

**THE EFFECT OF RAIN ON THE TURBIDITY OF GRAVITY FEED WATER
SUPPLY IN REMOTE VILLAGES IN MARUDI DISTRICT IN SARAWAK**

IN REMOTE VILLAGES IN MARUDI DISTRICT

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ABSTRACT

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Water is available as surface water, ground water and as rain. Although 97.2% of the 20 million population of Malaysia is provided with water, only the urban areas have treated water. The remote areas and rural villages are still without treated water.

In Sarawak, water supply to villages in remote and rural areas are made available through wells, water tanks, gravity feed supply and in certain areas, extension of the public water supply. Water that is contaminated, smelly and polluted are not accepted nor use by the people.

In rural Sarawak, 57.2% of the total households of 109,605 persons has gravity feed (mountain water) supply as their source of drinking water. Although this water is safe for drinking, it is rejected when it becomes turbid.

Three remote villages in Sarawak with gravity feed water supply is studied to show the effect of rain on the turbidity of the water supplies and how the turbidity affect their utilisation.

In this study, it is found that the turbidity of water in these areas are increase during rain. It is also found that when the gravity feed water becomes turbid, it is not readily used for drinking or cooking but is used for other domestic purposes.

The National Drinking Water Guidelines have set a standard of 5 NTU as the standard turbidity of water for drinking. This study shows this standard is exceeded. It is therefore recommended that the all the catchment areas where there are gravity feed supply be preserved and protected and its water be filtered and treated before use.

Abstrak

Air terdapat didalam tanah, dipermukaan tanah dan juga sebagai hujan. Walaupun 97.2% dari kesemua dua puluh juta penduduk di Malaysia dibekal dengan bekalan air, tetapi hanya kawasan bandar sahaja menikmati bekalan air yang dirawat. Penduduk dikawasan luar bandar dan kampong terpencil masih menikmati air yang belum dirawat.

Di kawasan luar bandar Sarawak, 57.2% dari sejumlah kesemua 109,605 penduduk dibekalkan dengan air bukit sebagai punca air utama. Walaupun bekalan air ini selamat untuk diminum, tetapi, apabila air tersebut menjadi keruh, air ini tidak digunakan sama sekali.

Tiga kampong terpencil dengan bekalan air bukit di Sarawak dipilih untuk menununjuk kekesanan hujan jeatas kekeruhan air dan juga bagaiman air ini dipergunakan.

Didapati bahawa kekeruhan air bertambah apabila hujan. Juga didapati bahawa air tersebut tidak diguna untuk minum atau masak, tetapi digunakan untuk aktiviti lain.

“National Drinking Water Guidelines” telah mengariskan piawaan 5 NTU sebagai tahap maxima untuk minuman. Kajian ini telah membuktikan bahawa kekeruhan melebihi 5 NTU apabila hujan. Oleh yang demikian, adalah disyorkan bahawa tadahan dimana air bukit diguna sebagai punca bekalan air dipelihara, dilindungi dan juga ditapis.

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CHAPTER 1

INTRODUCTION

1. Introduction

Malaysia, with an area covering 329,758 sq. km is made up of West Malaysia and East Malaysia. East Malaysia, which is part of the Island of Borneo consists of Sabah and Sarawak. The States of Malaysia including Sabah and Sarawak are shown in Figure 1.

In 1997, the Department of Statistics Malaysia estimated the population of Malaysia to be 21.0 million of which 12.2 million or 56.5 % of the total population live in urban areas. 9,432.6 million or 43.5 % of the total population live in the rural areas. The population distribution of the states in Malaysia is shown in Table 1.

Table 1: Urban and Rural Population in Malaysia in 1997

State	Population ('000)			Area (sq. km)
	Urban	Rural	Total	
West Malaysia	10,359.9 (60.8%)	6,687.4 (39.2%)	17,047.3 (100%)	131,598
Sabah	969.0 (36.4%)	1,694.8 (63.6%)	2,663.8 (100%)	73,711
Sarawak	904.0 (46.3%)	1,050.3 (53.7%)	1,954.3 (100%)	124,449
Total	12,232.9 (56.5%)	9,432.6 (43.5%)	21,665.5 (100%)	329,758

Source: Department of Statistics, Malaysia

1.1 The rural water supply in the state of Sarawak

1.1.1 Geography

Sarawak, being the largest state in Malaysia, is divided into three main geographical zones. These are (1) a coastal plain covered mostly by swamp forest; (2) a middle zone of undulating country; and (3) a mountainous deeply covered tropical jungles.

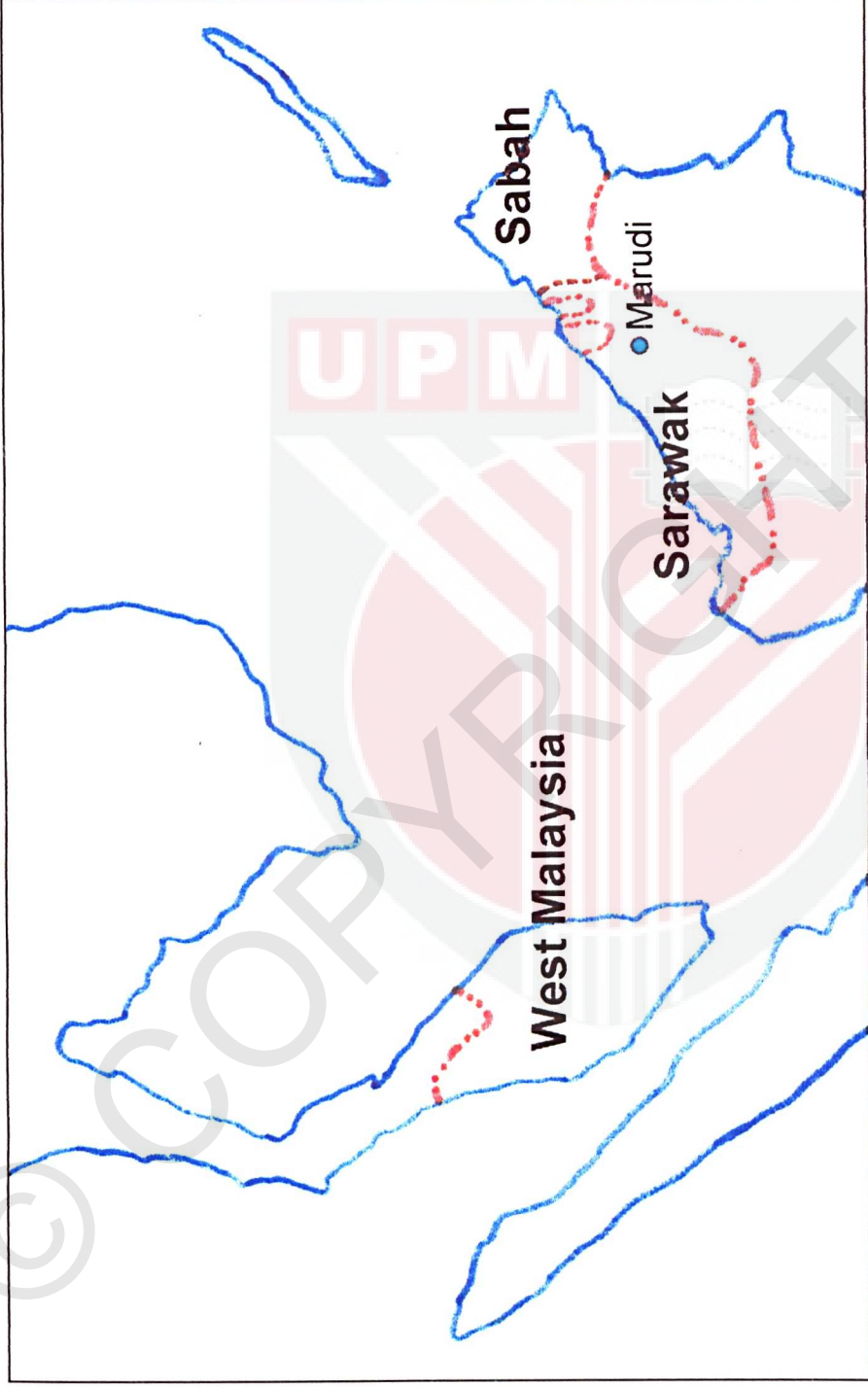


Figure 1 : Regional Map Of Malaysia Showing West Malaysia, Sabah And Sarawak

Many rivers which has its origins in the mountainous interior, flows through deep gorges and rapids and then more slowly through the mid-zone of undulating country and finally meandering through the coastal swamps into the South China Sea.

Internal travel to these rural areas is difficult and dangerous where the only means of transport is via rivers, logging roads and by tracking.

1.1.2 Coverage

1,141,433 people in 193,454 households or 97.2% of Sarawak have water supplies. For Sarawak, until 1997, there are 2647 gravity feed water supply providing water to 68,319 people; 233 sanitary wells supplying 906 houses; 1855 rain water collection (tanks) supplying 40378 houses and 65 connections from the mains supplying 1156 houses.

1.1.3 Historical perspective

The 1948 Annual Report of the Medical and Health Department of British Colony Sarawak stated that piped water only exists in main towns. In the rural areas, rivers, wells and rainwater storage met the requirements of the population.

The introduction of the RURAL HEALTH IMPROVEMENT SCHEME by the Sarawak Health Department in 1967 to reduce the occurrence of diarrhoea resulted in the implementation of five main type of systems for providing water. From 1967 to 1975, 763 systems were constructed in Sarawak. This is shown in Table 2.

In 1974, the Ministry Of Health Malaysia introduced THE WATER SUPPLY AND ENVIRONMENTAL SANITATION CONTROL PROGRAMME to reduce and control the incidence of water and excreta related diseases. The strategy was to ensure

Table 2 : Rural Water supply projects completed 1967-1975 in Sarawak

Type of System	Number of constructed
Pipe gravity	458
Ram/Dam/Pipe	31
Pump/Pipe/Storage	16
Sanitary well	243
Rain Catchment	15
Total	763
Total population served	818,000

Source: Sarawak Annual Medical and Health Annual Report 1975

100% coverage of water supply and sanitation facilities. The requirement of the system was to deliver sufficient quantities of water that meets the basic hygiene requirement at minimum cost. These systems provided untreated, wholesome water.

1.1.4 Types

The different types of water system available to supply the rural and remote areas include rain water tanks, mechanical pumps which pumps river water, the gravity feed system which makes use of a mountain stream to deliver water to communities and also the sanitary tube wells. The Public Works Department also complemented by supplying treated water to certain rural areas.

1.1.4.1 The gravity feed water supply system

The gravity feed system provides untreated raw water to villagers. This water supply system, which makes up 55.1% of the different types of water supplies system to the rural communities, is preferred as it is practical and easy to maintain and have a life span of more than ten years. Moreover, as long as human activities such as agriculture or logging at the catchment areas do not occur, contamination will not be

a problem. Nevertheless, the Health Department still advocates the people to boil their water before drinking.

By 1995, in Sarawak, out of 184,423 houses in rural areas, 109605 or 59.4% of houses are supplied with water. Of those supplied 57.2 % of houses benefit from the gravity feed system. This is shown in Table 3.

Table 3 : Coverage of Houses with the different types of system in Sarawak up to 1995

Type of System	Number constructed	%	House coverage	%
Well	499	5.4	6369	5.81
PG	2365	25.7	62700	57.21
RWT	1437	15.6	35642	32.52
JKR/KKM	4894	53.2	4894	4.47
Total	9195	100.0	109605	100.00

Source: Annual Health Report 1995 Malaysia

1.1.4.2 Description of gravity feed pipe system

The delivery of water using a gravity feed system relies upon gravity to facilitate movement of water from high catchment areas to the villages. Streams from a suitable mountain site are carefully selected so that the villages will receive adequate daily water output. These streams are dammed and is fenestrated by a pipe to drain water and thence piped to the villages via many lengths of PVC pipes which are joined together to deliver water to the various homes in the villages.

The laying of the pipes are through community efforts. Pipes, fittings, cement and other materials together with supervision are provided by the Health Department.

A typical gravity feed system is shown in Figure 2.

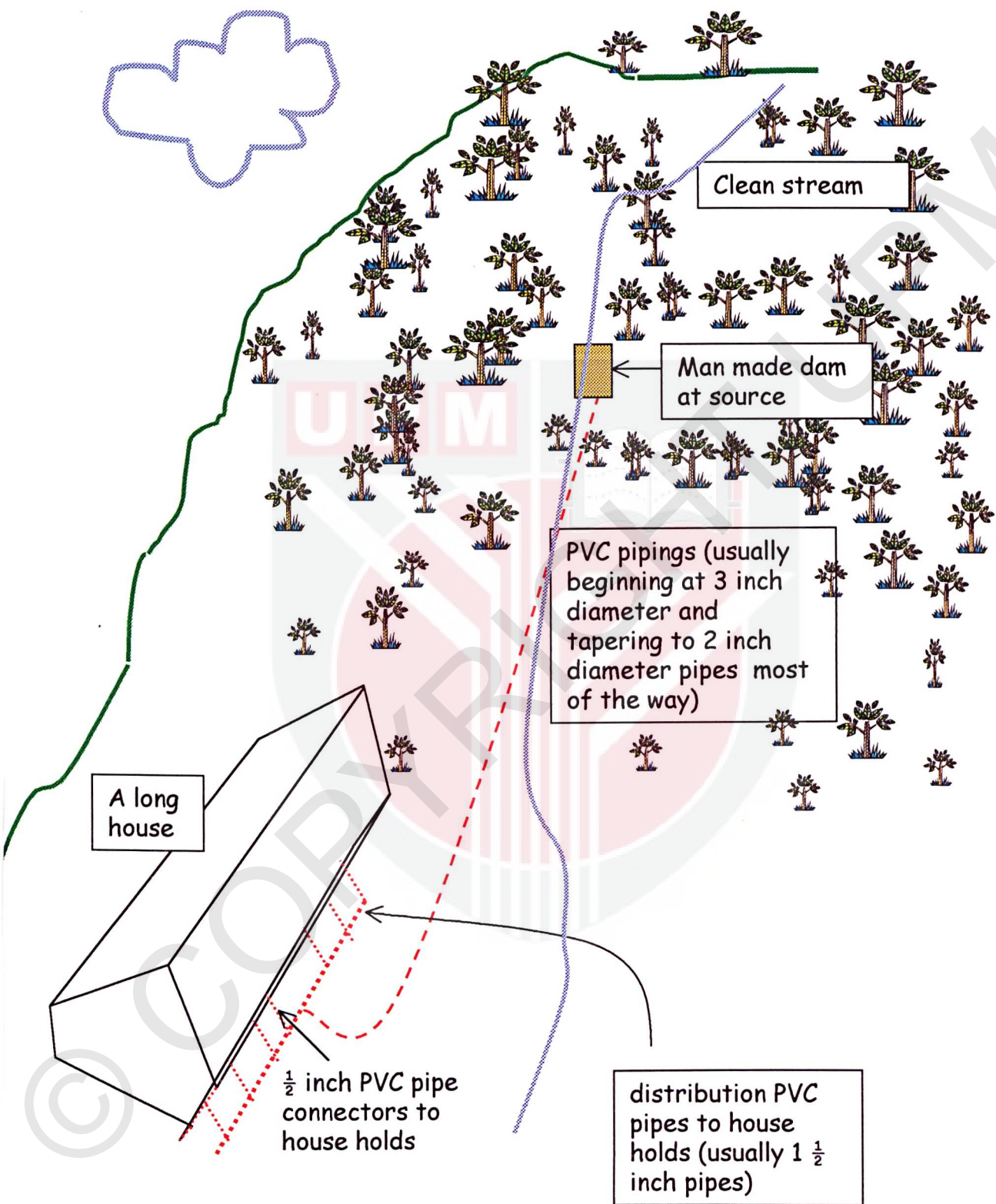


Figure 2 : A typical gravity feed system

1.1.4.3 Limitation of the system

A typical gravity feed system is designed to meet the targeted population up to 15 years. For economic reasons, the dead end distribution system is adopted in the rural areas.

Eventually, as population increases, the supply becomes inadequate. People resort to tempering with the design to get adequate demand of water.

The supply of water may be also interrupted due to blockage by leaves or soil debris at source, or leakage or breakage along the pipes from its source to the village.

Although the system provides clear water which can be use readily, the villagers do complain about the “muddiness” of the water during heavy rains.

At the present moment, there are no documented studies relating to the turbidity of the water to the villages with gravity feed system and its use.

1.2 Objective

The objective of this study are:-

1. To study the effect of rain on the turbidity of gravity feed water supply at three remote villages in Marudi District in Sarawak.
2. To determine the knowledge of water and its uses by the villagers

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