8 DRAINAGE

SUMMARY:

- Urban drainage deals with surface water:
  - rainfall run-off
  - water supply that is not consumed and thrown away
- Failure to remove surface water leads to problems:
  - Standing water encourages the breeding of insects and worms that impact on public health.
  - Damage to buildings and erosion of land.
  - Inconvenience in times of heavy rain, with a detrimental impact on social and economic life.
- Drainage systems in all towns are inadequate, made worse by careless dumping of waste in drains and water courses.
- Urban development increases surface run-off – hard surfaces reduce the natural absorptive capacity of the landscape.
- Drainage is planned around tree-shaped networks that carry run-off through increasingly larger capacity drains from higher ground to lower ground, and then out of the urban area.
- The location and design of new development areas must take account drainage requirements.
- Each network serves a distinct catchment area.
- The networks will reflect the natural landform, allowing run-off to be removed by gravity.
- Where this is not possible pumping or re-shaping of landform is necessary – but this should be avoided due to high cost.
- The drainage system can incorporate both natural water courses and built drains.
- Open drains should be used wherever possible: they are cheaper to construct and easier to unblock.
- The drainage system will designed to cope with a given volume of run-off, represented by the statistical frequency of the occurrence e.g. a 1-in-100 year storm.

Introduction

8.1 This section discusses ***drainage***: the efficient removal of surface water from the urban environment. It aims to address the problems caused by:

- Rainfall – especially surface water run-off;
- Water supply that is not consumed and is thrown away e.g. after washing or cleaning.

8.2 It is one of the four main elements that need to be addressed to promote the environmental health agenda.

➲ 4 – Environmental Health ➲ 5 – Water Supply ➲ 6 – Sanitation ➲ 7 – Solid Waste Management

The problem

8.3 Failure to remove surface water leads to three main problems:

- Standing water (e.g. around public standpipes) creates a ***breeding ground for insects and worms*** that have a direct impact on public health.
- Heavy flows of water cause ***damage to buildings*** (especially those built of mud or mud bricks) and ***erosion of land***.
- It creates ***major inconvenience*** – in many cases this is a temporary problem that interferes with pedestrian and vehicular circulation in times of heavy rain, and that passes as the rain ceases. But in some areas and some towns (e.g. Malakal) it has a serious detrimental impact on the social and economic life of the town for months on end during the rainy season.

8.4 ***Urban development increases surface water run-off***: the creation of hard surfaces (buildings, surfaced areas, roads etc) reduces the natural capacity of the environment to absorb rainfall. This is made worse in peri-urban areas by increasing deforestation, where the loss of topsoil reduces the capacity of the ground to absorb rainfall.

8.5 Less absorption means more surface run-off. Unless adequate drainage is provided, there is will be increased incidence of flash floods. This is a major problem in all countries, including developed countries, which emphasises the importance of planning good drainage.

8.6 The drainage in all South Sudanese towns is inadequate for the volume of surface water run-off cause by heavy rain. This is made much worse by careless dumping of waste in drains and water courses, which significantly reduces their capacity to handle heavy flows.

➲ 7 – Solid Waste Management

Drainage networks

8.7 A town drainage system is planned as a network of drains that carry the run-off from higher areas down to lower areas, and away from the built up area. The run-off can drain into the natural drainage system lower downstream, into a river or lake; or it can be discharged into lower open land.

8.8 Drainage networks are designed in a tree-like or *dendritic* shape: many small feeder drains (= twigs) connect with collector drains (= branches) that finally connect to the main drains (= stem or trunk). ***sketch/diagram***

8.9 A drainage network serves a distinct ***catchment area*** - all run-off in a catchment area flows to the same outlet (= stem or trunk). A larger town will usually have more than one catchment area.

8.10 The drainage network reflects the natural landform, following the natural contours – this allows run-off to be flow ***by gravity***, the most efficient and cheapest method.

8.11 Where gravity flow is not possible (e.g. a low-lying area within the urban area which collects natural drainage flows) it is necessary to consider pumping or major reshaping of land-form (e.g. raising the level by importing earth or rubble) – but this should be avoided if possible because of the high cost.

8.12 The drainage network can combine ***natural water courses and built drains***. Built drains are often provided alongside roads - they to help drain the road surface and also act as part of the larger network.

8.13 ***Open drains*** are better than underground drains: they are cheaper to construct, and less likely get blocked by refuse: although it is easier for rubbish to get in (because they are open), it's much easier to clear an open drain if it gets blocked.

Capacity of the network

8.14 The size of drains required depends on the estimated volume of run-off that is to be handled. It is normal to design drainage so that it can cope with a given level of storm flooding. This typically expressed as, for example, a *"1-in-100 year flood"* - this represents the severity of flooding.

8.15 This implies that the drainage system can cope with conditions below this level; but any conditions above this level will result in flooding. It is not realistic to design drainage to cope with <u>all</u> eventualities; and the higher the level, the more expensive the system.

8.16 Note that this is a statistical average for the occurrence – it is possible for a 1-in-100 year storm to occur two years running, or even twice within one year.