



Title	Water Resource Management in Panglong
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## **Water Resource Management In Panglong**

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### **Abstract**

This research is focused on core area in Panglong and its environ. The data required for this research were collected by using questionnaires in four wards and by gathering from Administrative Department and Municipal Department. The objective of this study is to clarify the management of water resource in Panglong by analyzing the distribution and application of water resource. Defined water resource include streams water, groundwater and wells. Stream water in Nam Pawn stream is flowing through Mongpaw, Loilem and Panglong Townships which is applied in agriculture. Groundwater, wells and water supply of Municipal Department are used in domestic and business. As the result, it is found that water resources are related to water supply system of Municipal Department and private management system. Wells are inadequately managed in marginal area. The pure water resources cannot be found in Panglong and its environ. Environmental degradation and health problems are encountered through increasing pollution around the Panglong. It is necessary to take water resource management into account in proper planning, design and implementation.

Key words: Water resource, Environmental degradation

### **Introduction**

#### **Objectives**

Main objectives of this research are:-

- (1) To study the relationship of water resource and physical factors in Panglong and its environ.
- (2) To access the requirement of domestic water, population factors and land use pattern, in Panglong
- (3) To evaluate the management of water resource concerning with the distribution of water quality and quantity conditions in Panglong

#### **Study Area**

Panglong is situated in Loinlem District and in the Southern Shan State. It lies between the latitudes of 19° 45' and 21° 27' north and between the longitudes of 97° 15' and 98° 09' east. The total area of the Panglong is

about 1,678 areas or 2.75 square miles. In the north are the township of the Laikha. In the east are the Nam San Townships. Loinlem Township is in the South and Hopong Township on the west have the common boundary with the Southern Shan State. It has a compact shape.

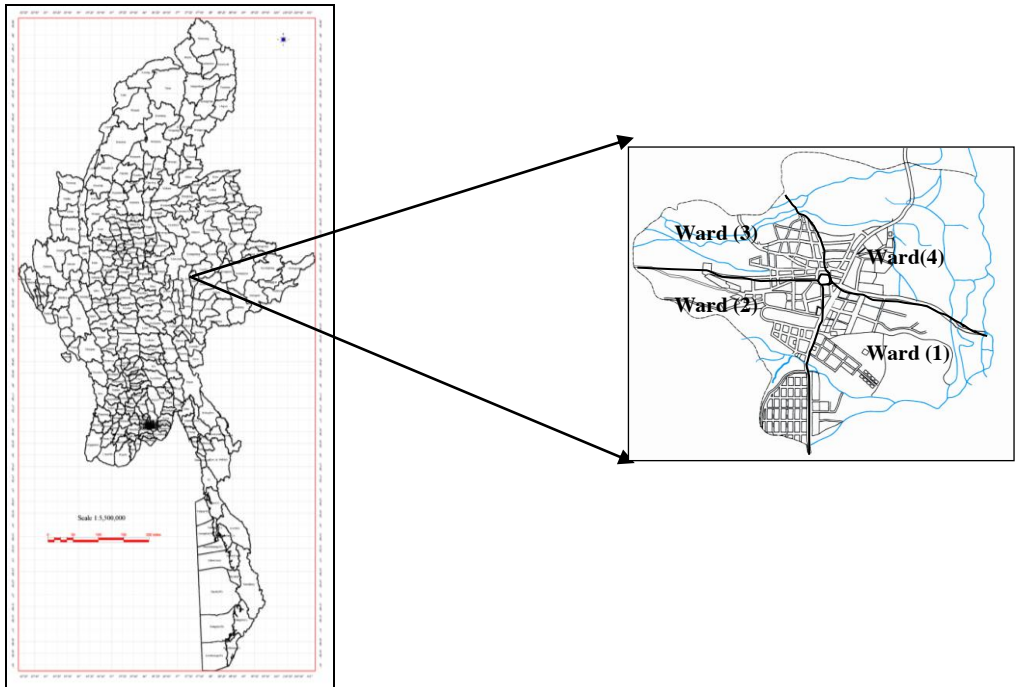


Figure (1) Location of Panglong Town

### Materials and Methods

To depict a general picture of water consumption, secondary data are obtained from administrative Departments, Municipal Departments. Primary data and information are gathered by questionnaires and interviews in both structured and semi-structured forms. Several field observations were done for both study areas. Data and observations for the management system of water resource were carefully made. The final result of the water resource and domestic water requirement in Panglong was measured by the combination of quantitative method and qualitative method.

## **Results and Findings**

### **1.Relationship of Water Resource and Physical Factors**

Water resources for Panglong is related to the physical factors of the region. Panglong is an upland . Panglong lies 4,440' sea level .The highest mountain range is "Loi Pha Lang" which rises in height in the north and which gradually becomes lower towards the south. The highest peak is Loilang which is over 6,334 feet. In the east and northeastern parts of the region lies Loilem which is a small mountain with a height of 5,605 feet.

In analyzing the relief of Panglong is a plateau which has higher slopes in the north and south. The highest of the wards are as follows: ward No (1) is 4,455 feet above sea level, ward No (2) is 4485 feet above sea level, ward No (3) is 4,495 feet above sea level, ward No (4) is 4,439 feet above sea level. The source of water for the four wards of Panglong is Naungtaunggyi Spring which lies 3000 feet away from ward No (3) which lies over 5,000 feet above sea level.The main stream is Nam Pawn stream with a length of 112 miles which rises in Kyeethi Township near Waman village in the south of Panglong.It is also a tributary of the Thanlwin River.

Although Panglong lies in the low latitudes of the Tropical Zone yet as it lies above 4,444 feet above sea level, it receives the Sub-tropical Mountain Climate (Cwb).December, January and February are the months with the lowest temperature ranging from 40' F to the freezing point. April and May are the months with the highest average temperature of 80F. As it is a hill region the daily range of temperature is high.

There are also variations in the amount of rainfall. From May to October are the 6 months with the highest rainfall. 90 percent of the total annual rainfall is being received during these months. January is the month with the least rainfall and it is the coldest month. The annual average rainfall for Panglong is about 53 inches.

The soil of Panglong is also important in relation with its water resources. In Panglong, Mountainous Red Soil, Meadow Soil and Red Brown Forest Soil are found. As the region is over 4,000 feet high, the natural vegetation is Pine Forest. But now due to Taungya cultivation Pine Forests are not found.

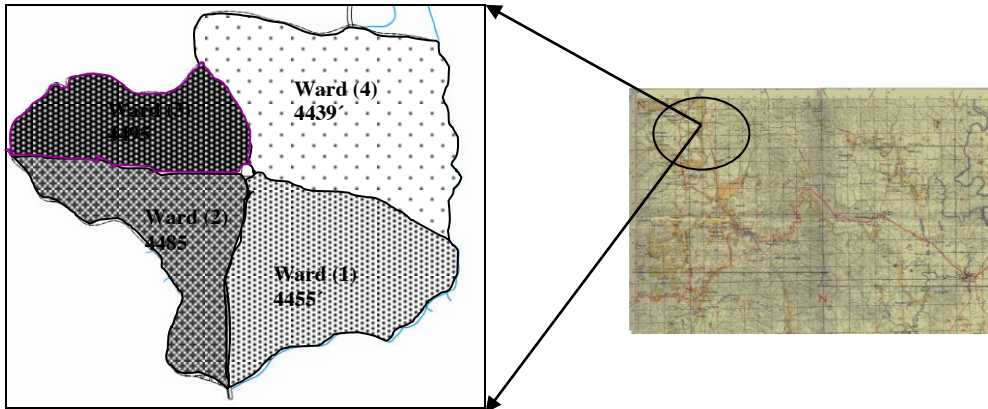


Figure (2) The above sea level and Relief of Panglong

Source: Geography Department of Panglong University, 2008

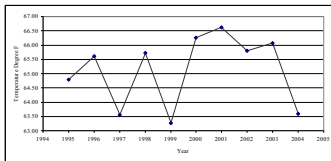
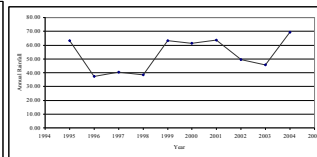


Figure (3)

The average temperature of Panglong, 1994-2005



Figure(4)

Fluctuations in Annual Rainfall of Panglong, 1994-2005

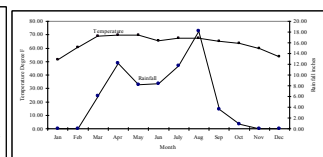


Figure (5)

Monthly Temperature, Rainfall of Panglong, 2008

The source of water depends greatly on the geological structure of the bed rocks. As Panglong lies in the Eastern Highland Region, it consists of rocks of Pre-Cambrian Epoch, Paleozoic Era and Mesozoic Era. The rock types mainly found in Panglong are rocks formed during Paleozoic Era. Rocks of Mesozoic Era are found on the north-eastern part. As Gneiss, limestone and schist, are underlain, percolation of water permeability of water is high. That is why during summer the drying up of wells and the less amount of spring water are found.

Conditions of topography and climate can change the water level of the wells. In taking the sample data, it is found that by digging a well from 5 to 35 feet, the water level will be from 3 to 12 feet. Rainy season is about 15 feet, the wells become dry. After observing 90 per cent of the wells

during March and April, hand-dug wells were dry. Due to the hard bed rocks artesian and tube wells cannot be dug. Natural spring water which has no cover and roof is being used for washing clothes and for .Artesian wells and tube wells are not found.

As "Taungya" cultivation is carried on the hill where clearing of land by cutting forests caused soil erosion. Due to soil erosion, the fertility of the soil becomes less. Moreover as the slopes of the hills are steep and as sheet erosion occurs and as there are many sediments deposited into the Nam Pawn stream .The water from Nam Pawn stream is used only for agriculture .At present due to "Taungya" cultivation (shifting cultivation) deforestation occurs due to the decrease in rainfall. Sometimes a hot dry climate is felt and the amount of underground water has decreased. However after purifying the muddy deposited water, domestic water can be used. It is also found that the purified drinking water is becoming scarce.

## **2.Quantity of Water and Factors of Population**

In determining the living standard of population, as factors regarding the usage of water have been calculated, the distribution of population and the use of water resources are being analyzed. According to WHO guideline Standard, the average consumption of water for one person in various countries varies from 15 to 50 gallons per capita per day. That means the average capita consumption rate per capita per day varies from 15 to 50 gallons.

As the least average consumption rate of water per capita per day in the developing countries 15 gallons per capita per day, it had been calculated that is average consumption of the water per capita per day for 20,870 persons of Panglong would be 313,050 gallons. At present as the availability of water from the hand-dug wells and water pipe distribution of water from the wells and water pipe distribution system can supply 191,295 gallons of water to 12,753 people: the amount of domestic water required for 8,117 persons is 121,755 gallons.

In analyzing the water consumption of the population living in the four wards of Panglong, it is found that 39 per cent of the total population of the town does not get adequate water as ward (2) has the largest population, it requires 51 per cent of the town's consumption of water. Ward (1) requires (28) per cent of the town's consumption of water. Ward (3)

requires (11) per cent of the town's consumption of water and ward (4) requires (10) per cent of the town's consumption of water. For the whole town it is found that the consumption of water is 320,000 gallons per capita per day and the consumption of water for the whole year will be 1,440,000,000 gallons per capita per day. By the next 20 years, as it is estimated that the population of Panglong would be 47,720 persons the need for domestic water would become more. As the economic business and enterprises such as pickled tea broker's sale centres, brick kilns and factories, the requirement for the consumption of water may be more than the above estimation.

Table(1) Population Distribution and Water Resource of Panglong, 2008

Sr.	Ward	Population	Household	Family	Well	Tab	Multi-Tab	Reservoir	Popu: per Tab
1	Ward 1	4019	555	557	255	58	5	2	69
2	Ward 2	7969	1363	1365	580	91	8	3	88
3	Ward 3	3931	675	677	390	60	4	2	66
4	Ward 4	4951	892	893	425	85	3	1	58
	Total	20870	3485	3493	1650	294	20	10	71

Source: Administrative Department of Panglong & Field Observation ,2008

Table(2) Race Population of Panglong, 2008

Sr.	Ward	Myanmar										Total
		Kayin	Chin	Bamar	Mon	Rakhine	Shan	Po-O	Inntha	Other	Chinese	
1	1	11	0	2073	0	8	684	712	63	456	12	4019
2	2	10	14	1729	0	10	2180	3248	65	700	13	7969
3	3	0	2	67	0	1	1594	1666	9	574	18	3931
4	4	42	0	77	1	6	3124	1032	20	635	14	4951
	Total	63	16	3946	1	25	7582	6658	157	2365	57	20870

Source: Administrative Department of Panglong

### 3.Relationship of Water Resource and Land Use

In observing the use of water at Panglong, there are 1,650 hand-dug wells; 294 Home water taps or hydrants 20 Public water taps or hydrants; 10 water tanks and reservoirs. During summer when the hand-dug wells become dry, water from the Nam Pawn stream is used.

In ward (1) of Panglong which has an area of 446 acres, there are 255 hand-dug wells. Thus the ratio of the land area to the amount of the wells is (1:0.5). The ratio of wells to the amount of person is (1:16). The Domestic water needed for this ward is equivalent to the needs of 28 per cent of the population, 58 home water taps (hydrants). 66 per cent of the area of ward (1) is used for institutional lands which consist of Government Offices, Courts, Monasteries and schools. That is why a lot of water for domestic and drinking purposes are needed.

In ward (2) of Panglong with an area of 366 acres there are 558 wells. The ratio of land area to the number of wells is (1:2). The ratio of wells to the number of people is (1:14). Now there are 91 Home taps in the ward. Houses with wells also use water given by small springs which are filled with water during the Rainy Season and which are 20 feet depth become dry. Residential land use covers 28 per cent of the area of the ward and the requirement of water for the population is 51 per cent, institutional lands cover 19 per cent of the area of ward(2).

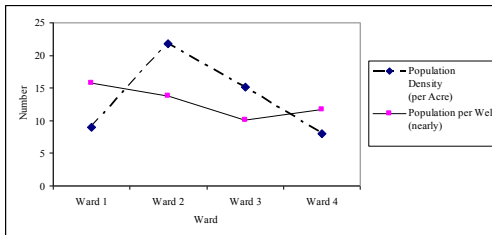
In ward (3) with an area of 260 acres are 390 hand-dug wells. As the ratio of the land area to the number of wells is (1:1.5). The ratio of the number of wells to the number of people living in ward (3) is (1:10). 30 per cent of the land area is used for residential use. 40 per cent of the land is used for agricultural land use. There are 60 Home water taps in this ward. Houses which received water from the water pipe lines through the Distribution System also use water from the wells too. In ward (3) water is available from the small springs throughout the year. Moreover as ward (3) is near Naungtaunggyi spring which is 2,000 feet away from ward (3), water is sufficient for domestic purposes. As 89 per cent of the population of ward (3) can use water from the private wells and government installed water pipe line system, it is necessary to supply water to only 11 per cent of the population who need water through the expansion of the pipe line system.

In ward (4) the area of the land is 615 acres and there are 425 wells. The ratio of the land area to the number of wells is (1:0.8). The ratio of the number of wells to the number of people is (1:12). At present there are 85 home water taps or hydrants. Residential land use covers 19 per cent of the land area and 24 per cent of the total population of the township reside in this ward. Agricultural lands cover 47 per cent of the land area. Only 10 per



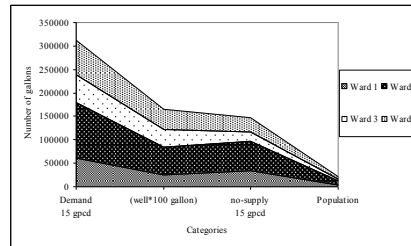
cent of the population in this ward need a few extension of the water pipe line distribution system.

In relating the availability of water and land use pattern of Panglong, the ratio of the land area to the number of wells is (1:1). It is sufficient for 11,000 people to use domestic water. As 11 per cent of the population can receive water by means of the water pipe distribution system installed by the Government 2,295 people can use water. It is found that 36 per cent of the total population of the town which amount to 7,575 persons need water. All these lands require water for domestic and drinking purposes.



Figure( 6)

Density of Population and  
Well in Panglong,2008



Figure(7)

Population and Demand of water  
in Panglong,2008

Source: Calculate based on field Observation and Geography Department of Panglong University,2008

#### 4.Assessment of Water Quality in Panglong

In Panglong the source of water is available mainly from the water resources obtained as well water, spring water and stream water. Pond water is not found. Well water is used by 89 per cent of the population. It is used for the domestic purposes such as for cooking, washing, drinking and for watering plants. Spring water is used by means of the pipe line distribution system. Within the ward, spring water is used directly without treatment or purifying for washing. Stream water which is taken from a streamlet of Nam Pawn stream in ward 3 is used. Moreover in ward (1) and (4) water obtained from the main Nam Pawn stream is used for cultivation of crops and washing.

Well water is generally used by the majority of the people in the town as suitable domestic water. In order to irrigate and use spring water and stream water which are not protected by roof or cover as domestic

water, WHO guideline Standard Quality analysis is being used. The quality of water is measured and analyzed according to its (a) physical properties (b) chemical properties and (c) bacteriological activities.

Table (3) Physical Properties of Water in Panglong

Sr.	Parameter	Unit	Supply System		Nan Pawn Stream		WHO Standard
			Rainy Season	Dry Season	Rainy Season	Dry Season	
1	pH		7.24	8.26	7.65	8	6.5-8.5
2	Color	unit			5	5.7	0-5
3	Turbidity	mg/l	15	5>	5	3	0-5
4	Sediment	mg/l			7.5	15.7	0-5

\*

Table (4) Chemical Properties of Water in Panglong

Sr.	Parameter	Unit	Supply System		Nan Pawn Stream		WHO Standard
			Rainy Season	Dry Season	Rainy Season	Dry Season	
1	TDS	mg/l			82	45	0-100
2	Total hardness	mg/l	122	0	44	39	0-500
3	Calcium chloride	mg/l	152		12.4	11	
4	Magnesium	mg/l			7.62	7	
5	Soluble iron	mg/l	0.04	0.07	0.1	0.3	0-1
6	Arsenic	mg/l	Nail	0	ND	ND	0-0.05
7	Lead	mg/l			ND	ND	
8	Mercury	mg/l			0.402	ND	
9	Nitrate	mg/l	0.18	0.1			0-10
10	Fluoride	mg/l	1.5	0.95			0-1.5
11	BOD	mg/l			1	0.6	
12	COD	mg/l			ND	ND	
13	DO	mg/l			7	6.6	
14	Electrical Conductivity	ohm/cm	218	143			0-1500

Moderately hard

\*

Table(5) Bacteriological Activities of Water in Panglong

Parameter	Unit	Supply System		Nan Pawn Stream		WHO Standard
		Rainy Season	Dry Season	Rainy Season	Dry Season	
Coliform count	mg/ml			Nil	3	0
E-coil	mg/ml			Nil	Nil	0

Source: Chemistry Department of Panglong University &

Border and Development Committee of Panglong, 2008

Intensive agriculture, population growth and floating agriculture produce some pollutants such as nitrogen and phosphorus. Using fertilizer and spraying pesticide also affect the water quality. Fertilizers for flowers cultivation and agriculture from water resource areas are the main nutrient sources of Panglong.

During the rainy season, soil erosion and surface run off flow into the Panglong can cause turbidity which brought down many materials such as organic and inorganic and some of the dissolved solids. Silt carried by runoff pollutes the water then deposited to the bottom, causing ponds and stream channels to silt up. Inorganic phosphate in municipal waste water and synthetic detergents or organic phosphate and nitrogen from agricultural fertilizers encouraged spring eutrophication. Eutrophication affect on many aquatic lives due to the DO depletion. Without free DO, streams and spring become uninhabitable to gill-breathing aquatic organism.

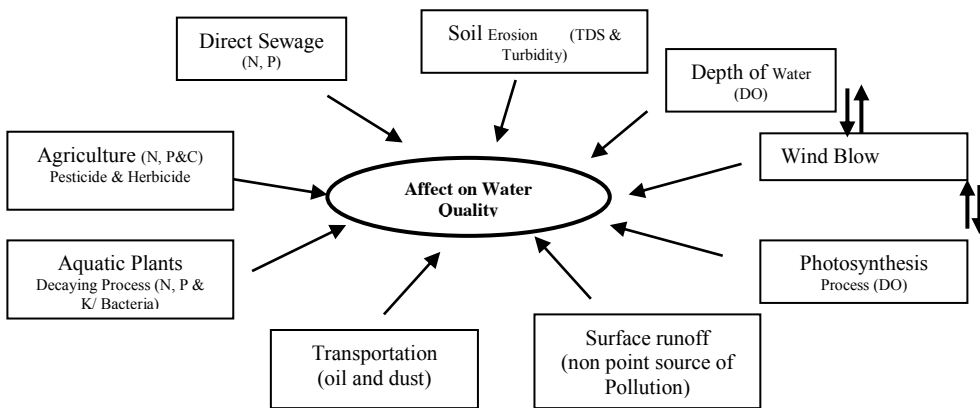


Figure (8) Factors influencing on Water Quality Degradation in Panglong

Source: Field Observation,2008

## **5. Deductions made from the respondents of Questionnaire and Interview**

In studying the management and consumption of water within the four wards of Panglong, it is carried on after making interviews and questionnaires to 10 per cent of the total households by asking 20 questions and by collecting sample data. In order to study the requirement and consumption of water by applying qualitative methods, field survey was carried on in all the four wards of Panglong. 360 persons were selected to respond to our interviews and questionnaire. Among the respondents in the samples in structured interviews, (60) samples from ward (1), (140) samples from ward (2), (60) samples from ward (3) and (100) samples were conducted from ward (4). The questions are focused on the study at the destinations of the management of water resource.

### **Perceptions on Traditional Conservation Method of Stream Water**

#### **Quality**

In Panglong, there has some traditional ways of conservation method on water quality related to agricultural aspect. In this study, about 70 percent replied that there have been traditional methods for management of water quality, but 30 percent answered that there have never been method for controlling water quality. Therefore, it can be found that over half of the interviewees knew and conserve the quality of water. (Table 6 )

Table (6)Perceptions on Traditional Conservation Method of Stream Water Quality

Method of Agriculture			Method on Cleaning Water	
Sr	Reasons	%	Reasons	%
1	use pesticide systematically	15	removing Coli form count	10
2	remove sediments	10	making retention streams	30
3	built dams	5	cleaning waste disposal	20
			Limit for washing and bathing places	5
			repairing regularly streams for good drainage	5

Source: Structured Interview Survey, 2008

**Table (7) Relationships between Water Resource Area and Water Quality Degradation**

Sr.	Water Resource Area	Characteristics	Pollutants
1	formed with limestone	chemical	alkalinity, hardness
2	cleared of vegetation, soil erosion on mountain slope	sedimentation	Turbidity, TDS
3	have intensive agriculture (Taungya, mountain agriculture)	Fertilizer and pesticide	Nitrogen
4	population growth (domestic and animal effluents and sewage)	solid waste and waste water	Phosphate
5	surface run-off, storm water	sediments, chemical and others (non-point source of pollution)	Several Chemical
6	urban runoff	municipal waste water, sewage or specific sites(point source of pollution)	Several Chemical

Source: Based on Field Observation, 2008

### **Opinions to conserve for spring water on Panglong Environ**

In this environmental situation, all of the local people have some of the opinions to conserve the water quality and water resource area of Panglong and they gave some suggestions to conserve the water quality as well as spring water resource area. On the other hand, they also desire to conserve the stream water surface area of Panglong. They gave some suggestions as shown in Table( 8) and ( 9 ).

**Table ( 8) Opinions and Suggestions on Conservation on Water Quality**

Suggestions on Conservation of Water Quality		
sr	Suggestions	%
1	should build more dams which trap silting in Naungtawngyi Source	6
2	should not extend the flower cultivation at east and west mountains	18
3	should not extend the houses beyond the limitation of mountains	10
4	should dig sediment when water dried up in water source	23
5	should reforest around the Panglong	15
6	government should sustain the Panglong area	18
7	should exercise with modern machines	10

Source: Structured Interview Survey, 2008

**Perceptions on Natural Environment**

Table ( 9 ) Perceptions on Taungya Cultivation around the Panglong

Perceptions on Crop Cultivation						
sr	More Taungya Cultivation		Less Taungya Cultivation		No change Taungya Cultivation	
	Reasons	%	Reasons	%	Reason	%
1	cutting for firewood	20	restricted by government	15	Prevent Taungya (poppy) cultivation	5
2	extension of shifting cultivation	25	prohibition of government	10		
3	population growth	15				
4	weather changes	10				

Source: Structured Interviews Survey, 2009

Concerning with the conservation and management method, it can be divided into two parts: water quality and water resource area. Similarly, the methods are based on two ways: traditional method and modern method.

**Perceptions of Local People**

In Panglong region, the natural environment is being converted rapidly by the people under the extension of agriculture, burning and cutting forest, for firewood, and loss of biodiversity, invasion or introduction of non-native species because of population growth. Around the area, eastern and western parts are nearly treeless mountains because of human activities such as unsystematic ways of hill cultivation, and cutting forest for firewood as well as forest fire caused by natural and human activities. As a result of deforestation which accelerates surface runoff and soil erosion, silting up on the springs and streams has gradually caused them to become shallower and to decrease the water holding capacity.

The extension of taungya cultivation has effects on the water surface area as well as water quality. Fortunately, Some of the interviewees have been living in this town since they were born. They have noticed well about the changing environment.

## **Discussion and Conclusion**

6 years ago, during summer as the water wells, become dry problems connected with health and the living standard of the people were encountered in Panglong.

The problem regarding the insufficiency of well water is found in summer and so water from the water pipe line distribution systems or springs is used.. The topography and climate can change the water level of the hand-dug wells. After observing 90 per cent of the hand-dug wells during March and April, one can find that 50 per cent of the wells were dry. The water resources of Panglong are received from wells, springs and streams. 89 per cent of the household use well water.

In relating the availability of water and land use pattern of Panglong, 36 per cent of the total population of the town which amount to 7,575 persons need water. By the next 20 years, as it is estimated that the population of Panglong would be 47,720 persons the need for domestic water would become more.

In spring water, reducing sedimentation of soluble materials deposition of materials should be carried out. Moreover the amount of the contents of Calcium, Magnesium and Fluoride should be reduced. In order to kill the pests, chemical pesticides should be put in the water. By reducing the colour and contents of sediment, iron, mercury, BOD,COD, DO,Coli form count in the stream water; and by constructing the water filtering tank and if necessary, by putting chemicals in order to kill the germs and pesticides and also by giving Oxygen and aeration, stream water should be used as domestic water. Eutrophication affect on many aquatic lives due to the DO depletion. Without free DO, streams and spring become uninhabitable to gill-breathing aquatic organism.

Intensive agriculture, population growth and taungya cultivation produce some pollutants such as nitrogen and phosphorus. Using fertilizer and spraying pesticide also affect the water quality. Fertilizers for flowers cultivation and agriculture from water resource areas are the main nutrient sources of Panglong.

In order to improve the quality of water "Taungya" cultivation (shifting cultivation) on the mountains, mountain ranges and watershed should be prevented. Reforestation should be encouraged. Erosion of soil should be prevented. Use of pesticides in the "Taungya" fields should be

lessened; Sedimentation of deposits should be lessened. Development and growth of bacteria should be lessened.

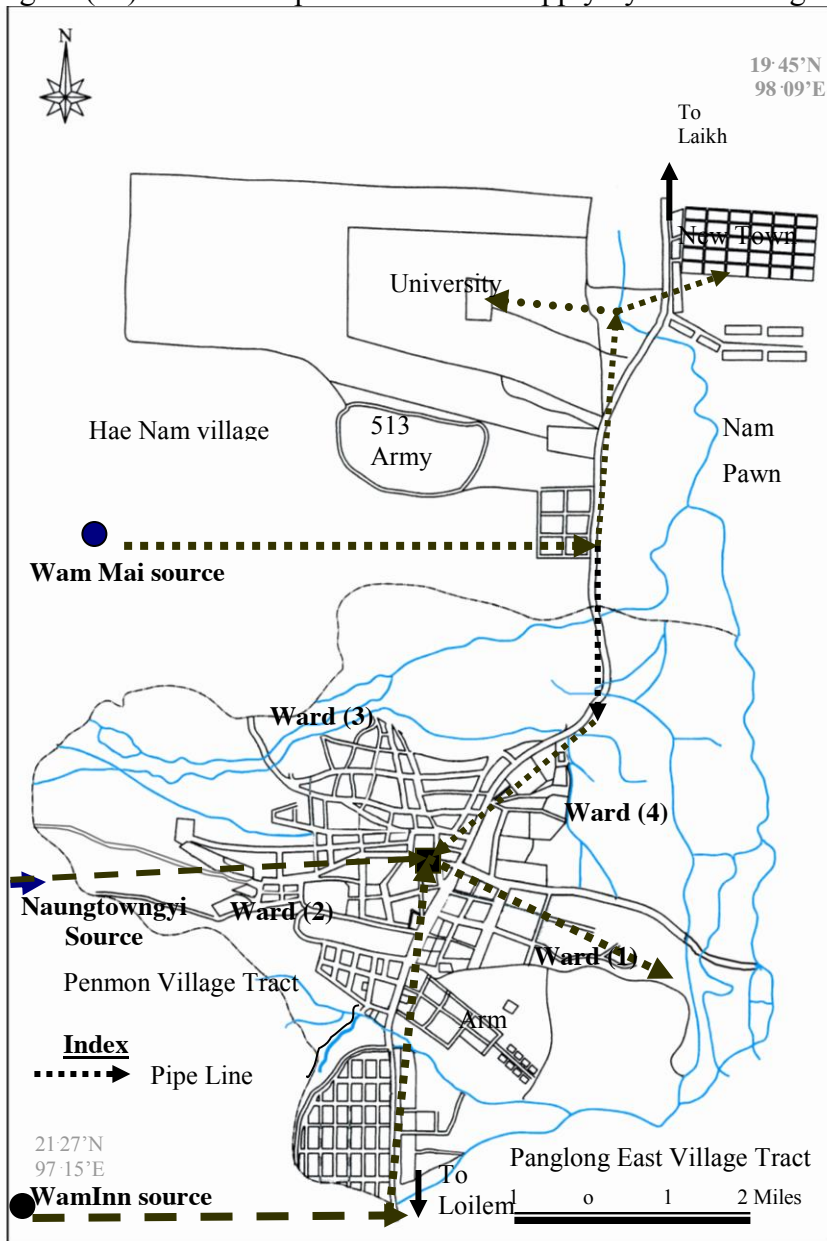
Although Nam Pawn Stream water is being used, it is suitable only for agriculture and cultivation of crops. In order to get good water quality to use as domestic water, filtering and purifying of water should be carried on. In Panglong hand dug wells are the main sources of water, but in places where wells can not be dug, it is necessary to implement and install water pipe line distribution system.

Moreover by collecting fees for water metres for using water and by not wasting water, one can systematically conserve water. To the south of this town lies WanInn Spring and to the north lies WamMai source. Water from the springs is sufficient for the Town and its environ. If the water from that springs is pumped, fresh water can be adequately supplied by the pipe line distribution system. In all the 4 wards, it is necessary to make roofs to cover wells and springs. Moreover in order to have good drainage ,water drains should be constructed.

These facts can make us realize that the population growth of an area is related to the environmental degradation of that place. There is a causal relationship between planning, environmental education and environmental perception for sustainable development of a region. Without peoples' participation, it is difficult to succeed in certain objectives of regional development planning.



Figure ( 9 ) Future Prospects for Water Supply System in Panglong



Source: Border and Development Committee of Panglong Sub- Township, 2008

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