INTI INTERNATIONAL UNIVERSITY

Faculty of Engineering and Quantity Surveying

ACID MINE DRAINAGE AND HEAVY METALS CONTAMINATION OF ABANDONED AND ACTIVE MINE SITE AT OLD REPAS DAM IN BENTONG PAHANG MALAYSIA

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SUPERVISOR'S DECLARATION

This project report entitled "Acid Mine Drainage and Heavy Metals Contamination at Abandoned and Active Mine Sites in Pahang Malaysia" is formulated, assembled and submitted by Syed Ali Haider - I13002656 as a compulsory requirement for my Bachelors of Engineering (HONS) in Civil Engineering, Inti International University.

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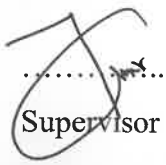

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STUDENT'S DECLARATION

I hereby declare this Final year project is based on originality and is a complete proof of all the authentic work done by me except for the mentioned quotations and citations, which have been appropriately acknowledged. I also assert that that this report is not submitted to Inti International University or any other college, organization or university for the sake of any kind of academic certificate or award for degree or diploma.

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ABSTRACT

AMD stands for Acid Mine Drainage. AMD results from the mining activities involved during mineral exploration. When minerals interact with each other in the presence of atmospheric oxygen and water AMD is the end product. AMD also accumulates from the weathering of sulphide minerals through the process of oxidation and hydrolysis. This case study was being carried out for the investigation of the occurrence of Acid Mine Drainage (AMD) and contamination of the heavy metals in the active and abandoned mining sites in Bentong Pahang. This case study deals with the traces of heavy metal toxins found in the water bodies causing the discoloration of the water catchment, downstream of the Old Repas dam. This discoloration of water proved the occurrence of AMD which is a very bad pollutant. To get a better understanding of the situation, site reconnaissance and survey were carried out to examine those areas closely that have been affected by AMD. Two different sampling points were recognised which had traces of AMD contamination. Water testing and sampling were to be carried on these particular sampling points. Four in-situ parameters and five heavy metals were selected for sampling. These parameters included PH of water, dissolved oxygen content, Total dissolved solids and Ammoniacal Nitrogen while the heavy metals included Zinc, Lead, Tin, Mercury and Arsenic. A total of four samples were collected on two different sampling points and on two different sampling days. Sampling was carried out, these parameters were measured and surface water with sediments were also collected and analysed for heavy metals. Based on the investigations done during this project, these sampling points had acidic PH values which indicate the occurrence of the Acid Mine Drainage, which had been a major find in this case study. During the Heavy Metal analysis the concentration of Pb, Sn, Hg, As & Zn was observed to exceed the allowable standard limits for treated water by the Malaysian Ministry of Health. I concluded this with the believe that there was an urgent need for appropriate treatment of this site to prevent further environmental deterioration.

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INTRODUCTION

1.1 General

AMD stands for Acid Mine Drainage. The outflow of the wastewater (acidic water) from the mining site is referred to as Acid Mine Drainage. During the mining activities two elements water and atmospheric oxygen interact with each other in the form of minerals to form Acid mine drainage which is the end product of this interaction. AMD also results from the weathering of sulphide minerals through the process of oxidation and hydrolysis. The commonly exposed sulphide minerals are pyrite and arsenopyrite, to air and water, resulting in the production of acid and elevated concentrations of metals and sulphate (Sengupta, 1992).

These minerals exist in large quantities in ground mine tailings. Mine tailings refer to as dumps or leach residue and they are those materials which are normally left over or deposited on surface after the separation processes of a metal ore. Some tailings with 5% pyrite and arsenopyrite are high enough to produce acid in mine drainage (Bodenan et al., 2004). This study refers to the current world situation the main pollutant found in the surface water in the Atlantic region is Acid Mine Drainage. AMD is known to be a significant pollution problem produced from both active and abandoned mine (Diz et al., 2006) which gives serious impact to the hydrological cycle. This study tells us that AMD is a major

problem or concern for mines which involve hard rock. The coal mines and the mines in which sulphur exists in metal ore suffer from Acid Mine Drainage. AMD pollution may cause several impacts on biological systems in long term period (Luptakova and Macingova, 2012). If acid generating rock is exposed to the environment then it can generate acid for a long time period so it must be prevented. The processes of oxidation and hydrolysis changes sulphide minerals to sulfuric acid that reduces the PH of the water at the mining sites. This type of water can be dangerous as they contain high concentration of toxic metals including As, Ag, Cr, Cu, Cd, Hg, Ni, Pb, Se, and Zn.

If the heavy metals are exposed for a long time then it can affect the nervous system and can damage blood circulatory system. High concentrations of heavy metals can cause potential risk to human health as heavy metal can easily accumulate into the living tissues of people. Water quality is a very important component to living things and for the benefits of people prevention measures should be taken to keep water quality good. AMD should be considered before the development process begins at a particular area which has mining activities going on nearby. This AMD is a very serious problem in most of the areas where mining activities are carried out so the engineers should take some initiatives and this problem should be dealt off very carefully. The prevention of AMD and the contamination of heavy metals from the active and abandoned mining sites in Bentong, Pahang is going to be the main objective of my case study.

AMD is very hazardous if it comes in contact with the skin. Prevention measures should be taken and the water should be treated so that it can be utilized by the people and they can be protected against the contamination due to AMD. AMD mostly accumulates from the mines which then are transported to the water bodies by surface runoffs due to precipitation. It is often recommended that AMD should be considered before the development process begins at a particular area which has mining activities going on nearby.

Figure 1.1: Tin mining

There are many forms of natural mineral resources that have been actively mined in Pahang. In 2010 Minerals and Geoscience Department carried out its mineral exploration activity for metallic, industrial and energy minerals in the Pahang state. According to the Malaysian Mining Industry report (2010) by Minerals and Geoscience Department Malaysia, Pahang remained as the top producer for most minerals in the country. Anomalies for iron ore and tin were identified in Pahang. Pahang is considered to be a major source for valued minerals such as pyrite and arsenopyrite which can be obtained by mining.

Due to heavy mining in Pahang, there are several mines that are abandoned without closing down in an appropriate way because the previous mining regulations were not enforced or carried out properly. Bukit Ibam is one of those mining sites. Currently, Environmental Quality Act (1974) and Mineral Development Act (1974) have been established to avoid abandonment and Contamination from mine activities in Malaysia. The Old Repas Dam (1925) and The New Repas Dam (1963) was built or constructed for the same purpose that is silt retention. New Repas Dam is constructed at a very near distance to the Old Repas Dam and it controls the flow of water into the Dam. Old repas down was abandoned or closed down due to some seepage issues.

Figure 1.2: Current Issue

1.2 Statement of problem

Several activities such as land development, mining and agricultural works being carried out on the upstream of the Old Repas dam in Bentong, Pahang are causing the deterioration of the water quality and it is contaminating the water bodies by the heavy metal toxins found in the wastewater (acidic water) and by surface runoffs occurring due to precipitation. This waste water would end up in the dam and it will affect the aquatic life. This Dam was constructed to hold residue, dirt and silt from the previous tin mining activities that has been washed down by surface runoff and prevent it from being washed downstream and block the lower part of the river which may cause flooding. The water downstream of The Old Repas dam was reported to be discoloured and polluted as it can be seen in Fig 1.2. This Discoloration of water shows traces of AMD contamination and is likely to contain high concentration of Ammoniacal Nitrogen. Even the grass around that area dies because of the polluted water, as it has no life.