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Impacts of Household Wastewater on the Environment: The Case of Debre Markos Town, Amhara Regional State, Ethiopia

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Abstract

The study is conducted in Debre Markos Town which is the capital of East Gojjam Administrative Zone. The paper aims at assessing the impacts of household wastewater management on environment. The existing household wastewater management in the Town is very poor and creates adverse impact on environment like health problem, river and air pollution. These are due to shortage of vacuum trucks to empty toilet, absence of central sewer system, improper drainage systems of household wastewater, low income and lack of awareness of the community to manage household wastewater are the common problems in the Town. As the result, the community discharges household wastewater in to open space, river and streams. Both primary and secondary data were used. The existing household wastewater management condition, the impact of inadequate household wastewater management and challenges were evaluated after findings based on the household survey of 162 sample respondents, interview and field observations. Microsoft-excel were used to present and analyze; and bar graph, pie chart and tables, percentages and figures were used. The results of the study included: the existing household wastewater management services was inadequate, health problem, river, stream and air pollution are impacts of improper management of household wastewater, insufficient infrastructure, lack of coordination between institutions, inadequate participation of stakeholders and lack of community awareness are challenges to manage household wastewater in the Town. Based on findings of the result and the case study; increase inaccessibility of household wastewater management facilities, creating awareness to community, coordination and integration among institutions, participation of stakeholders and provide sewerage system are the recommendations forwarded in order to promote proper household wastewater management system in the Town.

Keywords: Household wastewater, Environmental pollution, Environmental impact, Waste water management, Debre Markos, Ethiopia.

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1. Introduction

Debre Markos Town is one of the Administrative Zone of Amhara Regional state, which has the deterioration of urban environment becomes one of the major problems that we are facing today. Because, most of the households are directly discharging their wastewater into the environment through drainage line, from overflowing and seeping pit latrines, septic tanks, public toilets, open ground excreta defection and grey water from kitchens and bathrooms flow through drainage lines that connect to river and open spaces near to them without any treatment (Feyera, 2007).

Therefore, the discharging of untreated household wastewater on the environment such as air, rivers, streams and open space are adverse environmental impacts on the human health by unpleasant odour and diseases like typhoid and diarrhoea (Environmental Protection Authority, 2005). Due to this, proper waste water management is fundamental for maintaining public health and protecting the quality of the environment.

Man has always generated waste materials which are either by-product of his activities or products which have reached the end of useful lives. Although this was going on throughout the ages, it was not a problem until recent times because natures own waste treatment processes like dispersion, dilution and degradation, which took care of these problems (Syed, 2006).

Methods for wastewater management for centuries simply relied on the self purification mechanisms of natural waterways for the renovation, dispersion and redistribution of low concentration wastes (Craggs *et al.*, 1996). Whilst these natural mechanisms might have historically provided adequate treatment, current effluent discharge volumes and concentrations now exceed effective treatment thresholds of these natural ecosystems (Harlin and Darley, 1988).

Cities are now facing serious problems of high volumes of wastewater, characterized by inadequate disposal methodologies, raising costs of management and the adverse impact of wastes on the environment. These problems, however, also have provided opportunities for cities to find solutions that involve the community and the private sector, including innovative technologies, disposal methods, behavior changes, and awareness raising (Sridhar and Joe, 2005).

Like other developing countries, the management of household wastewater service has been one of the major problems in Ethiopia. The first attempt to address these problems in Ethiopia appears to have been undertaken in the 1920s when the sanitation inspection section was established under the municipal police of Addis Ababa (Assen, 1987). A notice of cleanliness and health was also issued in 1927, and in 1928 the `YetsidatZebegna` or sanitation guards were set up to ensure environmental sanitation when residents started cleaning dirt and burying it (Assen, 1987).The first recorded household wastewater sewage disposal system for the city of Addis Ababa is reported to be the one constructed by the Italians in the 1930s (BCEOM, 1970) and the first time centralized sewage collection system in Addis Ababa was started in the late 1960s (Environmental Protection Authority, 2005).

In light of the fact that, Debre Markos Town has shown speedy growth in every direction, the present installation of modern sewerage infrastructure i.e. sewerage line have been covering limited area of the town and only serving 8% of town`s residents from the total. As the result, the current sewerage disposal work has been mainly undertaken through sewerage cars (Debre Markos Town Water and Sewerage office, 2011). Due to shortages of sewerage infrastructure management of household wastewater in Debre Markos, that has created environmental problems like water pollution, human health problem and air pollution.

One of the major problems facing urban areas today is the contamination of soil, groundwater, surface water and air with wastewater discharged from households. While management of household wastewater in the recent past to reduce or eliminate the production and release waste into the environment, nevertheless a significant deterioration of the environment has already occurred so far (Ashager, 2009).

Debre Markos town, with high population number, it is very difficult for collection of pit latrines and septic tank sludge and services running at very slow capacity. Overflowing pit latrines and septic tanks are in many parts of the town, which is common and are aggravated via road inaccessibility, insufficient management of household wastewater, increase population and lack of community awareness, most of the existing households has low incomes and live in slum areas and most of the toilets are left unattended for many years (Feyera, 2007). The challenges are also similar in Debre Markos town; as the result, it difficult to provide proper household wastewater disposal infrastructures such as toilets and sewerages. The household wastewater is discharged into the environment through drainage canal, from overflowing and seeping pit latrines and septic tanks. In addition to these, open ground excreta defection and grey water from kitchens and washing cloth flow through drainage canals that connected to river and streams in the town (Mazhindu *et al.*, 2010). This river is used as sources of washing cloths and bathing for the communities who are lived near and around to the river.

Improper management of household wastewater is adversely affects the environment such as human health by unpleasant or offensive odour and diseases like typhoid, diarrhoea, common cold and asthma (Environmental Protection Authority, 2005). It also affect the quality of the environment through reduce aesthetic value of the town due to creating unpleasant odour by the stagnant of the wastewater on themselves drainage and the open spaces.

In view of the above stated problems, improper management of household wastewater has adverse effects for environmental protection like air, river, stream pollution and social impact. Hence, this study tries to assess the impact of household wastewater on environment in Debre Markos town.

2. Methods and Materials

2.1. Description of the Study Area

Location: Debre Markos, the capital of East Gojjam Administrative Zone is located in the north west of the capital city of the FDRE of Ethiopia, Addis Ababa at a distance of 300 Kms and 265 Kms to the capital of Amhara Nation Regional State, Bahir Dar. Specifically it is located in the Amhara regional state, East Gojjam zone. The town served as the capital city of East Gojjam zone. Until 1995, Debre Markos was the capital city of the province of Gojjam. It has latitude and longitude of $10^0$20'N, $37^0$43'E and altitude of 2,446 meters above sea level and it has moderate temperature (The Enlightenment, 2009) . The town is named Debre Markos after its principal church, which was constructed 1869 and is devoted to Saint Mark.

Area/size: The area of Debre Markos Town is 6,160 ha and has oval shape; its Average Annual Temperature is 18.5ºC; Mean Annual Rainfall is 1,380 mm and the existing wind direction is from north to south. The main natural constraints for the physical expansion of the Debre Markos town are hills, swamps, rivers and forests; while the manmade constraints are illegal settlements and urban rural boundary conflicts.

Population: According to Central Statistics Agency (2007), the population of the town was 62,497. Out of this 29,921 (47.87%) were males and 32,576 (52.1%) were females; 16,325 (26.14%) were within the age group of 0-15 years, 42,185 (67.49%) 16-60 years, and 3,987 (6.37%) 61 years and above. The population growth rate at low variant was 2.4%, while household size in the town is calculated to be 3.2. The majority of the urbanites worshiped Ethiopian Orthodox Tewahido church. 97% of the inhabitants are speakers of Amharic language. The remaining 3% of the inhabitants are speakers of Tigiregna, Agew and Afan Oromo. According to Central Statistic Agency (2013), the population projection figure of the town had been estimated 38291 male and 41689 female inhabitants which is a total of 79980 populations. Area of the town is expected to be 1214.9 sq. Km and 65.82 km/square density.

3. Research Design

Descriptive type of research helps in describing the existing condition of household wastewater management and its impact on the environment. It also enables to describe the situations like access to toilets, type of toilets, toilet ownerships and disposal system of wastewater, their impact on environment and challenges of household wastewater management in the study area.

Each research method has own techniques, hence the researcher prefers to use survey techniques though questionnaires, interview and field observation employed for data collection. It helps to assess the impact of household wastewater on the environment to attain the research objectives. To do this, four enumerators were hired and trained to distribute the questionnaires and collect the data for analysis.

To conduct the study thoroughly both probabilistic and non-probabilistic sampling techniques were used. In order to get reliable information, the research was adopted stratified sampling methods particularly systematic random sampling method and purposive from non probability sampling methods. In systematic random sampling, the researcher had used the order of the house number list available in each Kebele for choosing the sample. In addition, stratified random sampling has the advantage that contributes much representatives of the sample for large sample size and it is easy to apply. Purposive type of sampling was another important method of selecting sample units that aims in obtaining detailed information from different officials and experts to increase the validity of the study.

The study had employed both probability and non probability sampling techniques. Probability sampling technique was used for selection of households. The way of selecting sampling was using stratified system until it reaches to specified target for each Kebele under study. While non probability sampling technique was for officials from water and sewerage office of the sub city and woreda health office by using purposive sampling technique.

As stated above, the sample size of the study was 162 households and 3 officials from the sub city water and sewerage office. In addition to this, 3 woreda health officials were interviewed. Therefore, 168 respondents were involved in the study as the sample in order to collected primary information to achieve the stated objectives in the study area. The researcher determines to use this much sample that by considering it's representativeness of population, it's manageability, man power, and financial constraint and experience of the researcher.

4. Results and Discussion

This section, presents the interpretation and discussion of the major findings.

4.1. The Existing Condition of Household Wastewater Management Systems

4.1.1. Sources of Household Wastewater

The investigation of the study shows as, Debre Markos town, gray water and black water are the two types of wastewaters which are generated at household level. Similarly, during field survey, the main sources of wastewater in the households are: from cloth washing, kitchen, bathroom and toilet services. Hence, the result indicated that, from the major sources in the town, household wastewater was generated from washing clothes and materials. In relation to this, Duncan (2004) explored that, household wastewater sources are black water (toilets) and gray water (slullage), which are wastewaters resulting from personal washing, laundry, food preparation and the cleaning of kitchen utensils. Similarly the result of the study revealed as, washing clothes, kitchen, and bathroom and toilet services are main sources of household wastewater in the study area.

4.1.2. Means of Discharging Household Wastewater

The findings of the study shown as, household wastewater produced in the sub city is discharged at drainage canal, open space, river and septic tank. Majority of households discharged in to drainage canal that was prepared for storm water drainage.

In support of the finding, Rosenthal (2005) said that, most of the household wastewater generated in developing countries, including Ethiopia, is discharged in to the environment such as river and open space without treatment, which contaminating downstream water supplies used for drinking water, irrigation, and recreational activities. Similarly according to interview results, from health office officials even if the majority of household discharged their wastewater to drainage canal, the canal was built long time, opened and majority of existing drainage canal was blocked by solid wastes, it does not give proper function to the community. Therefore, the study shows that, wastewater discharged in to the environment such as open spaces, river and streams without any treatment systems, which polluted river and air and also create health problem on community like diarrhea and upper respiratory diseases in the study area.

4.1.3. Access to Toilet

Access to toilet is the main to manage household wastewater. Around 300 million urban residents have no access to sanitation and they are mainly low-income urban dwellers that are affected by lack of household wastewater discharging infrastructure (Walid *et al*., 2008), 27% of the population in Debre Markos has no toilet facility, who are defecated on open ground in any open spaces especially river bank. Similarly, Debre Markos town is one of town which has high density of population and lives in crowded homes. Hence, the management of household wastewater is very poor and some of the populations have no access to toilet and used river banks and open space for defecation. As a result, it created health problem, pollution of air, river and steams.

4.1.4. Types of Toilets and Emptying Condition

The degree of household wastewater management varies in most developing countries. Hence, household wastewater is discharged to offsite (centralized plants) and on site (pit latrines, septic systems) or disposed of in unmanaged drainage canal or waterways that can open or closed sewers. In urban area of Ethiopia, the most common used for the management of household wastewater is on site wastewater disposal method. This is because its cost for construction and management is easy as compared to off-site disposal method. Similarly, the findings of the study indicated as, like any other Ethiopian urban cities, in Debre Markos town the common type of household wastewater management is on site systems (pit latrine, septic tank and ventilated pit latrine).

In addition, Debre Markos town has no offsite (sewerage line) system; instead canal system that covers a small part of the city, only 7% of the population is connected to channel line (Debre Markos Town Water and Sewerage office, 2011). In contrast to this, according to interview findings, from the town water and sewerage office official off site wastewater management is absent in the sub city due to it takes large amount of resources to construct and maintain and majority of community who lived the town are low income and lives in slum homes, hence, they have no a capacity to build off site wastewater management system. The most common type of toilet used by the community in the town is pit latrine and used as shared with each other.

On the other hand, emptying of onsite facilities is often neglected and wastewater overflows from the pits to the roads or gardens, and is often disposed without treatment in to open streams and rivers (Kebede, 2004) that create a negative effects on urban environment. This is also, the result shows, to some extent common in Debre Markos town, residents who have access to toilet 23.3% are not emptying. According to interview responses from woreda officials, households did not get trucks from town water and sewerage office to emptying their latrine; because some pit latrines are not accessible for transportation to pick waste water and some communities have financial constraints to emptying the latrine. Therefore, it is difficult to access truck for the community in the required time; as a result, the latrine could not empty on time.

The sub city water and sewerage branch office give emptying service and charged 69 Birr per truck at household level. Some communities are connected their toilets directly to river and drainage canal at rainy season. As a result, its consequence of the problem resulted in pollution of river and stream water in the study area.

4.2. Impacts of Household Wastewater on the Environment

Improper management of household wastewater has various impacts on environment. The result of the study shown as, the impacts of improper household wastewater management are observed and these impacts are grouped in to health problem, water and air pollution.

4.2.1. Social Impacts

Household wastewater is the principal vector by which a large number of communicable diseases are transmitted and spread in urban areas (Sien, 2001). The findings of the study revealed as in the study area, 94.4% of sampled households source of wastewater were gray water, 16.6% of respondents have no access to toilets and 23.3% those have access to toilet but not empting in truck who disposed their wastewater either or both in open space, in river and drainage channels. As a result, it creates environmental problems.

In relation to these, according to Debre Markos Town Health Centre Annual Report (2013) the mostly occurred top diseases were: upper respiratory disease and diarrhea 35% and 9.8% respectively, which are resulted from, the town households were discharging there wastewater in to the environment without any treating mechanisms. Therefore, these methods of wastewater management have a negative consequence on health status of the community in the sub city and it also has health cost, needs additional cost and reduce the productivity of the community. A losing of a working day to health problems related to poor household wastewater management has an economic cost, which brings a reduction of household income and the productivity of local and national economy and conflicts between neighborhoods due to improper disposal of waste water in the study area.

4.2.2. River Pollution

Improper management of household wastewater has great impacts on the quality of water.

Hence, the finding of the study indicates in the study area, household wastewater is directly discharged to the river and streams, which pollutes the water. The river and stream which were found in the town are used as washing cloth and bathing for those low income communities lived near and around the river and streams.

Results from field observation shows people of Kebele 2 released their wastewater directly to the river. This river was also used as washing cloth and recreational activity for low income groups live around and downstream of the river. In addition, interviews from woreda health office, the community who uses the river and stream for washing cloth and bathing are affected by different diseases like skin infection. In relation to these data from Debre Markos Town Socio Economic Annual Report (2013) explained that, 6.2 % of the diagnoses in the town were skin infection disease.

4.2.3. Air Pollution

Air pollution occurred due to improper management of household wastewater in town. Wastewater discharged from household overflowing on road, and stagnant at drainage canal and open space that decays create bad smell that hinders the aesthetic value of the town.

Stagnant of wastewaters that discharged from households at road side and drainage canal are not mostly flow in to the river or stream. This creates bad smell and reduces the aesthetic value of the sub city.

Similarly according to interview finding from health offices, the wastewater which are produced at household level are not flow properly; due to, majority of the drainage canal in the town are works for long year, opened and outdated. Households also openly had thrown solid wastes on and around drainage canal which restricts the flowing of wastewater, which resulted in stagnant of household wastewaters on canals. Due to this, wastewater is not flow and stay long time cause to create offensive odder and the community easy to catch with common cold and the cause of disease of those asthmatic patients**.**

4.3. Challenges of Household Wastewater Management Systems

Many cities in developing countries have problem in managing the household wastewater, especially in big and densely populated cities. Debre Markos town is one of most densely populated and business area; such massive person needs adequate sanitation infrastructure services, and fulfilling these needs was the challenges faced by the town.

Hence, the result of findings from interviewee officials; shortage of household wastewater management infrastructures, lack of awareness and sense of ownership on the communities, inadequate participation of private sectors, NGOs and inadequate coordination between institutions were the main challenges of household wastewater management in the study area.

4.3.1. Shortage of Household Wastewater Related Infrastructures

Infrastructure accessibility and sufficient services is the base for urban development. In Debre Markos town, some of the communities were in accessed with basic sanitation infrastructures like toilets and drainage canals as the result, used open space, street road, river bank and streams defecation and discharging mechanism. Similarly, due to shortage of trucks to collect the wastewater, some of the communities are also discharging their wastewater through direct connect to river and drainage canals.

In relation to this, according to About Briscoe (1993), one- sixth of the world's population lives in urban area with inadequate sanitation infrastructure like; toilet, septic tank, drainage canal and wastewater treatment plants.

In Debre Markos town, currently to collect wastewater only one truck is available. According to Debre Markos Town Water and Sewerage office (2011).Therefore, due to shortage of the trucks, some community has no access to get truck to emptying their toilet, and prefers to discharge their toilet illegally through directly connecting in to the river and drainage canal at rainy season. Hence, from the findings it can summarized that, shortage of infrastructures, produced household wastewaters are not managed properly, and discharging in to river and stream, street road, open space and open defecation creates an adverse impacts on health problems of the communities, air, river and stream pollutions in the study area.

4.3.2. Lack of Coordination between Institutions

The provision of effective and efficient household wastewater management service is not possible alone; rather coordination of other sector is important to provide adequate services to the community. In Debre Markos town, as the result of inadequate coordination, the management of household wastewater is very poor.

Similarly, according to interviews response the coordination between Debre Markos town water and sewerage service office, the town solid waste management office, health and land and planning administration office was poor on proper management of household wastewater in the town. In addition, interviews from woreda health office officials, due to lack of coordination among the concerned sector, some of community were dumping their solid waste in to drainage canals and open spaces. Due to the absence of timely maintenance, the existing drainage canals are old and open on which the community dispose wastewaters. As a result, due to lack of coordination and integration between institutions this fuels the environmental problems like river and air pollution and health problems on the community in the study area.

4.3.3. Inadequate Participation of Stakeholders

Household wastewater management is not government task only, but NGOs and private sectors should also participate. In Debre Markos town the participation of stakeholder was very limited. According to Debre Markos Town Water and Sewerage office (2011), there is no any private sector that participates in collecting and transporting wastewaters in to disposal site in Debre Markos. Similarly interviews finding indicated that, not only small private sectors small participation but also are not covered whole parts of the town. Hence, due to the private sectors are small, they are no providing services to the community, charged high price and select the nearest areas that accessible to transportation as compared to the government sectors. Therefore, it can be generalized that in adequate participation of concerned private sector was the challenge for household wastewater management in the study area.

4.3.4. Lack of Awareness and Sense of Ownership on the Community

Increasing public understanding and know how on the value of proper household wastewater management is critical. Household wastewater management is the most important basic function for protecting public health, wellness and the environment. In Debre Markos town, due to lack of awareness and sense of ownership of the communities, the management of household wastewater is very poor. According to interview result from woreda health office, some of households are damping solid wastes produced at home in to drainage canal, directly connect their toilet and gray water with drainage canal, river and streams at rainy season. Therefore, it can generalized that,

due to the absence of awareness and sense of ownership of local communities, the dispose their wastewaters in to the environment without treatment which causes a health problem of the community, air, rive and stream pollution in the sub city.

4.4. Strategies to Improve Household Wastewater Management

The creation of suitable and favorable environment requires the proper management and disposal of household wastewaters through involving concerning stakeholders like government sectors, private companies, NGOs, local communities, CBOs, and associations by involving them from planning to implementations.

In addition the involvement of major stakeholders by itself do nothing without continuous monitoring and evaluation and undertaking remedial measures for the identified gaps and problems in relation to household wastewater management. The findings of the study also revealed that, government sectors to properly mange household wastewaters, design mechanisms that are cost, time and effort effective in order to minimize the costs of the tasks accomplishments in the study area.

Similarly, local communities can be encouraged to participate; to contribute indigenous, valid ideas, have strong sense of ownership by members of the community. It is also very important to engage 'gatekeepers or influential community leaders and existing community in to maintenance and cleaning of wastewater related activities in the study area.

5. Conclusions

This part concludes the overall existing condition of household wastewater management services, the impacts of improper management of household wastewater on environment, and challenges to manage household wastewater in Debre Markos town. In addition, enabling ways to solving the identified problems were recommended in the recommendation part. Thus:

Household wastewater management, among other urban problems, has currently become a concern of local government of developing countries including the public at large. The degree of household wastewater management varies in most developing countries. Hence household wastewater is discharged in off site (centralized plants) and on site (pit latrines, septic systems). In most cities particularly Ethiopian cities, the management of household wastewater is commonly used to on site discharged systems.

Unlike other cities of Ethiopia, Debre Markos town was the town which has no offsite (sewerage line) system that covers a small part of the city, only 8 percent of the population is connected to sewer line, but, Debre Markos town is not included in the existing sewerage system. Hence, the study finds that, the town used to manage the wastewater by using on site like septic tank, pit latrine and ventilated pit latrine. Among these, majority of households in the town used pit latrine and they utilized by sharing, few of the household used ventilated pit latrine and a very few used septic tank.

In the study area, the management of household wastewater is not in proper way. As a result, the wastewater disposed in to the environment like to river and stream, drainage channel, road side and open space. Hence, majority (49.7 percent) of households discharged their wastewater in to drainage canal that was prepared for storm water drainage and 16.6 percent have no access to toilets and they were used different mechanisms for defecation (river banks and open space) in the study area.

Consequently, it results a serious water contamination, over flow toilet and stagnant of wastewater in to the road side in the town and particularly in the congested low-income neighborhoods. These exposed the community to disease such as, diarrhea, skin infection, upper respiratory diseases like influenza and common cold, and also reduce an aesthetic value of the study area. These problems are aggravated due to shortage of household wastewater management infrastructures provision, lack of awareness and sense of ownership on the communities, inadequate participation of private sectors, NGOs and inadequate coordination between institutions in the study area.

6. Recommendations

The points discussed below are forwarded for improvement of household wastewater management system in Debre Markos town. The provision of household wastewater management at present is not as such properly. So, in order to create proper management of household wastewater in the sub city the following recommendations are forwarded;

Increase Accessibility of Household Wastewater Management Facilities: The management of household wastewater in the town is poor due to less accessibility facilities like less access to toilet, lack and poor drainage canal and shortage of truck to collect wastewater. Hence, to mitigate the current toilet access problem, the municipality should construct additional public latrines on areas that problems are commonly observed and areas that open space and river bank defecated. The municipality should also, maintain the existing drainage canal and construct drainage canals in areas that drainage canal were not available by participating communities to support money. In addition, Debre Markos water and sewerage office should buy additional emptying trucks. Therefore, as all this needs high cost, the municipality should operate in cooperation with concerning bodies like the town land administration office, the town road authority, Debre Markos town water and sewerage office, involving NGOs and donors by preparing proposals related to inadequate management of household wastewater management infrastructures.

Creating Awareness to Communities: Findings indicates that majority of households discharge their household wastewater in to the environment like open space, river and streams without any treatments, thus awareness for all required. Solid waste disposed of illegally in drainage canal, connecting their toilets in the river, open space and drainage canal at rainy season are not only because of lack of solid waste disposal container and other services like truck for empted toilet to discharge wastewater but also lack of awareness of the consequences of mismanagement of wastewater in the sub city. The concerned bodies such as the health office, solid waste office, water and sewerage office should be raise public awareness about proper household wastewater management and its impacts on the

environment and how to maintain and use household wastewater management facilities by using and participate in construction of drainage canal and toilet by using techniques like mass media, pamphlet and demonstration of best experience woreda to woreda. Furthermore the town health extension workers should work to bring continues behavioral change though communication to improve the awareness and attitude of the community concerning household wastewater management in the town.

Make strong coordination and Integration among Institutions: A single institution cannot perform the required service being alone; the coordination of other institution seems to the crucial. The municipality should promote institutional coordination among different sectors like water and sewerage office, health offices, lad administration office, road authority and solid waste management office in order to proper management of household wastewater in the town. The municipality should be also participation of community and CBOs like *Edir* in different components of household wastewater management services such as construction of toilets, maintaining and building of drainage canal in the town.

Participation of Stakeholder: Household wastewater management is only the task of government. NGOs, stakeholders and private sector should involve in household wastewater management services in various motivational activities like tax fee imported truck, spare parts and other relevant materials, and the municipality should be a favorable condition for NGOs participation to promote and support on activities like, facilitation of credit provision; providing supporting skills, management, financial and training.

Expand Sewerage System: Debre Markos town like other town has no sewerage line, due to the presence of slum areas and low income households living in the area which restricts the development of sewerage lines. Therefore, the municipality should give attentions and renew the slum areas for the future to provide sewerage line in the town by giving kebele houses with minimum fee, providing condominium houses and creating job opportunities to the communities to afford the house.

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