

PERPUSTAKAAN UMP



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**EFFECT OF POPULATION GROWTH ON DEMAND FOR WATER AND WATER CRISIS IN
UNIVERSITI MALAYSIA PAHANG, PEKAN CAMPUS**

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ABSTRACT

This study was conducted with the demand; water crisis and consumptive water use at Universiti Malaysia Pahang Pekan Campus since it build. Increasing demand for water depends on population at UMP Pekan itself that increase rapidly in one year. The region around UMP Pekan also face water crisis and it affected also not only residents at UMP Pekan, but residents at Kuala Pahang. This study was conducted to identify the volume of the water demand and capacity at UMP Pekan Campus and also analyze the water demand and crisis for making a suggestion in future plan. The data was collected via interview with residents of UMP Pekan Campus, questionnaire developed for UMP Pekan's residents and also data collected from Jabatan Perbendaharaan dan Pengurusan Harta, Bahagian Pengurusan Pelajar and Pengurusan Air Pahang Berhad (PAIP). From the study, the real causes of water shortage that occur at UMP Pekan Campus was determined and also it concluded with the best solution to avoid the water crisis occur in the future.

ABSTRAK

Kajian ini mengandungi perbincangan mengenai permintaan, krisis air dan juga penggunaan air di Universiti Malaysia Pahang Kampus Pekan sejak ia dibangunkan. Permintaan air yang semakin meningkat bergantung kepada peningkatan jumlah populasi yang mendadak dalam setahun di UMP Kampus Pekan . Kawasan sekitar UMP Kampus Pekan juga mengalami masalah air yang sama dan ia memberi kesan bukan sahaja kepada residen di UMP Pekan malah penduduk sekitar Kuala Pahang. Kajian ini juga dijalankan untuk mengenalpasti jumlah permintaan dan kapasiti air di UMP Kampus Pekan dan juga menganalisis permintaan air dan krisis air yang berlaku bagi memberi cadangan untuk pelan pembangunan masa depan di UMP Kampus Pekan. Pengumpulan maklumat di perolehi melalui temubual bersama residen di UMP Kampus Pekan, soalan kaji selidik yang disediakan untuk residen UMP Kampus Pekan dan juga maklumat yang diperolehi dari Jabatan Perbendaharaan dan Pengurusan Harta, Bahagian Pengurusan Pelajar dan Pengurusan Air Pahang Berhad (PAIP). Daripada kajian, punca sebenar berlakunya masalah kekurangan air di UMP Kampus Pekan dikenalpasti dan kaedah penyelesaian yang terbaik di nyatakan bagi mengelakkan krisis air berlaku di masa hadapan.

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LIST OF ABBREVIATIONS

| | |
|------|---|
| BPA | Bahagian Pengurusan Akademik |
| GWh | Gigawatt per hour |
| JBA | Jabatan Bekalan Air |
| JPPH | Jabatan Pengurusan dan Perbendaharaan Harta |
| MLD | Million liter per day |
| MPP | Majlis Perwakilan Pelajar |
| PAIP | Pengurusan Air Pahang Berhad |
| UMP | Universiti Malaysia Pahang |

CHAPTER 1

INTRODUCTION

The annual rainfall was found to decrease in the Southeast Asia region between 1961 and 1998 and the number of rainy days has decreased significantly throughout most of the countries of Southeast Asia (Manton et al. 2001). In recent years, several extreme and drought events have been reported in Malaysia. For example, an extreme rainfall event from 9 to 11 December 2004 caused severe floods over the east coast of Peninsular Malaysia (Juneng *et al.* 2007). In addition, due to the cold surges of the northeast monsoon, abnormally heavy rainfall occurred in the southern part of Peninsular Malaysia for several days in late December 2006 and in the middle of January 2007, causing massive floods in the region (Malaysian Meteorology Department 2006, 2007)

Malaysia receives an annual average rainfall of more than 2500 mm, mainly due to the Southwest and Northeast monsoons. The country is therefore rich in water resources when compared to the other regions of the world. The average annual water resources on a total land mass of 330,000 km² amount to 990 billion m³. Out of which, 360 billion m³, or 36% returns to the atmosphere as evapotranspiration, 566 billion m³,

or 57% appear as surface runoff and the remaining 64 billion m³, or 7% go to the recharge of groundwater. Of the total 566 billion m³ of surface runoff, 147 billion m³ are found in Peninsular Malaysia, 113 billion m³ in Sabah and 306 billion m³ in Sarawak (MANCID).

Fresh water supply is an important aspect of public utility to all kinds of building premises. Unlike in housing and residential areas, where the number of household and water use behavior is a pre-determinant factor, public university campus is quite different in terms of population and water usage. The type of building in a university campus is a mix between student residential colleges, office buildings, sport complexes, laboratories, and cafeterias. In addition, the number of people living on-campus varies according to the university academic calendar. (Ayob Katimon & Amat Sairin Demun, 2004).

Water is used for a variety of purposes. Consumptive water use is largely for irrigation, industrial and domestic water supply and to a minor extent for mining and fisheries. In stream water uses which are non-consumptive in nature include hydropower, navigation, recreation and fisheries (MANCID). In the past, water was regarded as inexhaustible resources such as air. In more recent year we have begun to value water as a limited resource. This may be because of increasing demand but more probably due to the fact that realized there are the demands on water other than for human consumption (David Stephenson, 2003). Increasing demand for water, higher standard of living, depletion of resources of acceptable quality and excessive water pollution due to agricultural and industrial expansions have caused intense social and political predicament (Mohammad Karamouz, Ferenc Szidarovszky, Banafsheh Zahraie, 2003).

As the country progresses towards industrialization coupled with the increase in population and urbanization, the demand for water in the domestic and industrial sectors grows rapidly. The current annual domestic and industrial water demand is 4.8 billion m³ and is expected to increase to 5.8 billion m³ in 2020. The present water supply system serves 99 % and 83 % of the urban and rural population respectively (Mohd. Azhar, 2000).

1.2 Problem statement

The Population growth (annual %) in Malaysia was last reported at 1.61 in 2010, according to a World Bank report released in 2011. The Population growth (annual %) in Malaysia was reported at 1.71 in 2008, according to the World Bank (Trading Economics, 2011). Increasing populations that lead to both decreasing per-capita water availability and increasing overall demand, and changing conditions (particularly technology and climate) that affect both water supply and demand. In the first case, assuming constant levels of total water availability, increasing populations lead directly to decreasing per-capita water availability and pressures on the levels of benefits or the mix of benefits that water provides. Ultimately, unlimited population growth must lead to decreasing water availability, the reallocations of water from one user or sector to another, the unsustainable "mining" of non-renewable stocks of water, and, in the end, decreasing overall human well-being (Peter H. Gleick, 1995).

The growth in population and GDP over the last three decades has resulted in heavy demand for water. The problem of population growth is particularly felt in the urban areas, due to rural-urban migration and growing urbanization. The exponential growth in urban population has stretched the government's ability to answer infrastructure and service needs and provide the environmental conditions required for better living. Often the supporting infrastructure for the collection, treatment and

disposal of sewage and solid wastes is inadequate to cope with the amounts generated. This state of affairs raises problems of water and air pollution, public health and urban environmental degradation. The increased demand for the limited and diminishing supply of clean water available has led to competition among the various water users; a competition the continued economic growth exacerbates increasingly (Regional Office for Asia and the Pacific, 2011).

Domestic water demand has also been rising due to an increase in per capita consumption. In many countries, water rationing is used to limit demand. The main cause of scarcity of water is population growth. In this study, Universiti Malaysia Pahang, Pekan Campus was chosen as the study area. Universiti Malaysia Pahang, Pekan Campus has experience the population increases from 739 to 2282. Beside that, the water capacity is low than water demand at the campus. One of the reason is the uses of water in the peak hour is very high. Another reason is the size of water tank available is not enough to resist the water capacity needed in the campus area and also the low water pressure cause the student that living in the top floor of the hostel building have to face the worst water crisis because of the water cannot reach the top floor.

1.3 Objectives

Based on the current issue, UMP Pekan faces a serious problem regarding to water. It is reported that the whole campus will face water crisis almost every week. Therefore, the study is undertaken based on objectives given;

- i. To identify the volume of the water demand and capacity at UMP Pekan campus
- ii. To analyze the water demand and crisis for making a suggestion in future plan

1.4 Scope of work

Water demand represent to the requirement of the water toward consumer. Minimum used of water daily by a consumer or sum of the water used for the population will be determine. Population growth in study area caused the water demand increase. Water reservoir capacity is not sufficient.

The first phase in this study is about to find information and do some researches regarding the topic. Starting from searching of literature review and case study based on the objectives of the study. In short, this phase is fully used to find primary and secondary data weather using online or manually.

After finding and summarizing the data, questionnaires can be constructed referred to the issues. Sample of respondents are identified to answer the questionnaires. This is the second phase of the study. Interview is the other method used in collecting data. All the data are analyzed briefly and recommendations are perfectly defined.

1.5 Significant of study

Developed of population growth at UMP Pekan is increase year by year. So it indicates that domestic water demand will increase. With the increase of demand, it also will face the high chances to meet water crisis at UMP Pekan itself. The important of this study can be interpreted based on the objectives of this study. It is including knowing the volume of the water requirement at UMP and also the volume of water storage at UMP Pekan from year 2009 until 2011.

Besides that, it will also show how water demand is directly proportional to the water capacity at UMP. Therefore, conflict between water demand and water capacity will cause of water supply during the scarcity of water. From the study, it can be use to find the best way to plan, to solve and supply enough water for the residents of UMP Pekan.

CHAPTER 2

LITERATURE REVIEW

2.1 Water Situation

Water is one of the most important of all natural resources. It is vital for all living organisms and major ecosystems, as well as human health, food production and economic development. Difficult to purify, expensive to transport and impossible to substitute, water is essential to life. It is a precious resource that has too long been taken for granted. Clean water is not an infinite resource. There is a limited amount which cannot be increased, yet it is constantly under threat from overuse and pollution. In the past 100 years, the world's population tripled, but water use sixfold. Rivers and lakes are stretched to their limits. Many of them dammed, dried up or polluted. With groundwater taking up an average of 1400 years to be replaced, aquifers are being drained far faster than their natural rate of recharge. Eighty countries, accounting for 40% of the world's population already experiences serious water shortage. Despite improvements, about one-sixth of the world's population doesn't have access to safe water, and half does not have access to adequate sanitation.

With accelerated urbanization and industrialization, the demand for power has been increasing rapidly. In 1993, the annual output of hydropower totaled some 4,500 Gwh accounting for about 16 % of the total power supply in the country. The total hydropower potential for the country has been estimated at 123,000 Gwh of which about 85% are found in the States of Sabah and Sarawak (MANCID).

2.2 Factors affect the use of water

From physical factors, global fresh water supplies are abundant, but because of climates and geographic relief, they are unevenly distributed among and within places. In some growing places, some people cannot obtain an adequate amount of water because of a large number of populations within with the limited supplies of water. Another factor is affluent lifestyles make heavy demand on water but because of the limited sources, it directly causes a serious water crisis.

2.3 Water Demand

Water demand is the scheduling of quantities that consumers expect to use per unit of time. Water use can be classified into two basic categories; consumptive and nonconsumptive uses ; the first category removes water from the immediate water sources, and the second one is related to water diversion or nondiversion from water sources and immediate return of water to the source at the point of diversion in the same quantity as diverted and water quality standard. Consumptive use is the part of water withdrawn that is removed from the immediate water environment through natural or anthropogenic phenomenon such as evaporation, transpiration, incorporation into products or crops, consumption by humans or livestock.

A problem for government authority is the provision of adequate water supply and hygiene to the rapidly growing urban population. Capacity expansion by finding or expanding existing sources is becoming more difficult and costly in many developed or developing parts of places, and is often physically and economically infeasible (Mohammad Karamouz, Ali Moridi, Sara Nazif,2010).

The use of water exceeds the available supply will cause the occurrence of water. The mismatch between increasing water demand and decline in water availability is the most critical resource issue in Malaysia. Population growth, intensive agricultural development, urbanization, industrial growth and environment requirements are all increasing demand for water.

The water demand will always increasing and never falls down due to the capacity and the population growth in the area. So, in short term, it can be concluding that water demand and population is directly proportional.

2.4 Competition of Water

The growth in population and Gross Domestic Product (GDP) over the last three decades has resulted in a heavy demand for water. The increased demand for a supply of clean water has led to competition in water use among the various water users, and the continued economic growth will magnify this even more acutely. In addition, as the readily available portion of surface water resources has already been developed for use in practically all regions of major water demand, future surface water resources development will require the construction of more storage dams. These are not only costly, but there is a high environmental price to pay. Furthermore, the practicable limit of surface water resources development has been reached in some regions of high

demand, and it has become necessary to consider inter-basin and inter-state surface water transfer schemes. Before the latter is implemented, the prospect of developing other water sources and water recycling, and the implementation of water demand management should be looked into. (Mohd. Azhar, 2000).

2.5 Water Crisis

Water crisis is a term which defines the relation between the world resources of water and the human demand for it. It also a general term used to describe a situation where the available water within a region is less than the region's demand.

Compared with Singapore's 155 liters, the Philippines' 175 liters and Indonesia's 130 liters per person per day, Malaysia is among the highest water consumers in the region. Currently, Malaysians use an average of 226 liters of water per person daily, which is way above our South-East Asia neighbors while Thais manage with 90 litres.(Meng Yew Choong, 2011). Malaysia's water sustainability index had fallen from 64 per cent in 1992 to 33 per cent in 2002. If Malaysians don't start consuming water sparingly, water companies are projecting a daily shortage of 476 million liters in 2014. (Ahmad Zahdi Jamil, 2011).

The existing water capacity for 2010 (January-December) was 4,326 MLD as against 4,063 MLD in usage. This left 263 MLD in water reserves or six per cent of the daily needs. For January-December 2010, the demand for treated water increased by 4.0 percent and taking into this year's increase in demand the water reserves would be depleted in early 2012 and this would lead to a water crisis (Abdul Halem, SYABAS, 2011)

2.6 Water Shortages

Water shortages creep up quietly on communities for many years; droughts generally accentuate them. Often the occurrence of a water shortage has been delayed by normal or above-normal rainfall even though the causes have been growing in strength, ever ready to assert themselves at the first opportunity. The chief reasons for most water shortages can be attributed to greater than anticipated population increases, decreases in well capacity, sediment accumulations in reservoirs, and increased water requirements, both domestic and industrial.

Shallow well water supplies, that are locally recharged, can warn communities of their growing inadequacies. Normal rainfall generally provides sufficient recharge for such wells to meet usual pump age demands. During dry periods lack of recharge permits well water levels to decline and less water is pumped. This warns the community in the form of periods of low pressure in the distribution lines on peak-load days. During protracted dry periods these distribution problems show up more frequently, and the customers are gradually impressed with the inadequacy of their well supply. On the other hand, surface water sources are designed to meet periods of low stream flow. When stream flow is normal or above normal the source can supply many times the demand. In fact it would be possible for municipal use to double or triple in wet years without any strain on the source. The strain would show only on the distribution end of the system.

With continuous increasing of population, the need of water is increasing. In these years, water resource shortage has become a restricted factor to economic development in many countries and region; water shortage threatens human lives and the city's development. Whether water resource is running off, and how the circumstance is

being short of water are influenced by two factors: water use and water supply. Because of the randomness of river flow and rain, water supply and water need have uncertain factors. Whether water resources run short, and how the circumstance of being short of water is, are influenced by the two factors of water use and water supply. Because the randomness of the river flow and rain, water supply and water need all pose the dicey factor (Dongmei Jin , Jiquan Zhang, Junshan Han, Northeast Normal University, Changchun).

The Malaysian economy has gone through rapid structural change since independence in 1957. In global arena, Malaysia is often considered as a ‘develop’ country. The urban growth is dynamic in accordance with the rapid economic growth and industrialization. The infrastructure has been strained by rapid urban growth and there are high needs of improvement of amenities such as water supply, electricity, transportation, environment and drainage. The impacts of the growth have put excessive demands on water supply and water resources. Besides economy and industrialization, the number of population also has increase. Malaysia has a few cities with high density of population such as Lembah Klang, Pulau Pinang and Johor Bahru. These cities required more demands on water supply than other cities in Malaysia (Che-Ani A.I, *et al* , 2009)

2.7 Water Scarcity

Water scarcity is either the lack of enough water (quantity) or lack of access to safe water (quality). Water scarcity already affects every continent. Around 1.2 billion people, or almost one-fifth of the world's population, live in areas of physical scarcity, and 500 million people are approaching this situation. Another 1.6 billion people, or almost one quarter of the world's population, face economic water shortage (where countries lack the necessary infrastructure to take water from rivers and aquifers).

Water scarcity is among the main problems to be faced by many societies and the World in this century. Water use has been growing at more than twice the rate of population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water.

Water scarcity is both a natural and a human-made phenomenon. There is enough freshwater on the planet for six billion people but it is distributed unevenly and too much of it is wasted, polluted and unsustainably managed.

2.8 Water Profile

The water profile of Malaysia is dominated by a supply regime of copiously flowing rivers and a widespread series of dams for surface water storage. Demand includes the growing human population, industry and agriculture, of which rice farming is the most water intensive crop. Water pollution from sanitary domestic sewage sources

as well as industry is major challenges for the country, with the recent and ongoing growth of the population and the country's industrial base.

Malaysia is situated in Southeast Asia. It consists of two regions: Peninsular Malaysia in the west lying between Thailand and Singapore, and the states of Sabah and Sarawak located in the east on the island of Borneo. The two regions are separated by the South China Sea. The total land area of the country is 328,550 square kilometers (km²). Malaysia is a federal country, divided into 13 states plus the federal territories of Kuala Lumpur and Labuan Island.

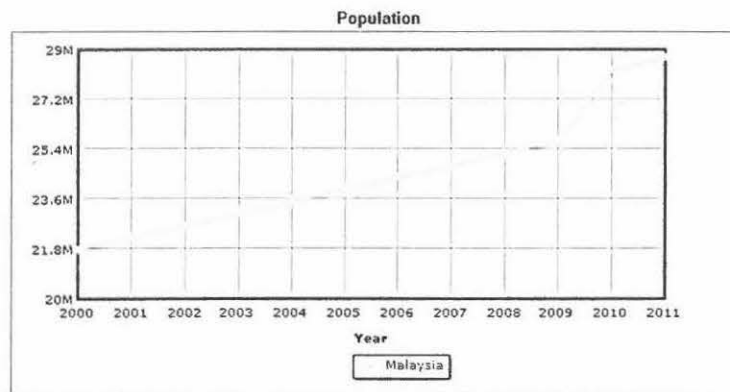
In Peninsular Malaysia, a mountainous spine known as Banjaran Titiwangsa separates the east of the peninsula from the west. About 61 percent of the peninsula is below 100 meters (m) above sea level and the land is generally suitable for cultivation. The interior of Sabah is cross-crossed by a series of mountain ranges and hills, the most prominent of which is the Crocker range with the highest point at Gunung Kinabalu (4101 m). Sarawak is generally mountainous with the highest range forming the border with Indonesia.

Table 2.1 Water Profile in Malaysia

| Demand | Unit (mfl) | 1998 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 |
|--------------|--------------------|--------|--------|--------|--------|--------|--------|--------|
| Domestic | m ³ /yr | 1,833 | 2,029 | 2,987 | 3,862 | 4,606 | 5,251 | 5,904 |
| Industry | m ³ /yr | 1,260 | 1,454 | 2,592 | 3,561 | 4,330 | 5,016 | 5,639 |
| Both | m ³ /yr | 3,093 | 3,483 | 5,578 | 7,423 | 8,936 | 10,267 | 11,543 |
| Irrigation | m ³ /yr | 7,350 | 7,350 | 6,517 | 6,517 | 6,132 | 6,132 | 6,132 |
| Total volume | m ³ /yr | 10,443 | 10,833 | 12,095 | 13,940 | 15,068 | 16,399 | 17,675 |

2.9 Population

Population is all the organisms that both belong to the same group or species and live in the same geographical area. In ecology the population of a certain species in a certain area is estimated using the Lincoln Index. The area that is used to define a sexual population is such that inter-breeding is possible between any pair within the area and more probable than cross-breeding with individuals from other areas. Normally breeding is substantially more common within the area than across the border.



| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Malaysia | 21,793,290 | 22,229,040 | 22,662,360 | 23,092,940 | 23,522,480 | 23,953,140 | 24,385,860 | 24,821,290 | 25,274,130 | 25,715,820 | 28,274,730 | 28,728,610 |

Figure 2.2: Population in Malaysia

With current population of nearly 29 million people, the demand for water is ever increasing. Changing tastes, life style and preferences can add further to the demand pattern. It seems that there is no end for the need of water and as such the supply has to keep a breast with whatever development that takes place in the population.