PUBLIC HEALTH ENGINEERING DEPARTMENT

NAGALAND

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SUSTAINABILITY OF DRINKING WATER SUPPLY SYSTEMS IN HILLY AREAS - UNIQUE PROBLEMS AND THE NEED OF FINDING SOLUTIONS

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SUSTAINABILITY OF DRINKING WATER SUPPLY SYSTEMS IN HILLY AREAS-UNIQUE PROBLEMS AND THE NEED OF FINDING SOLUTIONS

Introduction

Nagaland is situated in the north eastern part of India within 93° 17′ to 95°15’ E longitude and 25° 10’ to 27° 04’ N latitude, bordering Arunachal Pradesh in the north east, Assam in the west and north, Manipur in the south and Myanmar in the east. The State consists of 11 districts, 74 blocks and 1500 habitations. The total population as per 2011 census is 19,78,502, of which rural population is 71.14% and urban population 28.86%, with a population density of 120 per sq.km.

The topography is hilly which constitutes 95 % of the total State area of 16,579 sq.km. The altitude varies from 110 to 3840 metres above mean sea level. The annual rainfall varies from 1000 mm in the south-west to more than 6000 mm in the north.

Problems

Most of drinking water supply systems in Nagaland depend on surface sources such as streams, rivulets, springs and ponds, which are monsoon fed. The volume of water discharge of such sources vary widely from season to season, depending on the frequency and intensity of rainfall, which is indicated by vastly diminished discharge during the non monsoon periods leading to drinking water scarcity in many towns and

villages. Depletion of discharge in water sources have been observed across the State, which could be due to deforestation, logging activities, Jhum cultivation and other human activities. Destruction of forest cover affects the water retention capacity of the catchments resulting in increased surface runoff triggering landslides inflicting huge damage to properties, pipelines, roads etc, disrupting normal life and services in the hilly areas. Erratic rainfall pattern, which could be due to climate change, is observed more frequently causing flash floods and draughts. Due to heavy rainfall, a lot of landslides has been triggered leading to heavy damage to the water supply pipelines of Dimapur town, Mokokchung town, Zunheboto town, Yachang 'C', Longsa Village and Mokokchung village during this monsoon. Due to difficulty in accessing damaged area and shortage of spares at hand, there is always delay in repair and restoration of damaged pipelines leading to disruption of water supply to consumers. Heavy rainfall also leads to scouring of river beds causing damage of catchment areas as well as silting of intake structures like Diversion weir.

The Nagaland PHED has been struggling to restore water supply services, especially at major urban areas, with limited resources for operation and maintenance. Damages to infrastructures due to natural causes cannot be predicted nor prevented. Such damages not only causes loss in terms of capital cost but also require extra expenditure for repairs, besides stoppage of water supply to the consumers and consequent loss of government revenue in case of delay in restoration of services. The need to minimize the extent of damage and preparedness to restore services with least delay calls for selection and application of appropriate technical measures, and review of existing policies and guidelines.

Preventive measures

1. Avoid landslide prone zones in the pipeline alignment which involve longer pipelines, involving higher capital and maintenance cost.
2. Improved methods of fitting, fixing and laying of pipelines and use of support structures to prevent damage of pipes and prevent leakage which involve higher cost.
3. Adopt landslide/flood control measures by way of increasing forest cover, especially through participation of beneficiary community. Construction of counter bunds in hill slopes is another measure to control landslide by way of checking surface runoff.

Measures for redressal of problems/damages

1. **Contingency Plan:** Large scale destruction of water supply assets due to landslides is a yearly occurrence, resulting not only in huge losses in terms of crores of rupees but the water consumers are also compelled to endure hardship even as they wait for the rainy season to pass for restoration of the pipelines. These hardships become inevitable in the absence of a contingency plan with ready stock of materials and resources for such emergencies. Under the existing guidelines of National Drinking Water Programme (NRDWP), 2% provision exists under Natural Calamity component at the government of India level which is kept as reserve fund to the states on demand. This provision of 2% is not sufficient in view of the extent and numbers of damages and, therefore, it may be proposed to enhance to 5% of the States' annual allocation in the case of the hill/mountain states of India, to facilitate this contingency plan. The 5% provision should be inbuilt into the normal NRDWP allocation and made available along with other NRDWP components.

   Despite the provision of contingency plan, it is expected that the redressal of problems may involve

longer time as repair and replacement of pipes etc cannot be done till monsoon recedes or till transport and communication is possible. However, the preparedness with a contingency plan in place will help mitigate emergency situations to a great extent and restore water supply to the consumers.

2. **Alternative drinking water support system:** Since drinking water is a basic necessity and citizens cannot survive without regular water supply, it is essential to ensure water security in each and every household by way of providing alternative support system, in addition to the main water supply as it is done in other places, e.g in Thailand.

   Provision of roof top rain water harvesting tanks is expensive and the government may not be in position to create these facilities for all households. However, creation of some support system needs to be incorporated in the guidelines of NRDWP.

3. **Provision of water tankers:** In the event of unexpected disruption of drinking water supply due to landslides/ floods or other agents of disaster, which is a regular feature every year, the provision of water tankers for emergency requirement in critical places such as hospitals etc is necessary. Since most of the population live in rural areas, provision of at least two water tankers of 5000 litre capacity may be ideal. The operation and maintenance cost can be met with contingency plan.

Sustainability of water sources

1. **The problem of water source depletion:** Since time immemorial, for village security, most villages in Nagaland, so also in other hill states, were established at hill tops. These villages draw drinking water from surface sources, either by gravity or pumping. Catchment areas of such water sources are small and delicate. With unabated destruction of forest due to logging, Jhum cultivation and other human activities, the problem of diminishing water discharge at sources is a real threat to sustainability of drinking water sources in hill/mountain areas. It is matter of grave concern that some sources having good yield during the last two or three decades have dried up. The level of discipline and awareness among the people in conserving the water catchments is very low and if this apathy continues, drying up of water sources will happen sooner than later in the case of many villages in the State, thereby posing threat to the very existence of the villages.

   Suggested measures: In order to arrest the diminishing trend of water discharge at sources, measures such as afforestation to conserve the natural environment of the water catchments. Recharging of sources by construction of cross drainage/counter bunds may be another measure.

2. Since the reliability of existing surface water sources is becoming increasingly questionable, harnessing ground water, which is mostly untapped in the hill areas(of Nagaland), could be explored for drinking and other uses, incorporating sustainable recharge measures. This would provide an alternative to areas where the depletion of surface water source is more pronounced. Presence of

chemical contamination in ground water need to be tackled through appropriate cost effective technology.

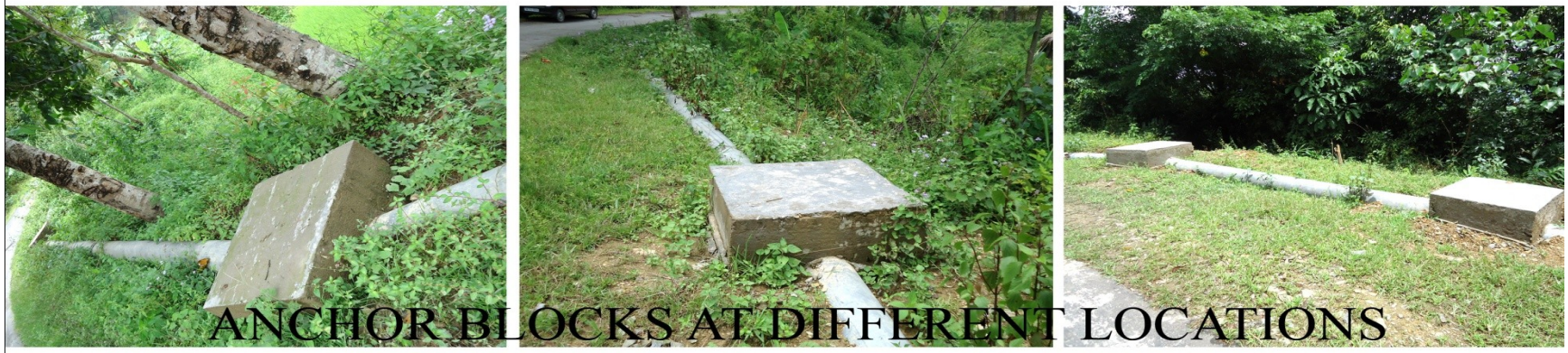
The issues concerning landslides/floods in respect of water supply systems and water source depletion are two unique problems being faced by the hill/mountain States. Other vital issues such as the need of building up of efficient O&M of water supply distribution systems, etc are common to all other States of India, which, therefore, are not addressed in this presentation.

Recent damages to water supply infrastructures due to landslides/floods

Sl.no.	Name of water supply scheme where damage occurred	Date of occurrence of landslide/flood	Nature of damage	Cost of repair and restoration of damage (Rs in lakh)
1	Mokokchung town	15th May 2013,	Washing away of pipelines	571.89
2	Dimapur town	16th & 17th July 2013	Washing away of pipelines	66.44
3	Zunheboto town	4th Aug. 2013	Washing away of pipelines	

Only 6.6% of the total number of habitations in the State are fully covered with 55 lpcd w/s level and above. The rest 93.40% are under PC & NC due to *Slip Back* which are mostly due to depletion of water source, natural calamities and O&M issues.

AUGUMENTATION OF WATER SUPPLY TO KOHIMA TOWN BY PUMPING



ANCHOR BLOCKS AT DIFFERENT LOCATIONS

SUPPORTING PILLARS AT DIFFERENT LOCATIONS

Due to the steep nature of topography, anchor blocks and RCC supporting pillars are necessary to maintain proper alignment of pipelines in w/s schemes which require high cost of projects as different from plain areas of mainland India.

Often no other pipe alignment options are available except to go through difficult terrain/alignment often crossing landslide prone areas as in the case of w/s project for Dimapur Town.

Damages due to landslides are a regular feature and extensive at times.

O&M costs are high due to frequent occurrence of landslides/floods during monsoon months each year.

W/S PIPELINES TO ZUNHEBOTO TOWN DAMAGED DUE TO LANDSLIDE/FLASH FLOOD