

## **Investigation on Urban Drainage System in Sululta City, Ethiopia**

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### **Abstract**

Urban drainage facility is one of the urban infrastructure development challenges in developing nation. Flooding and water logging are very common issues in the city of Sululta, Ethiopia. In this context, study was conducted in Sululta City to investigate the existing drainage system. Sululta town is one of fast growing in the peri-urban of Addis Ababa city and needs to develop the city drainage system. Hence, the following objectives has identified (1) to study the sustainable urban drainage from literature review, (2) to study the existing drainage coverage and field investigation, and (3) to study the performance of drainage through households survey. The research methodology for data collection was adopted through various techniques such as field investigation, observation with photographs and household survey (200 household as sample size in each locality with the town) and limited literature review.

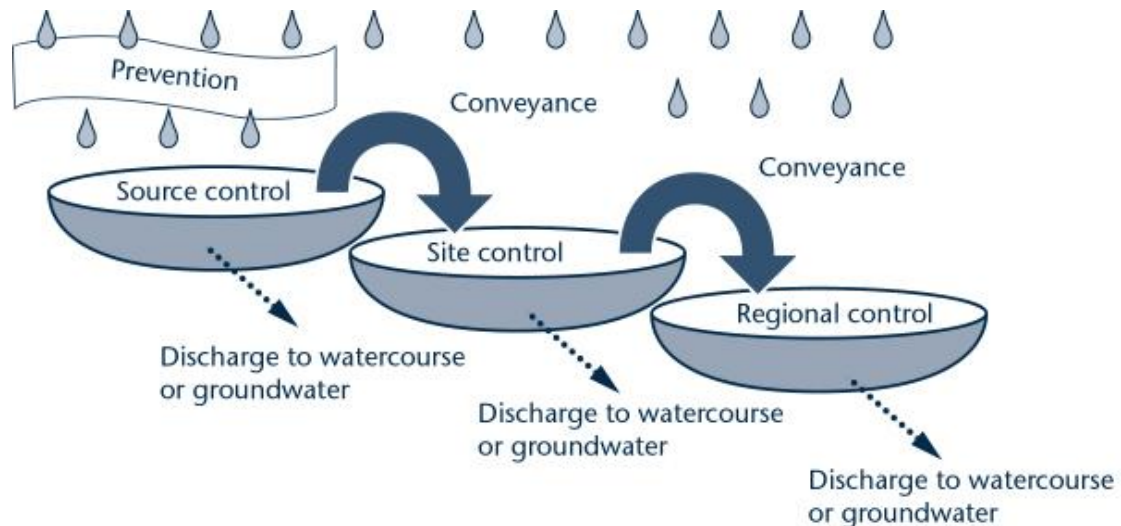
**Key Words:** Drainage System, Urban, Urban Environment

### **INTRODUCTION**

The urbanization has negative impact on urban drainages system in unplanned cities and towns in our planet. In the densely populated town and cities are facing water logging and flooding during heavy rainfall. These are common issues mostly in the

developing nations (Anisha. N.F and Hossain. S., 2014). The waste water generated from the domestic as well as institutional bodies is merging with storm water into the existing water channel. Lack of planned for separate waste water management such as grey water (sullage), storm water, sewerage (waste water from toilets) has to encourage at Urban Local Bodies (ULBs). To set up the Waste Water Treatment Plan (WWTP) to avoid the polluting of water body is necessary (Neil Armitage, 2006). The aim of Sustainable Urban Drainage System (SUDS) is on maintaining good public health, protecting valuable water resources from pollution and preserving biological diversity and natural resources for future needs (Qianqian Zhou, 2014). The waste water will be considered as a source after treatment which is generated from various sources.

The strategy for SUDS in regards to storm water is divided into four stages to discharge storm water into ground water body – (1) sources control: discharging of storm water to the surface where rainfall lands, (2) site control: discharging of storm water on the surface water run-off from large areas, such as part of housing estate, major roads, or business parks. The run-off from large urban areas can be channeled to a site control measure using swales (shallow drainage channels) and (3) regional control: discharging of storm water with the gathered run-off from a large area at regional level (Fig.1) (NIEA, 2016).

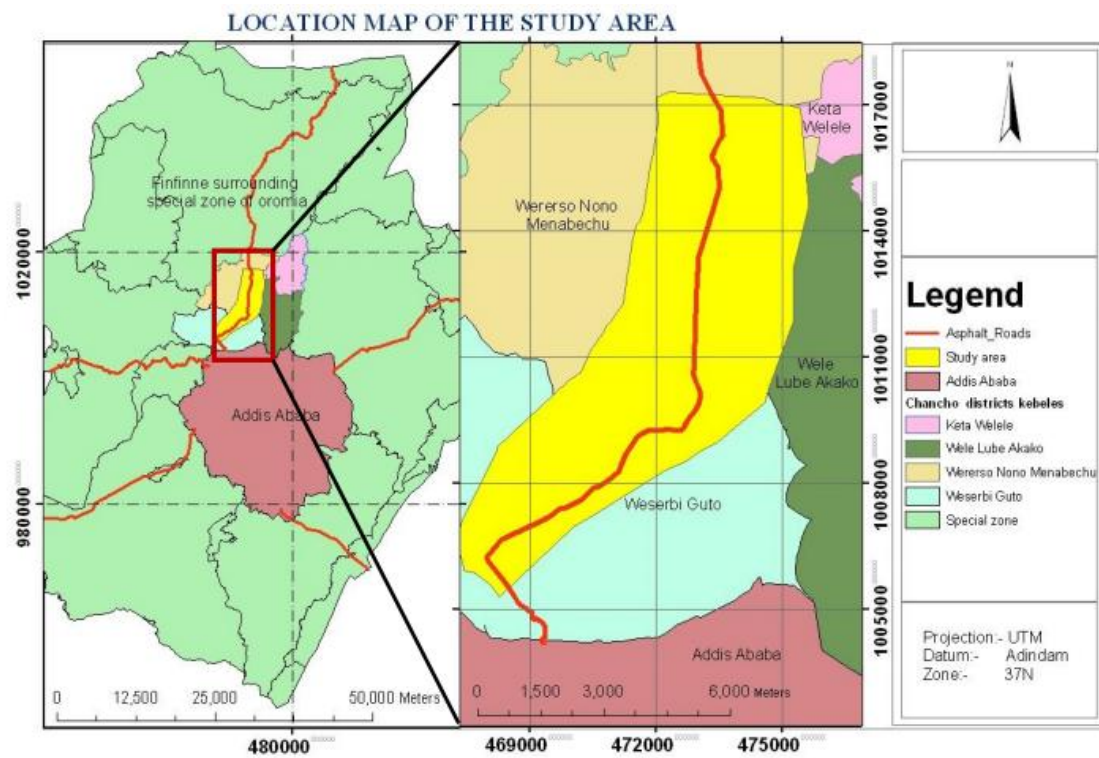


**Fig. 1: Step for Sustainable Urban Drainage System, Source: NIEA, 2016**

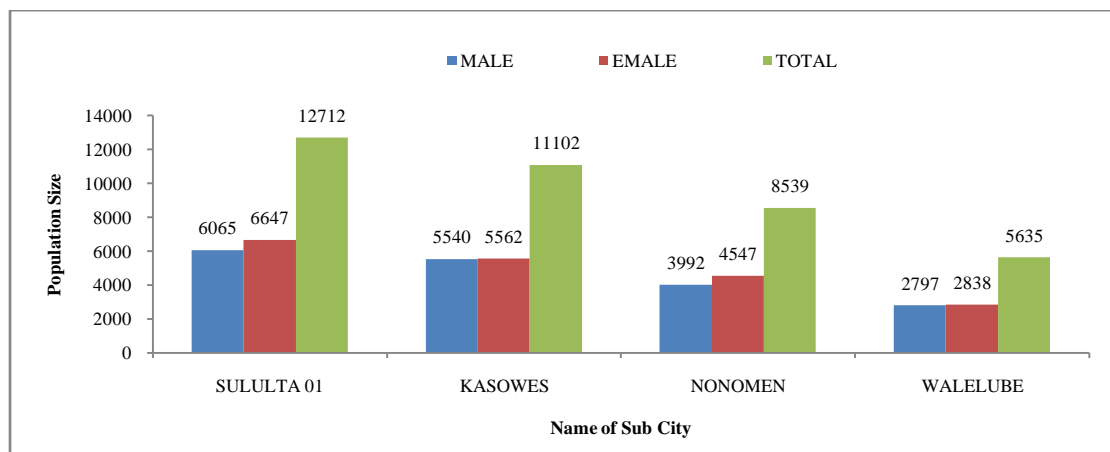
#### **CASE STUDY TOWN:**

Sululta city is located at a distance of 23 km from the capital city of Addis Ababa (Capital of Ethiopia). City has a population of 37,988 with an area of 4470.50 hectare area at location of 09° 17' 84" N Latitude & 38° 75' 79" East longitudes (Fig.2). The major economic activities in the town are trade, farming, industries, hotels service and other social services. The total population of the town is 37988 as on 2015 (CSA, 2010). This city has classified into four sub-city namely; (i) Sululta 01, (ii) Kasowes,

(iii) Nonomen, and (iv) Walelube with a population of 12712, 11102, 8539 and 5635 in the respective sub-city (Fig.3).



**Fig.2: Location Map of Study City, Source: Merga Mekonnen, 2012**



**Fig. 3: Population Distribution in Sub-City, Sululta City**  
 Source: Based on CSA, 2010

Flood is common issues in Sululta city due to unplanned and less attention towards the drainage system by city municipality. The main causes of flood for storm water are

- (i) no master plan for storm water,
- (ii) weak governance,
- (iii) shortage of technical staffs at city municipal and so on.

In the above context, paper is addressing the drainage issues by investigation through field investigation, and household survey and limited literature review.

## RESULT AND DISCUSSION:

### Drainage Coverage:

Total roads length of the city is 345.90 km in considering all types of roads (primary, secondary and tertiary). Approximately, 37.12 percent of the total length is covered by drainage facilities and remaining 62.87 percent are not having drainage facilities (Table 1). As per filed investigation, the existing drainage in this city is classified into three types; (i) open drainage, (ii) closed drainage, and (iii) semi closed drainage. The open drainage is approximately 115 km length within the town, about 8 km length for closed and 5.6 km length for semi-closed drainage. Its reveal that high percent of drainage is covered by open drain (89.56%), closed drain (6.23%), and remaining 4.20 is party covered by semi-closed (Fig. 4).

**Table 1: Drainage Facilities in Sululta City**

Sl. No.	Urban Drainage Covered	Length in km	Drainage Line Coverage in %
	Total Road in City	345.9	
1	Total Road with Drainage Line	128.4	37.12
2	Total Road Network without Drainage line	217.5	62.87

Source: Based on Sululta City Administration, 2015

Approximately 13.18 percent of city population had been affected during rainy season due to lack proper planning for storm water and drainage within the city. The serious issues are flood and water logging during rainy season and this has negative impacts on urban water body as well as socio-economic status of the people. The maximum population of Sululta 01 sub-city was affected almost 26.68 percent of the total population. Affected populations of various sub-cities were 9.39 percent for sub-city of Kasowes, for Nonomen (3.79 percent), and 4.09 percent for Walelube sub-city (Table.2).

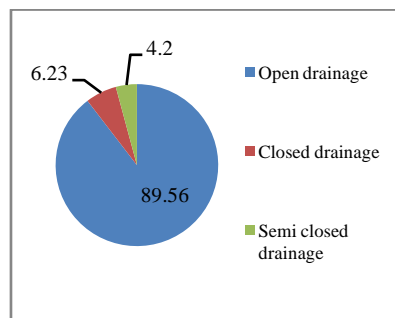
**Table 2: Affected population in Town**

Sl.No.	Name of Sub City	Total population	Total Population in flood prone areas	Affected Population in %
1	Sululta 01	12712	3415	26.68
2	Kasowes	11102	1040	9.36
3	Nonomen	8539	324	3.79
4	Walelube	5635	231	4.09
	Total	37988	5010	13.18

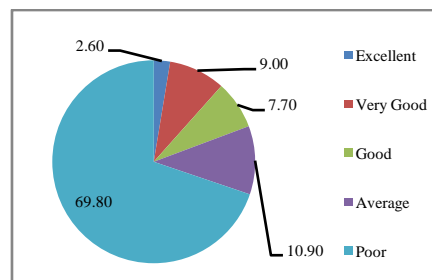
Source: Based on Sululta City Administration, 2006

**Status of Drainage:**

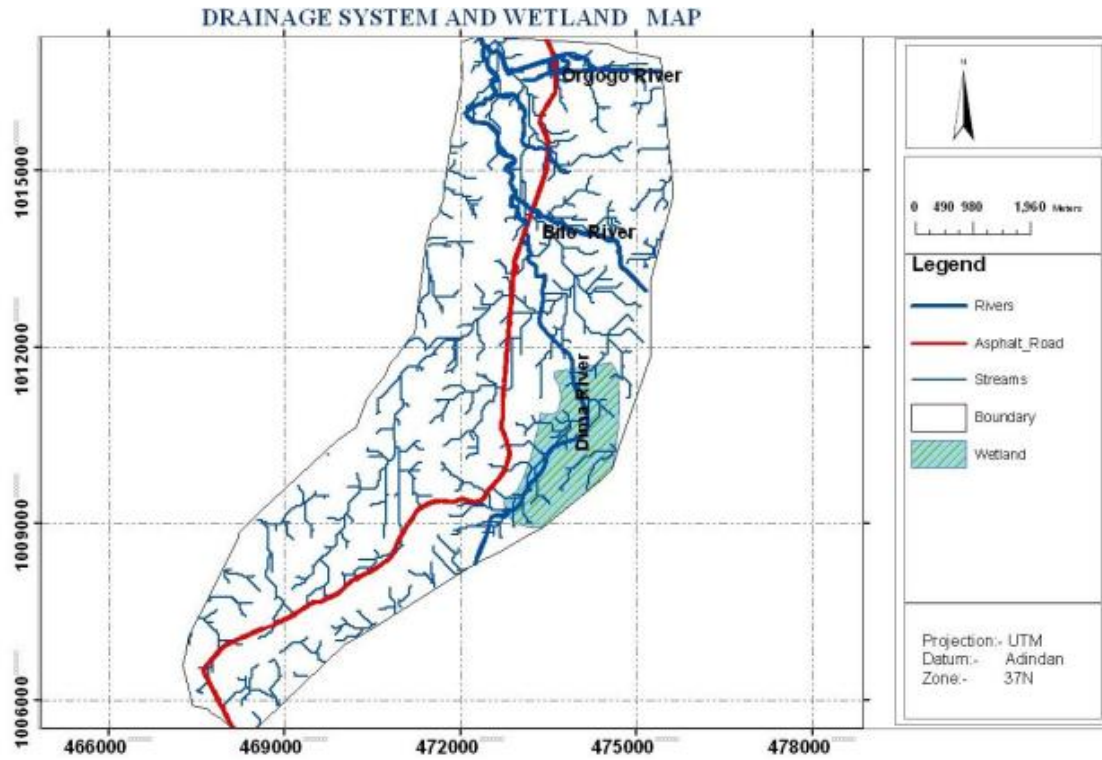
The author has designed to find out the existing condition of drains by using the photographic technique and household questionerto ensureperformance level such as excellent, very good, good, average, and poor. Based on household survey data, maximum of household (approximately 69.80%) had responded for poor condition of drain and about 10 percent of the households for average category in the areasof flood occurred during rainy season in the city. Only 2.60 percent of households were responded for excellent category, 9 percent of household for very good category, and 7.70 percent for the good category (Fig. 5). The identified existing drains in the city are not well planed and suffering by common people living in the areas (Fig.6). It is reflected that drain condition is poor in terms of operation and maintenance as well as physical condition of the existing drainage (Fig.7, 8, 9 and 10).



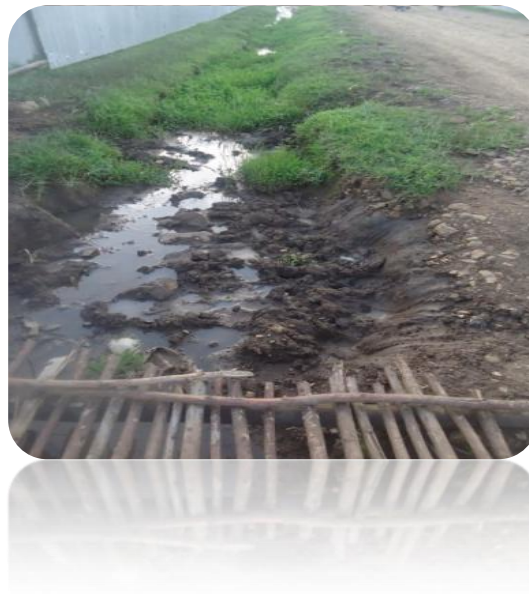
**Fig. 4: Types of Drainage in City in Percentage**



**Fig. 5: Status of Drainage**



**Fig.6: Identified Drains in Sululta City, Source: Merga Mekonnen, 2012**



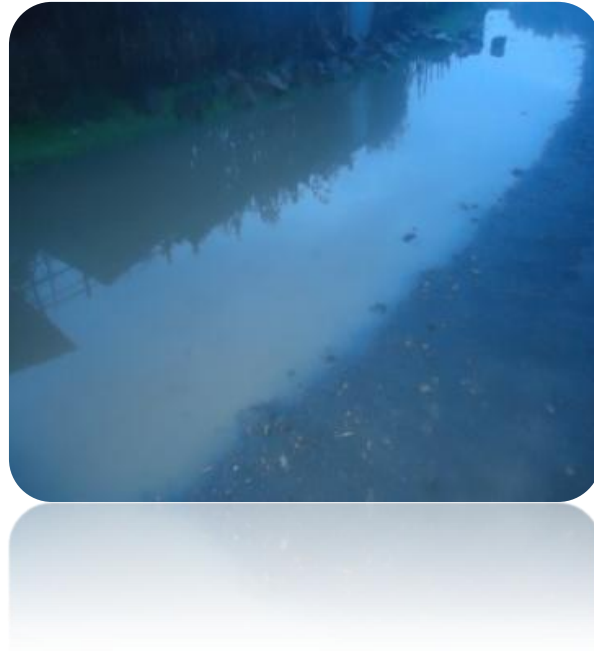
**Fig.7: Open drain, Picture Credit by Author, 2015**



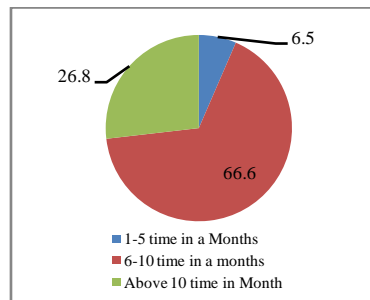
**Fig. 8: Semi-Closed Drain, Picture Credit by Author, 2015**



**Fig. 9: Open drain, Picture Credit by Author, 2015**



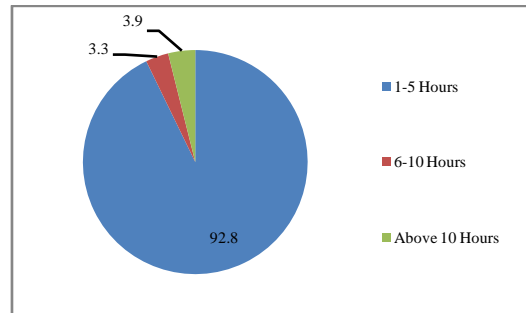
**Fig.10: Flood During Rainy Season, Picture Credit By Author, 2015**



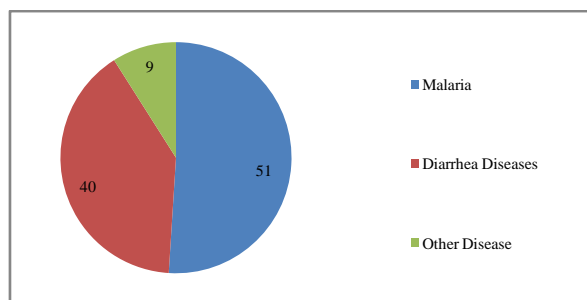
**Fig. 11: Flooding Frequency During Rainy Season**

**Flooding Frequency:** About 6.5 percent of households had responded for water logging from 1-5 times in month during rainy season, 66.6 percent of households for 6-10 time and 26 percent of households for above 10 times in a month during rainy season. This has reveals that flooding is very common and no proper flow of water channel of the existing drains (Fig.11).





**Fig. 12: Water Logging at one time of Flooding**



**Fig.13: Diseases occurred during Rainy Season**

**Water Logging:**

Water logging during rainy season were ranging from 1- 5 hours, 6-10 time and above 10 times in one time of flooding during reason season. About 92.8 percent of the households had responded for water logging with an ranging 1-5 time in one time, 3.3 percent ofhouseholds for 6-10 times and 3.9 percent of household for above 10 time (Fig. 12). Due to lack of drainages facility in the city causes various diseases such as malaria, diarrhea, and other diseases to weaker section of society. More than fifty percent of sample population of household suffered from malaria, 40 percent of households had suffered from diarrhea and remaining from other diseases (Fig. 13). SulultaCity has inadequate drainage system and existing of the identified drainages are not well planned within the city administrative boundary. Few drains are constructed with semi-closed drains. The problems of drainagesof uncovered will increase until the city administration are not initiative to provide adequate drains facility. To set up reforms strategy to strengthening the city administration to provide adequate drains facility. Feasibility study of drain system in the Sululta city is another challenge by city municipality to action plan. Public private partnership is one tool to carry out the drain planning in future. Awareness to community level for drain plan is to be design by municipality since common people are intension of throwing solid waste into existing drains and caused the water logging.

**Conclusion**

The drainage system in the Sululta city is inadequate. Common people are suffering due to lack of drainages facility. Sululta City Administration (SCA) is needs to plan out to solve the drainages problems and right time to facilitate adequate drainage system. It is suggesting to upsetting the strong municipality in the SCA to improve quality of life. The SCA should encourage carrying out the feasibility in order to identified projects to improve drainage system as soon as possible.

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