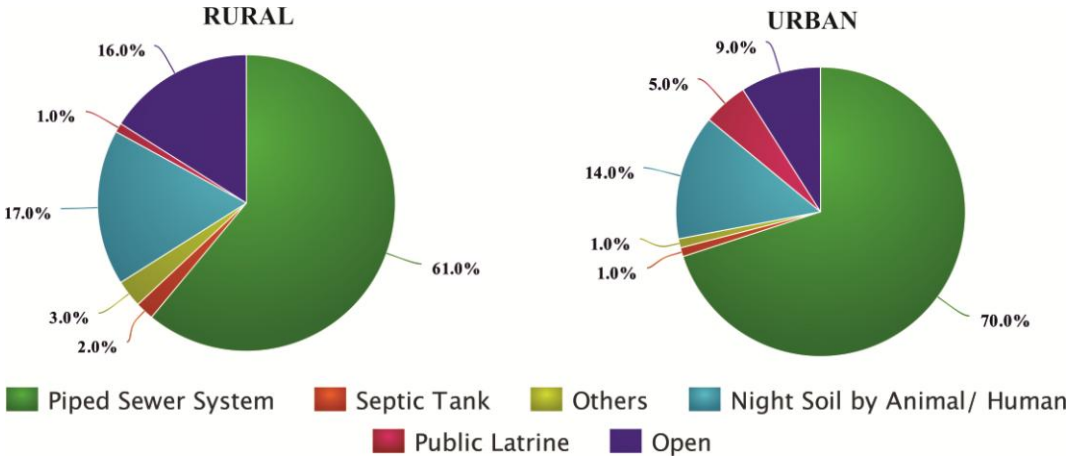
Source: Primary Survey conducted on 03rd of March, 2019

It is expected that the generation of waste water is about 20-30MLD and there is a need of scrutiny in this sector to full fill the gap for better sanitation. The treated waste water is not reutilized or reusable for irrigation and recreation purpose because of non-standard quality of treatment. It is also to be noted if the treated water is drained to nallahs, streams etc, then the usage of STP is quite worse. It is all because in due absence of Tertiary treatment in Sewerage Treatment Plant.

There is a plenty source of waste water in this city to manage sustainably but it is been diluted with natural stream and that may impact other region for no reason due to slope. Nowadays, waste is considered as an gold resource for making money because it is available all over the world at free of cost. Hence the opportunities are higher for the private investors to setup a sewerage treatment plant in PPP model for the development of society as well as own.

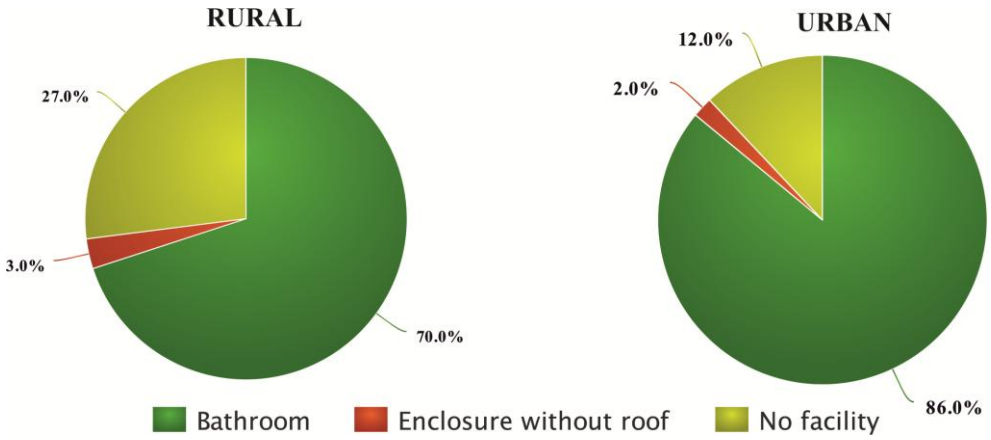
In India, manual scavenging is prohibited legally by the government for the better way of humans. Because it is found in some places that the peoples used to practice without any precaution and that leads to loss of lives. Hence it was proper initiative from the government to regulate the body and guidelines against scavenging.

Chart 13: Disposal Methods Area wise



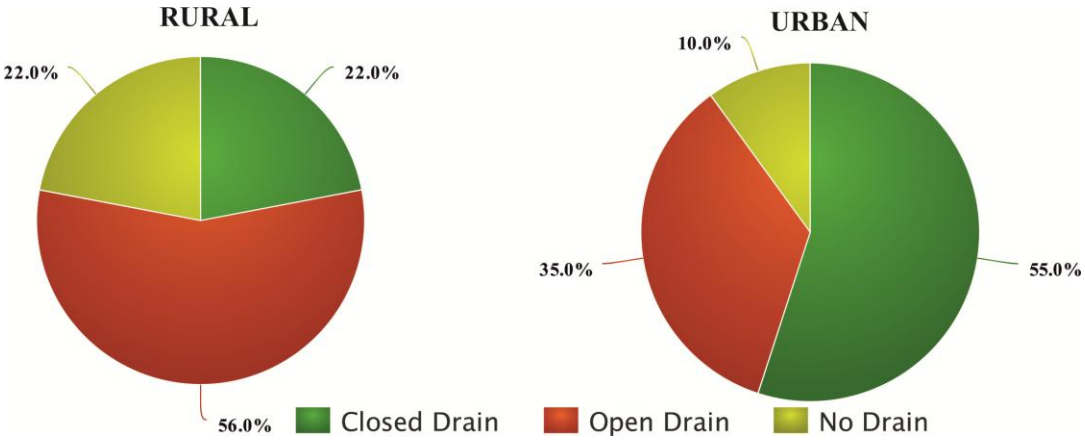
Source: City Development Plan, Dharamshala 2035.

Chart 14: Bathing Facility



Source: City Development Plan, Dharamshala 2035

Chart 15: Waste water outlet connections



Source: City Development Plan, Dharamshala 2035

Table1: Existing Service Level Benchmarks

Performance Indicator	Desired Level of Service	Existing Level of Service	Remarks
Coverage of Sewerage Network	100%	60%	Significant coverage in terms of area
Collection efficiency of Sewerage Network	100%	43%	Low collection efficiency in-spite of extensive coverage
Adequacy of Sewage Treatment Capacity	100%	25%	Existing treatment capacities are adequate for the next 10-12 years
Quality of Sewage Treatment	100%	No data	STPs are functional. Some additions required for optimized treatment levels.
Extent of Reuse and Recycling of Sewage	20%	0.00%	Due to quality, the reuse of treated wastewater has not been explored
Extent of cost recovery	100%	0.00%	Nil.
Efficiency in Collection of Sewage Charges	90%	0.00%	
Efficiency in redressal of customer complaints	80%	100%	The response time to address the complaint has been good

Source: City Development Plan, Dharamshala 2035 and Primary Analysis

X. Key Issues & findings

- Inadequate number of Sewerage Treatment Plant to cater the entire households and waster water.
- Degraded sewer network and engineering failure i.e., flow of waster water.
- Lack of Sewer network coverage throughout Planning Area Boundary.
- Current practice being a threat for Water Borne Diseases and others etc.
- Recycling or Reusable method is not being practiced due to non standard quality of treatment.
- The open discharge from septic tanks results in pollution of land, natural water bodies etc.
- The accountability for provision of efficient services is not ensured.
- Lack of scrutiny in treatment technology and alternative modes.

XI. Proposals & Recommendation

Implementation

- Sewer Network- 100% coverage of planning area.
- Pressurized interceptors should be installed in decentralized manner.
- Combined with Solid waste, usage of Bio-Gas plant which should be eco-friendly in nature may work efficiently to cater the gap, So it has to be invested.
- Integration of Sewerage Treatment Plant with Bio-Gas Plant through lagoon.
- Extension of Planning area for Bio-gas plant is required.
- Operation & Maintenance should be done regularly.
- Advanced tools and technology should be engaged timely.
- Skilled labors and expertise should get involved for the innovative design.
- The treated sludge can be used for Bio-cement and treated waste water can be used for ground water recharge, irrigation, green belt development, recreation purposes etc.

Awareness

Social Awareness Program should focus on Liquid waste management by the NGO, Institutions to the end user.

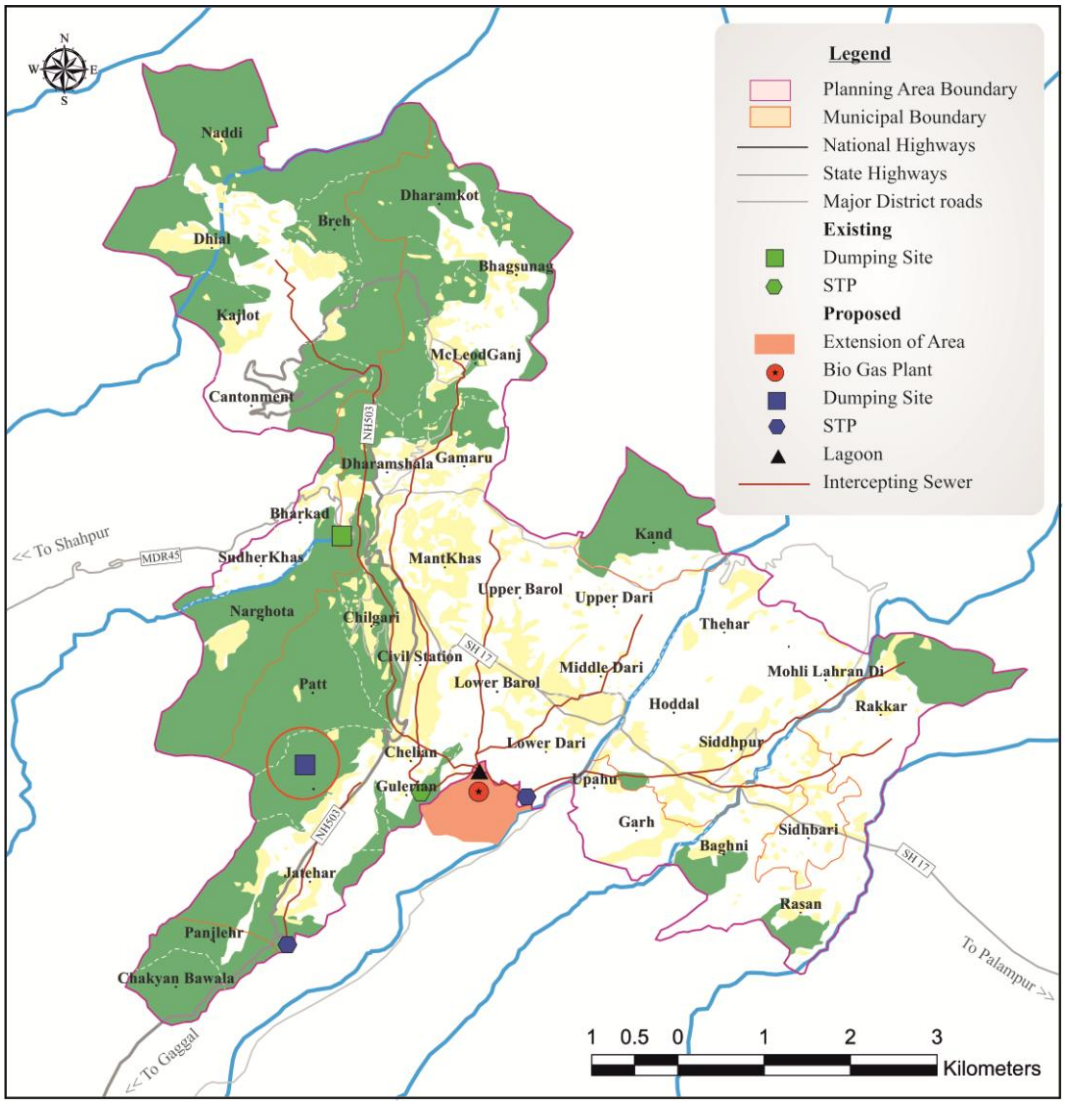
Rules & Regulations

Disposal of treated waste water into streams, drains should be abandoned.

Economy generation

- Levied through Municipal Tax.
- Production of Bio-gas tends to reduce the alienation of power from other sources.
- The treated effluent water can be provided for the institution, irrigation, recreational purposes in commercial basis.

Fig 16: Proposals & Recommendations



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At last to the start of my journey, a lovely wishes to my parents who gave me this beautiful life 'SLAM'.

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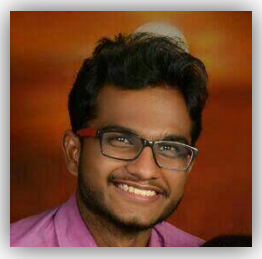
[1] en.wikipedia.org/wiki/Sanitation, visited on 29 Jan, 2014

[2] Dharamshala Development Plan 2035, Town & Country Planning Department, Government of Himachal Pradesh.

AUTHOR



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