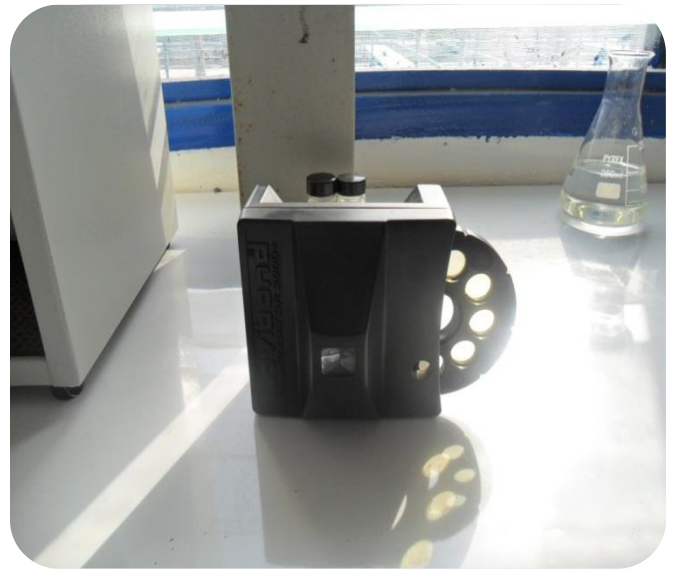


RESEARCH REPORT

***ASSESSING THE SOCIAL AND ENVIRONMENTAL IMPACTS OF
ILLEGAL MINING OPERATIONS IN RIVER BONSA***



Prepared By

Solomon Kusi-Ampofo & Theophilus Boachie-Yiadom

Commissioned by

PURE FM- TARKWA, for the BUSAC Project

September, 2012

Citation: please cite this document as,

Kusi-Ampofo, S. & Boachie-Yiadom, T. (2012) "Assessing the social and environmental impacts of illegal mining operations in River Bonsa" A research Report Commissioned by Pure Fm, Tarkwa and funded by the Business Sector Advocacy Challenge (BUSAC) fund, 40 pp.

LIST OF ABBREVIATIONS/ ACRONYMS

BUSAC	Business Sector Advocacy Challenge
CEPIL	Centre for Public Interest Law
CEIA	Centre for Environmental Impact Assessment
CNC	Centre for National Culture
DNA	Deoxyribonucleic acid
EPA	Environmental Protection Agency
GNA	Ghana News Agency
GWC	Ghana Water Company
IGF	Internally Generated Fund
MC	Minerals Commission
MTDP	Medium Term Development Plan
NDPS	National Development Planning System
PBOs	Private Business Operators
PHC	Population and Housing Census
PMMC	Precious Minerals Marketing Company
TNMA	Tarkwa-Nsuaem Municipal Assembly
UMaT	University of Mines and Technology
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation
WRC	Water Resources Commission

LIST OF FIGURES

Fig 1: showing population projections of the municipality 2010-2013	07
Fig 2: Study Area	10
Fig 3: A bird-view photograph of the highly turbid (impure) Bonsa River	13
Fig. 4: water from River Bonsa fetched for bathing	15
Fig. 5: impurities exposed after pipe-borne water settles in this tank for less than 2 weeks	18
Fig. 6: excessive dirt builds up in sediment tank at GWC, hence requiring constant dislodging	20
Fig. 7: privately owned public bath, urinal and toilet facility at Tarkwa	23
Fig. 8: showing occupational distribution of male and female for the year 2000 and their projections for the year 2010, 2011, 2012 and 2013	26
Fig 9: showing dependency ratio for the municipality	27
Fig 10: dominant ethnic groups in TNMA	29

TABLE OF CONTENT

List of Abbreviations/Acronyms	i
List of figures	ii
Table of Content	iii
Executive summary	v
Chapter 1: Introduction	01
1.1: Water	01
1.2: Background of the research	02
1.3: Scope of the Work	03
1.4: Objectives of the Research	03
Chapter 2: Literature Review and Methodology	04
2.1: Water in Retrospect	04
2.2: Profile of TNMA	05
2.2.1: Geology of Minerals	05
2.2.2: The Natural Environment	06
2.3: Demographic Characteristics	06
2.3.1: Population size and Growth	06
2.4: Structure of the Local economy	07
2.4.1: Household Income and Expenditure	08
2.5: Governance	08
2.5.1: Traditional Authority	08
2.6: Works done on effects of mining activities on TNMA	09
2.7: Methodology	10
2.7.1: study area	10
2.7.2: study plan	11
2.7.3: field methods	11

Chapter 3: Research Findings and Discussions	12
3.1: Environmental Impacts of Mining Activities in the River Bonsa	10
3.2: Social Impacts of Mining Activities in the River Bonsa	14
3.2.1: Health Implications	16
3.2.2: Economic Implications	19
3.3: comparative analysis with the Pra river	28
Chapter 4: Conclusions and Recommendations	29
4.1: Conclusions	29
4.2: Recommendations	31
List of References:	35
Appendix:	36

EXECUTIVE SUMMARY

River Bonsa which is the major source of water production in the Tarkwa Nsuaem Municipal Area is on the verge of drying up due to activities of small scale illegal miners in and closely around the river. The quantity of water to be produced by the production plant of the GWC has dropped from 1.2 million gallons of water a day to between 700,000 and 900,000 gallons of water a day, over a four year period of illegal mining activities in the river. The volume of water currently produced is obviously inadequate for a growing municipality with a population estimated to rise from 107712 in year 2000 to 159413 in 2013. As a result of this, various private businesses and industries that are highly dependent on water for their activities are in a constant threat of collapsing. People in the municipality and other users of the water produced in the municipality are also threatened with health related effects, and other social consequences.

As part of efforts to halt the activities of illegal small scale mining in the river, Pure Fm, with support from the Business Sector Advocacy Challenge (BUSAC) Fund, seeks to implement a project entitled *Promoting Socially and Environmentally Responsible Mining* which aims at creating awareness on the social and environmental impacts of the illegal small scale mining activities in the river. This is to induce stakeholders to dialogue to halt activities of illegal small scale miners operating in and around the river.

This research report presents findings of a research carried out within a 30-day period, soliciting information from key stakeholders in the municipality. The research proved that the natural course of the river has been immensely discoured due to the mining activities carried in and closely around the Bonsa River. In addition to this, the quality of the water has immensely been affected and destroyed. For example, the colour range of the raw water (i.e. the river) which used to be within 80 and 300 before the invasion of mining activities in the river about four (4)

years ago now stands at between 300 and 900; and this is nowhere close to the WHO standard for the colour range of potable water of between 0 - 15 for Apparent colour and between 0 - 5 for true colour. All the other parameters of water quality analysis at the Bonsa Intake point of the GWC have also been affected by the illegal mining activities.

Furthermore, some untold health implications were observed during the research as some respondents complained of itchy and sore throat and associated this implication to excessive application of chemicals like chlorine in the treatment of water.

The research showed that most Private Business Operators stand the risk of losing huge sums, approximately more than 200% of profit when there is water shortage in the municipality. Most of the severe water shortage conditions however, were noted to originate from activities of illegal miners in the Bonsa River.

On a national scale, Ghana loses its productive manpower and has to borrow resources from other nations to keep the wheel of its economy spinning. There is therefore the need for a collaborative effort and an integrated approach of managing our water resources.

CHAPTER 1

INTRODUCTION

Chapter one examines water, describes the background, scope and the objectives of the research.

1.1: WATER

Water is the most abundant compound on the earth's surface covering about 70% of the planet (http://en.wikipedia.org/wiki/Properties_of_water). It is also one of the most important elements that support earth life and has been in existence for over 3.5 billion years.

Clean water is good business. Clean, abundant water is economically important for residential, commercial, agricultural and industrial use. Property values, tourism, sea food harvesting and farming are dependent upon clean water. Water is a shared resource (Feurt, 2008).

Rivers among various water bodies serve as a source of water for production at the intake points of the Ghana Water Company Limited. The Bonsa River is one of such rivers in Ghana that serves as source of water at an intake point, serving the entire population in the Tarkwa-Nsuaem Municipal Area.

1.2: BACKGROUND OF THE RESEARCH

The Bonga River which serves as the major source of water treatment and distribution by the Ghana Water Company to the inhabitants of the Tarkwa-Nsuaem Municipal Area is heavily polluted by illegal mining activities resulting in increased cost of production and gradual drying up of the water body.

The treatment plant at the Tarkwa head works which was originally designed to produce 1.2 million gallons of water daily currently produces between 700,000 and 900,000 gallons of water a day mainly due to heavy pollution as result of activities of illegal miners in the river. This is obviously inadequate to serve the entire population of the municipality estimated at 159,413 and the several businesses in the area. The precarious of the situation is reiterated by a Ghana News Agency report on Monday, December 5 2011, where Mr Daniel Muomaalah, the General Manager of Ghana Urban Water limited (a subsidiary of the Ghana Water Company Limited), speaking at a press briefing at Bonga expressed worry that the raw water intake point at the Tarkwa Head works was covered with sand due to uncontrolled activities of the illegal miners. He indicated that the situation has posed a lot of technical problems for the treatment plant and cost of production. He intimated that production capacity of the treatment plant was affected as a result of this, though he cited power supply, out-dated pumps and equipment, water source and distribution network limitations as some of the challenges confronting the company from supplying water to Tarkwa regularly. This situation is therefore affecting industries, businesses, households and even threatening closure of some business.

It is in this context, that Pure FM, a private radio station operating in the Tarkwa Nsuaem Municipality, with support from Business Sector Advocacy Challenge (BUSAC) Fund is undertaking this research as part of activities under the “Promoting Socially and Environmentally Responsible Mining” project. The project aims to create a platform for stakeholders to dialogue

and find means of halting the activities of illegal small scale miners operating in and around the river.

1.3: SCOPE OF WORK

The scope of this research is as follows:

- Assessment of the effects of the pollution of the river on the quality and cost of water production.
- Assessment of the impacts of quality and quantity of water production on economic activities in the District.
- Assessment of social and environmental impacts of the illegal small-scale mining operations in the Bonsa river.
- Recommendations on strategies to be adopted to halt the activities of illegal small scale miners around the River.

1.4: OBJECTIVES OF THE RESEARCH

The objectives of the research are to:

- Assess the impact of illegal small-scale mining in the Bonsa river on water treatment and production
- Assess the impact of illegal small scale mining in the Bonsa river on the environment
- Ascertain the socio-economic impact of the polluted Bonsa River on the populace

CHAPTER 2

LITERATURE REVIEW AND METHODOLOGY

This chapter reviews water with its importance and reveals a brief relevant profile (including Demography, the local economy, governance structure and the geology) of the Tarkwa-Nsuaem Municipal Area and the methodology deployed in the research.

2.1: WATER IN RETROSPECT

Water is the most abundant compound on earth's surface covering about 70% of the planet (http://en.wikipedia.org/wiki/Properties_of_water). It is also one of the most important elements that support earth life which has been in existence for over 3.5 billion years as reported by an article in the Thursday, April 12, 2012 edition of the Daily Graphic. This article continues to report that contaminated water in our body carries along contaminants in a form of pathogenic microbes or chemicals which attack our body cells and sometimes interfere with codes of DNA in our genes, creating mutations. Many of the times, the body fights back but most of the time, we fall sick and become economically unproductive, putting economic burden on others as a result.

On a national scale, the article explains that the country loses its productive manpower and has to borrow resources from other nations to keep the wheel of its economy spinning.

“Too many people are needlessly being incapacitated and are dying of diseases that are supposed to be in extinction, considering the level of advancement of man and medicine” (Oti, 2012).

It has become usual of late to see people resorting to the use of bottled water and sachet water. For those who cannot afford these, they resort to the use of well water. If the rich men in the society and those who can afford bottled and sachet water have the perception that they are exempted from the effects of impure water, then they should definitely change their mind-sets and join in the fight against water pollution. This is because, as quoted by Oti (2012), chemicals used to make bottles and plastics under certain environmental conditions leach back into the contained water. Resorting to well water however, cannot be guaranteed total safety, especially in mining areas. Oti further explains that well water is prone to heavy metal contamination; and that in Ghana, many wells in mining areas have been found to contain Arsenic, a very toxic heavy metal that causes cancer. Pathogen contaminated water when ingested causes diseases like typhoid, cholera, dysentery and Salmonellosis, which has incredibly been responsible for uncountable number of deaths in all over the sub Saharan-Africa.

2.2: PROFILE OF TNMA

2.2.1: Geology and Minerals:

The geological formations in the Municipality are mostly the Birimian and Tarkwain rocks. Economically, the Birimian rocks are regarded as the most important formations due to its mineral potentials.

Due to the geological formation of the Municipality, there is the existence of mineral components. These minerals include Gold and Manganese. For this reason, many mining activities have sprung up in the Municipality creating employment for several people and reducing the economic hardships of the people in the Municipality.

On the other hand, the increasing number of mining companies and small scale miners (galamsey) in the Municipality are gradually degrading the forest and water bodies through their

activities which pose threats on the environment. Materials like iodine in the area pollute the underground water (draft MTDP-2010-2013).

2.2.2: The Natural Environment

The natural environment was serene some years back but now the situation is different. The activities of the mining companies in the Municipality pose a lot of threat to the natural environment. The activities of both the mining companies and illegal miners degrade the natural environment and destroy the ecosystem especially the open cast method being used now has had a devastating effect on the environment. Through this method, hills are graded down, vegetative covers of the soils are stripped and deep excavations are made out by taking the mineral laden soils. Inadequate toilet facilities in many settlements results in people defecating in nearby bushes polluting the air and other water bodies as well.

2.3: DEMOGRAPHIC CHARACTERISTICS

2.3.1: Population Size and Growth

The Tarkwa-Nsuaem Municipal Assembly had a population of 107712 according to the 2000 Population and Housing Census. The Female-male percentage remains at 49.2% - 50.8%. Using the exponential formula at a growth rate of 3.0, the population of the municipal is expected to increase to 145410 in 10years time and further 159413 in 13years. It was projected then that in a period of 10 to 13years (i.e. 2010-2013), the various communities would increase their numbers to over 45%. The population projections for the plan period 2010 – 2013 is shown in Fig. 1

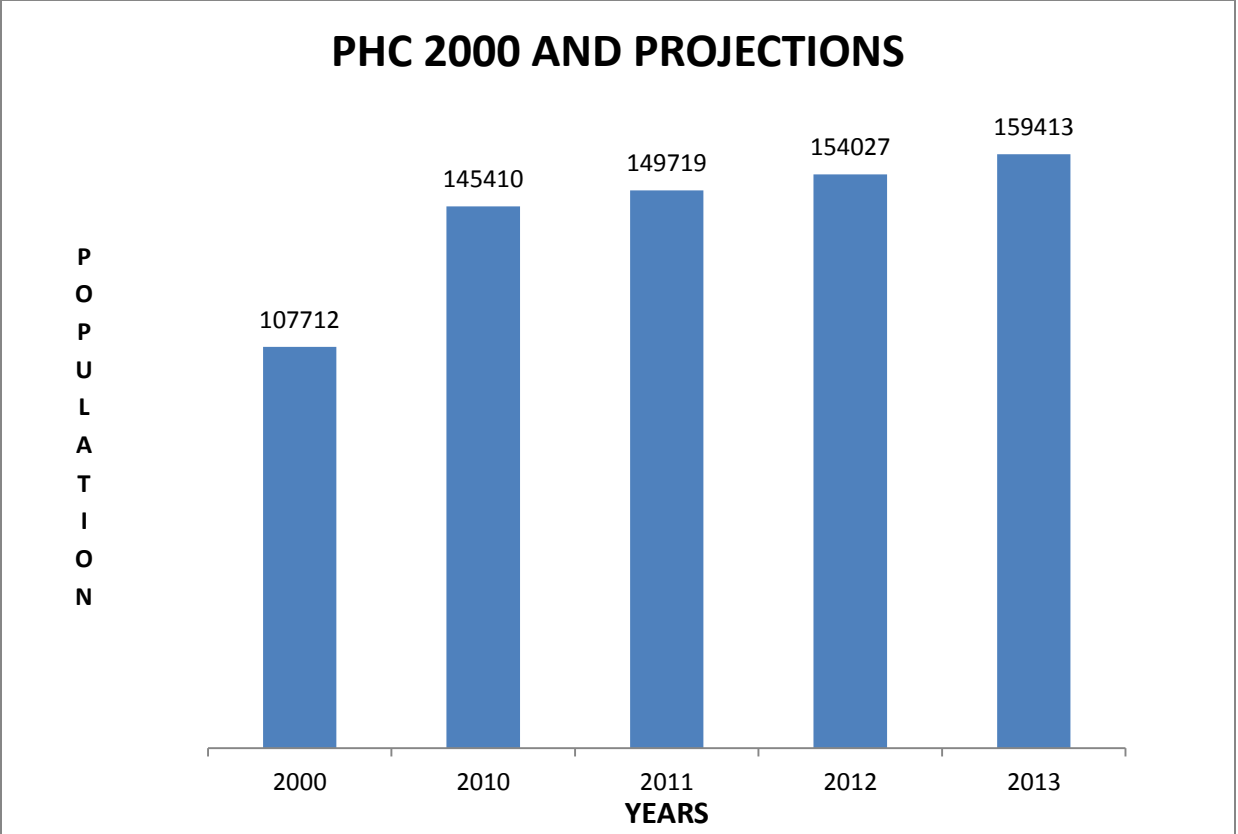


Fig.1: showing population projections of the municipality 2010-2013

2.4: STRUCTURE OF THE LOCAL ECONOMY

The economy of the Municipality is made up of mainly Agriculture production. About 68% of the entire active population is engaged in Agricultural production whilst the remaining 32% find themselves in the area of commerce, private informal sector and hospitality industries.

The private informal sector is one emerging sector that is pulling most number of the population recently. The emerging private informal sector underlines the need to create an enabling environment to maximize its contribution to economic activity in the Municipality.

The structure of the local economy is also made up of about 43% children under the age 18 and the age of 64 and above. These people are considered as the dependant class whilst the rest of

the percentage of 57% forms the working class or the active labour force. The working class of the economy can further be classified as comprising 65% males and 45% females.

2.4.1: Household Income and Expenditure

The Municipality can boast of an average household income of GH¢6899.33 per annum whilst the average household expenditure stood at GH¢5670.67 per annum for the year 2009. Average savings stands at approximately 18% per annum all in 2009.

2.5: GOVERNANCE

Tarkwa-Nsuaem Municipal Area was carved out of the then Wassa West District which was established by legislative instrument 1385 as one of the then 110 Assemblies country wide prescribed by the 1992 constitution and the Local Government Law 1991 Act 462. It is the highest political authority in the municipality vested with the powers to deliberate, legislate, plan and develop the entire municipality through the preparation and effective implementation of development plans and budget. Act 480 for 1994, the National Development Planning System, entreats the Municipal Area to formulate programme strategies and projects and see to their implementation, monitoring and evaluation using available resources. The Assembly can be compared to parliament as a legislative body making bye-laws for the municipality.

2.5.1: Traditional Authority

The municipality is within the paramouncy of the Wassa Fiase Traditional Council. There are regular consultation and cordial relations between the Municipal Assembly and the traditional authorities. The appointment of the one-third representative at the Assemblies is also done in consultation with the traditional authority and other stakeholders.

2.6: WORKS DONE ON EFFECTS OF MINING ACTIVITIES IN THE TNMA

- In 2011, the Centre for Environmental Impact Analysis (CEIA) published a research report on the 'Human Health Risk Assessment and Epidemiological Studies from Exposure to Toxic Chemicals in Tarkwa-Nsuaem Municipality, Prestea Huni Valley District and Cape Coast Metropolis, Ghana'. Their research found out that from oral ingestion and dermal contact of water and soil/sediments samples as well as oral ingestion of cassava contaminated with the elevated levels of toxic chemicals such as arsenic, cadmium, cobalt, copper, lead, manganese, mercury and zinc in whole blood and blood serum of residents in the TNMA and PHVD as compared to residents in the CCMA. They further stated that the elevated levels of arsenic, mercury, cadmium, copper, lead, cobalt, and zinc in blood samples of residents in the CCMA are attributable to ingestion of high amounts of sea foods as most of the polluted water bodies in the TNMA and PHVD flow directly into the sea. Their research again drew an inference that the cancer health risk faced by resident adults in Huniso by oral ingestion of water from river Huniso. By this, they implied that approximately 1 and 7 cases of cancer are likely to suffer from cancer related cases by both CTE and RME parameters.
- In 2005, Asklund & Eldvall published a research report on the contamination of water resources in Tarkwa mining area of Ghana, as a minor field study for their Master of Science Thesis at Royal Institute of Technology. They explained that Although their study generally showed quite good drinking water quality, contamination of groundwater from mining activities have been stated at some locations and further contamination is possible.

2.7: METHODOLOGY

2.7.1: Study Area

The Tarkwa portion of the figure below (Fig. 2) forms part of the study area.

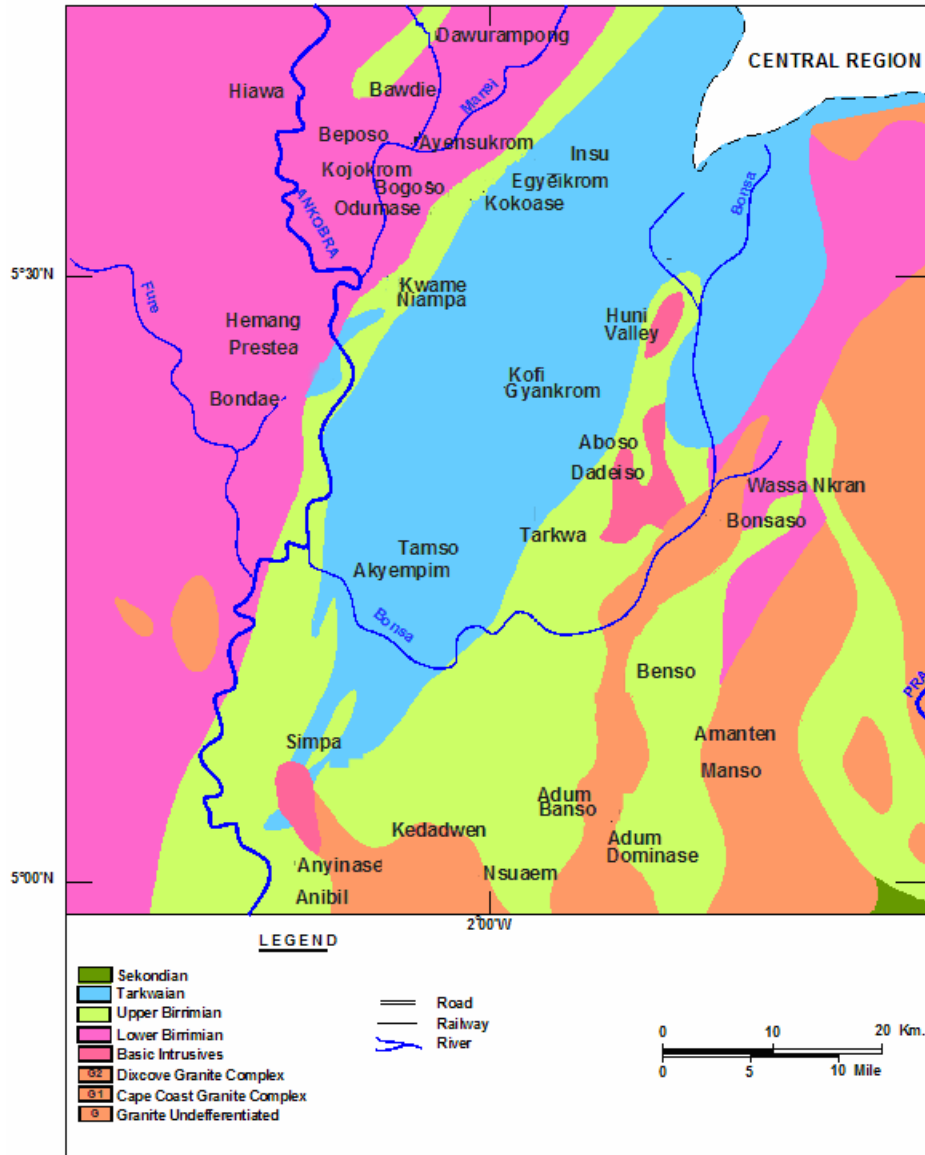


Fig 2: Geological map of the Tarkwa-Prestea area (modified from Kortatsi 2004)

(Source: Asklund & Edvall, 2005)

2.7.2: Study Plan

The research was designed and categorized mainly into two:

1. Ascertaining the socio-economic impacts of the polluted Bonsa River on the populace.
2. Studying the trend of water quality before and after the intrusion of the illegal mining activities within the municipality

2.7.3: Field Methods

In ascertaining the socio-economic impacts of the polluted Bonsa River, questionnaires were administered to various socio-economic groups and stakeholders to solicit their knowledge and concerns on the chosen matter. The stakeholders included GWCL, MC, EPA, TNMA, Student Groups, Private Business Operators-PBOs, WRC, as well as individual users (consumers). The PBOs included Hoteliers, Sachet water producers, Schools, restaurants and chop-bar operators. Attempts were made to solicit information from mining companies like Gold Fields Ghana Ltd, Tarkwa Mines as well as Ghana Manganese Company-Tarkwa. Unfortunately, the bureaucratic procedures involved extended beyond the consultancy period, making it impossible to get their perspectives on the matter.

The second aspect dealt with examining existing data and comparing values to expose the trend of the water quality before and after the illegal mining activities in the river. A similar challenge was encountered here too, with getting such relevant information from the regional office of the GWCL. However, a similar situation of illegal mining activities is recorded in the Pra River, also in the same Western Region. Hence a comparative analysis was done in the absence of specific information about the Bonsa River.

In all, about 700 people were interacted with during the research process.

CHAPTER 3

RESEARCH FINDINGS AND DISCUSSIONS

Chapter three provides findings of the research. Various stakeholders' perspectives of the problem are also captured in this chapter. The findings are grouped under two main thematic areas; **environmental** and **social**. Under the social effects, impacts related to **health** as well as **economy** are discussed.

3.1: ENVIRONMENTAL IMPACTS OF ILLEGAL MINING ACTIVITIES IN RIVER BONSA

According to some stakeholders, the natural course of the river has been immensely discouraged due to the mining activities carried on and around the river. For instance, some final year students of the University of Mines and Technology (UMaT) stressed “the way we saw the surroundings of the river when we were in first year, was far better than now- the beauty of it has been damaged”.

Some stakeholders attributed this to the way illegal mining activities are done – “the soil is heavily scooped and processed for the gold, after which the debris is left anyhow in and around the river”, explained a key informant from the Ghana Water Company, Bonsa intake points.

All the stakeholder groups involved in discussions pointed accusing fingers at the illegal mining activities as being the sole contributor to the increasing impurity of the river. It was also observed that the colour of the river is thick brown, which was explained by the respondents as not being so in time past. Some of the inhabitants around the river claimed that some years

before the illegal mining activities in the river, some farmers used to drink the riverine water directly without it being treated, because of the clear colour the water portrayed.

According to sources from the Ghana Water Company (i.e. Bonsa intake point), the initial colour range of the raw water (i.e. the river) was between **80 and 300** before the invasion of mining activities in the river about four (4) years ago (2008). Currently (i.e. four years of mining in the river-2012), the colour range has shot up to between **300 and 900**. Meanwhile, the WHO standard for the colour range of potable water indicates that of Apparent colour to be between **0 and 15** while that of True colour (i.e. when filtered) to be between **0 and 5**. In attaining the WHO standards, the specialists at the Water Company would have to treat the raw water (the river) in order to reduce the colour to the required range of between 0 and 5. Hence the quantity of chemicals that were initially used to reduce the colour range from between 80 and 300, to between 0 and 5, has to be increased and more efforts need to be employed to reduce the current range of between 300 and 900.



Fig. 3: a bird-view photograph of the highly turbid (impure) Bonsa River just before entering the sump of the treatment plant at the Ghana Water Company-Bonsa intake point

The river Bonsa, like many other rivers, serves as a habitat for most aquatic organisms such as fish, and amphibians such as frogs. Some fish species such as the Bighead Carp, *Hypophthalmichthys nobilis* are filter feeders that live in rivers (i.e. they are capable of filtering riverine water through their gills). Therefore, there is the probability that increasing impurity levels of the river may cause a blockage of their feeding tracts or filters and eventually cause their deaths. Implications are that, if there are filter feeder fish species in the Bonsa River, there is the possibility of future decline of the species, depriving some people of their source of employment and food. Although no literature is known to have established the presence of such species in the Bonsa River, other similar species which may be found in the river are likely to go extinct in a matter of time.

Additionally, increasing impurity implies increased turbidity as well as causing a drop in pH levels of the River. And 'a drop in pH controls many aquatic reactions such as dissolution of metal oxides as indicated by Boachie-Yiadom (2010). There is therefore the implication of the oxides of some metal elements which may find their way into the water, dissolving as a result of constant drop in pH of the raw water provided by the river.

Every river, apart from providing habitat for wildlife and water for consumption, also provides water for crops and farm animals. The River Bonsa is no exception as most of the farmlands in the Bonsa community and some other communities are near the river which nourishes the farmlands through the soils. These crops and farm animals may be affected as a result of the quality of water disturbed as well as chemicals diffused into the soil and surrounding water where they obtain their nutrients. For instance, Mr Asante a sachet water (Topline) producer explained that for the past two years, Cocoyam which used to be abundant in the municipality are no more since the chemicals in the polluted water kills the tuber crops. However, it must be noted that the small-scale illegal mining operators are vindicated from the use of chemicals when in the river, but use them later on during their processing.

3.2: SOCIAL IMPACTS OF ILLEGAL MINING ACTIVITIES IN RIVER BONSA

Fig. 4: water from River Bonsa fetched for bathing



Several communities in the municipality benefit from the river after it has been treated by the GWCL for various activities such as for all household chores, industrial purposes (including mining companies), by the hospitality industries, health sectors, schools, and by food vendors in preparing their foods.

Although community members have desisted from activities like drinking directly from the River, some activities are still on-going by some of the people living around the river. For instance, the man in the above picture fetched water from the river directly for bathing at Bonsa community; and just some few minutes after fetching the water, he used it to bath without treating the water in any form. When asked of known consequences, he claimed of none, only that at times, he experienced itching on his skin which he thought couldn't be attributable to the river since they have been using it for such purpose for years without any known consequences. As if this wasn't enough, some children swam with joy and skills at the time of the research. Swimming in the river for leisure was not left for only the children as some older people were also spotted from afar off, enjoying it too.

A very important indirect social effect is the increasing number of occurrence of teenage pregnancy in the municipality. Though there were no records indicating the rise in occurrence of teenage pregnancy in the municipality, some respondents reacted that the illegal miners lure the young girls with money in order to have sex with them, and the worst form of the situation as described by a respondent is that most of these illegal miners are from Volta Region, hence can decide to run away at any time leaving the girls and their babies in the municipality. “Some of the children you see loitering about don’t know their fathers and yet their fathers were illegal miners who are currently nowhere to be found”, reiterated one female respondent.

3.2.1: Health Implications

A sound mind dwells in a healthy body, so goes the saying. Most of the activities involved in the mining operations, if unchecked, come with associated diseases. This was a statement that most respondents expressed in the course of the research. And they further echoed that if people are not healthy, there is no way they can go on with their daily activities to earn a living. It was interesting to hear most of the respondents voicing out that they believed the mercury used in the operations of the illegal miners could contribute to their health threats if there are no proper checks

Although it was confirmed by the Minerals Commission that the miners don’t use the mercury when on the river, in a study conducted by the Centre for Environmental Impact Analysis (CEIA), Obiri et al., (2011) cited Obiri, 2005 and Essumang et al., 2007 as pointing out that in Ghana, the presence of mercury in the environment may be attributed to the use of mercury in gold recovery process where the inorganic form of the metal is either washed into rivers or is vaporized readily into the atmosphere. Meanwhile chemicals in the river can be harmful to the skin and the entire human body as well. Mercury affects the renal system, nervous system, gastrointestinal tract and the respiratory system (Obiri et al., 2011). They further state that in

1952, mercury was responsible for the death of 52 people in Japan as a result of fish contamination.

In a research report by Asklund & Eldvall (2005), they quoted Hilson (2001) explaining that, estimated 5 tonnes mercury is released from small-scale mining operations in Ghana each year. They continued that high concentrations of mercury have been found in sediments and fish in the vicinity of small-scale mining activities using amalgamation as their main technique; and also explained that the **concentration in most fish fillets in these areas exceeds the recommendations of the United States Food and Drug Agency (Babut et al. 2003).**

It therefore poses a huge threat to residents in the municipality as well as visitors who may consume any food prepared with 'mercury-infected' water or fish.

As a matter of fact and probably a basis of panic, the analysis involved in the treatment processes at the GWCL (Bonsa Intake Point) does not involve Mercury (Hg) analysis. Their analyses include but not limited to the following:

- | | |
|-------------|-----------------|
| -pH | -Colour |
| -Turbidity | -Total hardness |
| -Alkalinity | -Chloride |

As a result, presence of mercury in the treated water may not be known before it gets to the consumer. In the study, Obiri et al., (2011) cited USEPA (2001) which explains Methyl Mercury (meHg), one chemical form of mercury, as being able to cross biological membranes more easily and able to enter the brain, the spinal cord, peripheral nerves and the placenta. By this, USEPA, 2001 explains that foetus in the uterus may show symptoms of cerebral palsy through mercury intoxication, even though the mother may not show symptoms of mercury poisoning.

“*The Ghanaian Times*” on Thursday June 21, 2012 reported on increase in reported cases of kidney diseases, and stated that according to Dr. Amoako Atta (head of Renal Unit of the KATH), activities of illegal miners who use mercury was a contributory factor to kidney diseases.

A discussion with some students revealed that direct consumption of pipe borne water irritate the throat and eventually lead to sore throat. Their assumption was that it may be from the excessive application of certain chemicals like Alum, Chlorine, etc. in the treatment of the water. They were therefore compelled to also assume that swimming and bathing directly in the river or with the riverine water may be dangerous to the human skin should the river be contaminated with mercury. This notion cannot be downplayed since in his article, Oti (2012) pointed out that too much chlorine in water may be dangerous to our health.

For household chores, most of the households visited do not treat the water in any form, so long as the water is from GWCL. To keep their household chores effective in spite of the numerous water shortages in the municipality, most people have containers to store water.



Fig. 5: impurities exposed after pipe-borne water settles in this tank for less than 2 weeks

For the large containers which stored water for a longer period, the impurities observed were overwhelming. However, most of the respondents explained that before the intrusion of the mining activities, the impurities that were observed in such instances were comparatively very low. Hence they admitted they could not blame the GWCL for this unfortunate incidence, but rather pointed accusing fingers to the illegal mining activities.

From the picture above, the obvious scenario may be true; “Ingesting the volume of water in the tank (fig 4) means ingesting the associated impurities seen in the tank as well”.

3.2.2: Economic Implications

Although most water shortages in the district are mainly attributed to pipe burst and power failure, the illegal mining activities have also affected the water production in so many forms. For instance, the sump (where the raw water intake occurs) was noted to have been covered by silt somewhere late 2011. As a result, the sump was almost totally blocked, leaving a small path for raw water intake. This was solely attributed to the activities of the illegal miners by respondents, as they explained the miners leave the silt back into the river after they have extracted their ore.

To clear the sump’s pathway by removing the silt, the pump had to be stopped for people to descend into the river to clear the path for the sump to draw the raw water into the plant for treatment. However, as explained by a source from the Water Company, such frequent starting and stopping of the pump is actually not good for the pump, so gradually, if the blockage of the sump and removal of silt continues unattended to, the pump may be affected negatively, and this will also immensely affect its production capacity.

Again, if the dirt keeps building in the sedimentation tank without being dislodged, the sludge (mud) will mix with the settled water thereby destroying the quality of the water. With the interference of the illegal mining activities, the river has however increased in turbidity (pollution), and hence needs constant dislodging. Unfortunately, constant dislodging in itself



comes with its cost implications since the process involves throwing away of treated water (and the treatment of the water use a lot of expensive chemicals like alum and chlorine)

Fig. 6: excessive dirt builds up in sediment tank at GWCL, hence requiring constant dislodging

Moreover, addition of alum to the water makes the water slightly acidic (i.e. increasing quantity of alum increases the acidity of the water). Hence the water would need to be neutralized. Calcium hydroxide (CaOH) is therefore employed to neutralize the acidity of the water; and the obvious implication is that more CaOH will be used when more of the Alum is used. Apart from the fact that the excess of these chemicals can cause health hazards, it also increases the cost involved in the water production.

One other issue is the drying up of the river. It was noted that, the river has a lot of silt which became well exposed and seen to be even more than the water (usually at the sump end of the production plant). This situation (which was mostly observed in the afternoons) poses a greater challenge to the treatment of the water - during the water treatment process, alum is added to the water to settle and separate the dirt from the water. But sometimes, the dirt is so much that the separation and settling may not be properly done in time. In such cases, the filter (used to sieve the water) gets choked after filtering more of the dirt. And as a result, the water is backwashed to prevent a situation whereby the expected quantity of water to be produced will not be attained. (Backwashing is the process of reversing the water flow and the velocity of the water as it passes through a filter). These filters are used for collecting and gathering particles from incoming water flow. After the filter becomes worn and needs replacement, it is best to clean it through backwashing. Backwashing requires water to be blasted through the filter in order to loosen the clogged particles (en.wikipedia.org, <http://yourwaterneeds.com>). The unfortunate consequence is that in the course of backwashing, a lot of the treated water is thrown away regardless of the quantity and cost of chemicals used in the treatment. Apart from the cost incurred from wasting the chemicals, there is also loss incurred in the form of cost of electricity in the production process.

It is therefore obvious here that the illegal mining activities waste not only water resources but electricity as well, leading to financial loss to the state (GWCL), as well as individual private businesses. Some of these private businesses have ceased their dependency on the treated water from GWCL for fear of collapsing. Mr Asante Yentumi, the director of Topline (a sachet water producer) stated emphatically that, during the time they depended on the water from the GWCL, they spent relatively less. Like all the other PBOs, he couldn't quote exact figures to buttress the point. However, he recalled that changing from the dependency on water from the GWCL to dependency on drilled bore-hole cost him not less than GH ₵10, 000. Though costly,

he elaborated that in the long run, his business would boom, since filtration of the bore-hole water has proven to be more efficient than that from the GWCL. Adding to this, he explained that water shortages as well as increased impurity in the water used to disrupt his business more often, since their filtration process was being affected by the impurity as well as the shortages.

Christian Lodge Motel, one other Private Business entity which in times past was dwelling partially on GWCL for water, has now moved entirely to their own source of water other than that produced by the GWCL. This action was necessitated by inadequacies in the supply of water. Responding to questions posed, a respondent from the Motel indicated that if they were still depending solely on the water supply by the GWCL, they might have lost a lot of their customers.

Additionally, some respondents explained that at times water shortages take as long as two to three weeks. For some respondents from Cyanide, a suburb of Tarkwa, water shortages could last more than a month, only to be supplied about three days – all at dawn. And when this happens, things can become so worse to the extent that, people resort to the use of sachet water in all their household chores including bathing - “this is common amongst us students”, some students expressed.

Comparing the cost involved in using treated water by the Ghana Water Company and other sources like sachet water producers and privately owned water suppliers; that which is obtained from the Water Company is relatively cheaper. For instance it would take about 30 sachets of water to fill just one small-sized bucket. 30 sachets at GH¢ 0.10p is equivalent to GH¢ 3.00. A bucket of water when used in bathing may only be sufficient for two males if judiciously used. In the case of most females, one bucket of water may only be sufficient for only one user.

GH¢ 3.0 for 30 days would amount to GH¢ 9.00 for the entire month per person. For about six people in a household, this would amount to GH¢ 54.00, while water bill for a household of about six people may be GH¢ 6.00. In the absence of water from GWCL, a household of about six may therefore spend 900% more than it would on bathing alone within one month. Obviously, industrial and other private business operators who depend mainly on water have more than this to lose.

For private business operators who depend mainly on water, it becomes a headache when shortages take a longer period like two weeks. For instance, the operator of this **bath, urinal and toilet facility** depends totally on water from GWCL. She makes a daily sale of GH¢ 80.00, and at the end of the month, pays water bill of about GH¢ 40.00. Without water shortages, she is able to make not less than GH¢ 200.00 as profit, taking out other miscellaneous expenses.

She recalled a period in which there was water shortage for about two weeks, dating back to the same period during which silt covered the sump at the Bansa intake point. At this point, she described her business as nearly collapsing. Within these two weeks of continuous water shortage, she is likely to lose 214.3% of her profit.



Fig. 7: privately owned public bath, urinal and toilet facility at Tarkwa

To show the extent of her dependence on water, there have been two different attempts by her to dig a well; one using locally dug method, and the other using machines to dig. All these attempts proved futile since according to experts, the water level at the area is so low as a result of previous industrial activities that took place at that end of the municipality.

Two different hoteliers (who preferred to remain anonymous) narrated the ordeal they go through when there is water shortage. Though they have made alternative sources available in their hotels, they maintained that the flow of water from the GWCL is very crucial to the success of their business.

One of them who could only quote rough figures explained that their outfit lost 10 customers who had checked in some time ago due to the absence of water flowing through their taps and the fact that they had to depend on fetched water. He explained further that the room charge which ranges between GH¢ 50 and GH¢ 75 would have earned between GH¢ 500 and GH¢ 750 per night. To make things worse, he learnt later on that their customers spent two weeks (14 days) in the district, and this would have earned the hotel between GH¢ 7000 and GH¢ 10,500.

Narrating on the same line as the above, the other hotelier added that even their customers who patronise their rooms, refuse to patronise their food when they discover that their source of cooking water is not from the GWCL.

For some chop bar operators, “water shortage is a big blow”. In the absence of water, they would have to walk relatively longer distances in order to fetch water for their operations which include cooking and washing of utensils. For the chop bar operators, one woman explained that for business to be successful during water shortages, some extra hands need to be employed to be fetching water on regular basis. As if that is not enough, they spend much more on the water

to the extent that, they would have to reduce the quantity of food meant for the appropriate price. As a result of this, the woman explained that she has lost most of her customers. She was however quick to add that hers was better as she knows a friend who has closed down her bar because of losses incurred in trying to please her customers. A customer interviewed at another chop bar joint speculated that some of the chop bars have been using dirty water to wash utensils and even sometimes reuse the water that have been used to cook another food as a result of frequent water shortages. This situation can lead to increased prone of customers to diseases, and can cause drastic reduction in customers, explained another chop bar operator who confirmed that she knows about the speculation.

Some sachet water producers who depend mostly on the water produced by the GWCL for their operations lose quite a lot of money and as a result are forced to resort to the drilling of bore holes which according to some, are quite expensive though a good option. Butchers cannot be left out in this case as some butchers explained that though inadequate water supply leaves them no option than to work with the available small volumes of water; which may cause health hazards to consumers, when the media hype the unhealthy environment in which they operate, they stand the risk of losing most of their customers. They reiterated that this may cause some of them to either lose their jobs or reduce profit.

One of the fears of environmental impacts of the mining activities in the river is the drying up of the river, which would in effect render many people jobless and kill their sources of livelihood. From the occupational distribution table of the TNMA's MTDP, it was observed that as at the year 2000, **42,917** people in the municipality were involved in Agriculture, Animal Husbandry, and Fisheries activities, and all of them rely on the river in one way or the other; and also other indirect beneficiary activities like Hunting. It is projected that by 2013, this figure will shoot up to **63,517**. These figures represent 22% of the total occupational distribution as shown in the figure below.

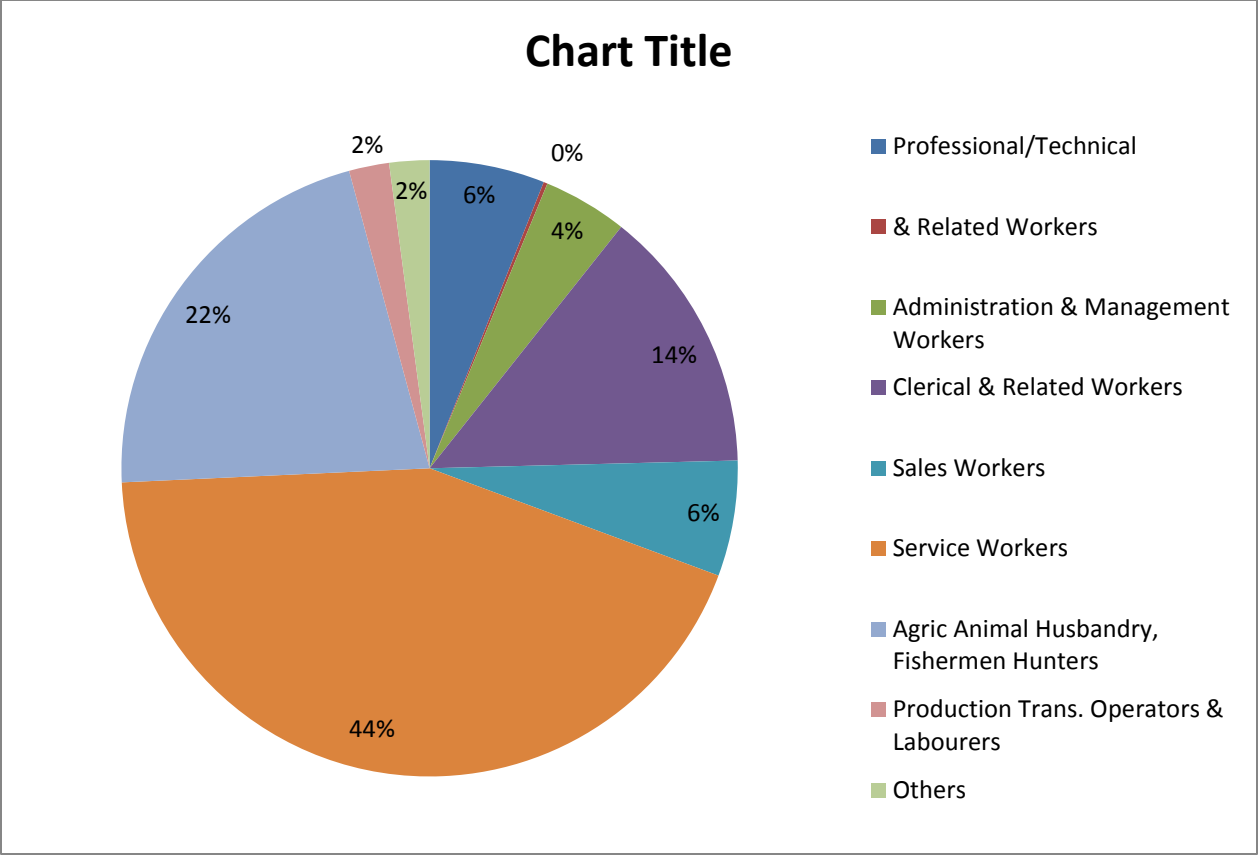


Fig. 8: showing occupational distribution of male and female for the year 2000 and their projection for the year 2010, 2011, 2012 and 2013

Now, should the river dry up, there is the danger of crops and farm animals dying. Inference is that, those in fishing, farming, animal rearing business as well as hunters would be deprived of their livelihood source. Not only might the 22% shown in fig. 6 be affected, but their families who are dependent on them too. In the municipality, the MTDP proves that the number of people in the dependency class is more than that of the independent class. Therefore, when the independent group who support the dependent group of the population lose their source of funds and cannot fend for them any longer, there might be chaos in the municipality since most of them may have to resort to various social vices (such as prostitution, armed robbery, thievery, etc.) in order to make ends meet as most of the people in the dependent group are within the

age range of 0-14 as shown in figure below, and cannot do any major work to support their livelihood.

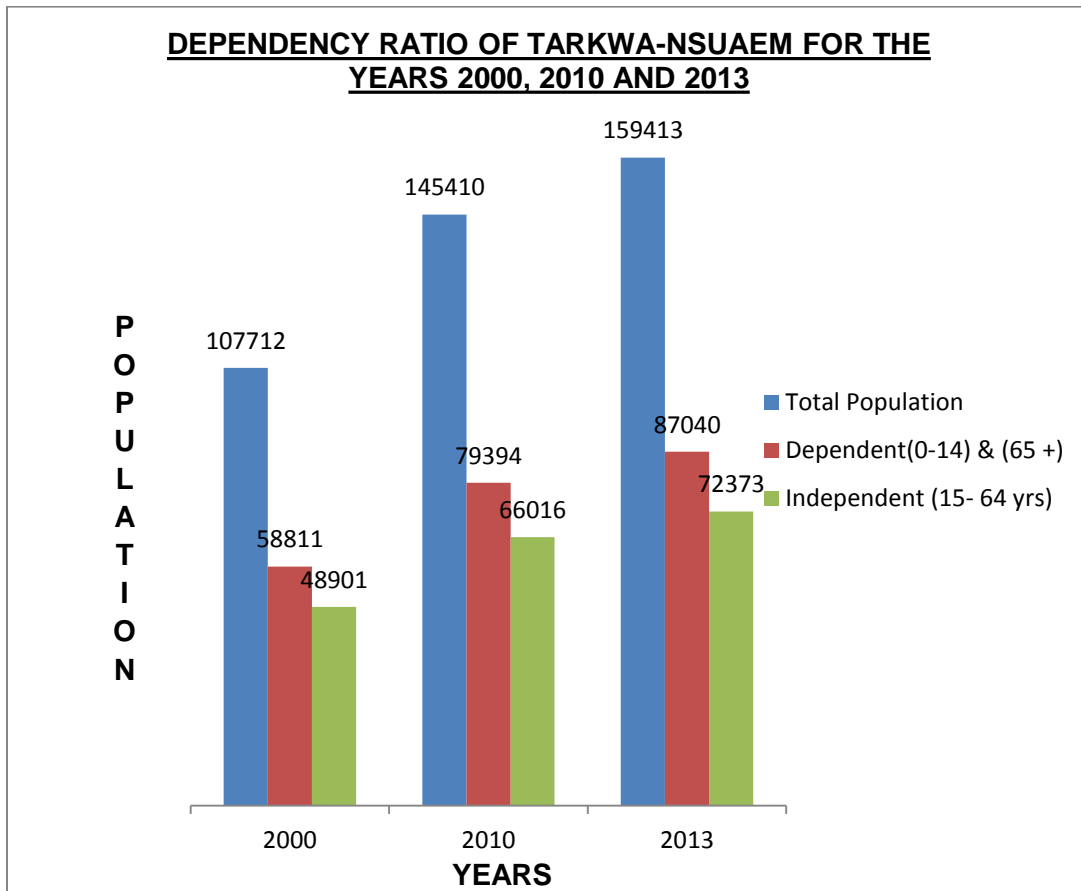


Fig 9: showing dependency ratio for the municipality

As a result, most of them might be pushed into child labour, reducing the literacy level of the municipality and eventually jeopardising the future of the municipality. Already, there are incidences of children being used in the illegal mining operations. “The issue of child labour in the illegal mining industry (galamsey) is adversely affecting the education of children in communities where galamsey has taken firm root” (TNMA MTDP, 2010-2013)

3.3: Comparative Analysis with the Pra River

The Pra River which is in the same Western Region has since 2009 experienced a similar situation of illegal mining activities affecting the river, with conditions noted to be closely similar to that of the Bonsa River.

The Pra River is the source of raw water for GWCL headworks at Daboase in the Western Region. It began to deteriorate extensively in terms of colour and turbidity in January 2009. The increase in color range over a ten-year period is 1700%, that is (50HU in January 2002 to 850HU in January 2012). Again, the turbidity rose from 16.3 NTU in 2002 to 594.3 NTU in 2012, a 3646 % increment over the ten-year period.

Alum consumption increased from 61.76 mg/l dosage in 2005 to 107.80 mg/l dosage in 2012, implying a corresponding 33.35 to 58.21 daily quantity/ bags. Cost wise, there was a huge jump from GH ¢ 426,046 in 2005 to GH ¢ 743,633 in 2012, indicating a 75% increase.

Assuming same period duration of analysis of the Pra River, inference can be drawn that the Bonsa River may record worse values and situations since its effects started approximately a year before that of the Pra River. It is therefore not shocking to find out that activities of illegal miners cost GWCL GH ¢ 100,000 every month for water treatment in Tarkwa (GNA, published by New Times Corporation on Thursday September 20, 2012). In a period of one year, if conditions do not escalate and remain as they are now; the GWCL will then spend not less than GH ¢ 1,200,000. However, the GNA in the above newspaper report indicated that the amount (GH ¢ 100,000 per month) keeps on escalating monthly as the illegal miners continue to mine in the Bonsa River.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATION

4.1: Conclusions

It was found out that the effects of illegal mining activities in the Bonsa River pose the following threats to the municipality and its business stakeholders

- Deterioration of quality of raw water, which has health implications
 - Reduction in availability of raw water for treatment
 - Deprivation of source of water for some communities
 - Destruction of fauna and flora
 - High cost of water treatment
 - High cost of maintenance of equipment for water production
- Additionally, It was noted that most of the individuals involved in this illegal practice are part of the 57% group (fig. 10 below), who are not indigenes, (mostly Ewes, according to all the respondents)

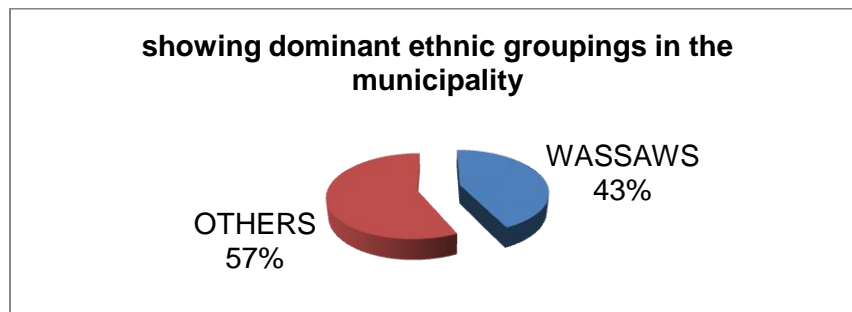


Fig. 10: dominant ethnic groups in TNMA

- Although the illegal mining activities provide source of food for some people in the municipality, it is causing more havoc than good since most people have their businesses and other sources of income heavily affected by the pollution of the Bonsa River. It is no wonder the actual receipts from the IGF of the municipality dropped from **GH¢ 1,845,257.55** (in 2008 – when illegal mining had just started in the river) to **GH¢1,664,831.16** (in 2009).
- Furthermore, the community members in the municipality have started experiencing the impacts and are unhappy about the current situation of the river and the state of water production in the municipality.
- Some of the community members are of the view that the illegal operators pay huge sums of money to the chiefs and elders of mining communities who then grant them access, which the community members are not in favour of.
- A lot of small scale miners have applied for legalisation but the Minerals commission have not been able to mandate them yet, and this discourages the miners to go through the right procedures since the first step (which is applying for legalisation) is not even attended to by the appropriate authorities

4.2: Recommendations

- It is advised that community concerns (which in this case is illegal mining activities within and around the Bonsa Rover should be stopped with immediate effect) be used as the basis for building campaigns at the local and national levels (Owusu-Koranteng et al., 2009)

The following are thereby recommended but not limited to the following stakeholder groups

TNMA

- There is the need for the Municipality to collaborate with relevant stakeholders in consultation with the communities within the municipality, to enact and enforce by-laws to deal with illegal mining activities since it poses threat to the municipality. (Note that the Assembly can be compared to parliament as a legislative body, making bye-laws for the municipality; and more so, Act 480 for 1994, the National Development Planning System (NDPS), entreats the Municipal Assembly to formulate programme strategies and projects and see to their implementation, monitoring and evaluation using available resources.
- The Assembly in collaboration with the Centre for National Culture (CNC) as well as National Commission for Civic Education (NCCE) must undertake sensitization programmes to brief the people on the effect of 'galamsey' on the future of the children in the municipality.
- The development of the small scale mining operations should be incorporated into their subsequent medium term development plans.

Minerals Commission

- In the legalisation of small scale miners, the Minerals commission's mandate to do so should be decentralised rather than waiting for so long a time to be mandated from 'headquarters – Accra'.
- During 'The Earth Summit +5' in 1997, a maintenance-free, small glass-retort (ThermEx) developed specifically for artisanal gold miners, was presented (picture at Appendix 2). This glass retort has been highly subsidised in Ghana and accepted by many small scale miners, since it prevents mercury vapour into the environment when the gold containing alloy is heated. The unfortunate thing is that when the evaporator vessel (1 in the Appendix 2) which is glass in nature breaks, a totally new one would have to be purchased. It is therefore recommended for the Minerals Commission in collaboration with the UMaT to research into possible glass-like vessels that can be used as alternative should the original be broken (since an alternative metallic one has not been welcomed by artisanal miners)
- The Minerals Commission is advised to expedite actions in undertaking geological surveys in identifying land banks, since this will help reduce the rampancy of illegal mining
- The Minerals commission should be empowered to issue more small scale mining licenses.

Ghana Water Company

- Co-operate entities such as the mining companies should be encouraged to adopt payment of ecosystem services to ensure the protection and conservation of sensitive ecological systems such as the Bonsa River so as to ensure the regular supply of water for their operations.
- The GWCL should receive capital injection to procure efficient equipment to ensure cost-effective and efficient water production and distribution
- Communities in the municipality need to be encouraged (through education by the GWCL) to cultivate the habit of rain water harvesting, to make up for the inadequate water provision. In addition, readily available local methods of treating water in the home, such as boiling, must be encouraged in the municipality since boiling the water for a while is advisable if the contamination is purely by microbes.

Environmental Protection Agency & WRC

- The EPA as well as the WRC should be provided with adequate human and technical resources to undertake effective monitoring and enforcement of environmental standards for small scale mining operations.

Local Authorities

- Traditional authorities should be transparent enough and desist from permitting illegal miners to operate in their communities. Chiefs and elders of all the communities in the municipality however need to be sensitised on the effects of the illegal mining activities in and around the River Bonsa. They should be further educated on the need and relevance of disallowing the practice in their communities and also the appropriate office to contact for verification of permit.

It must be noted however that, In the course of dialoguing, should there be the need for negotiations, it should go through a Collaborative Negotiation approach. This type of negotiation is treated as a joint effort at problem solving to allow both parties to benefit, i. e: the win-win approach (CEPIL, 2008). Reason being that, some of the illegal miners have applied for legal status but have not yet been granted; not because of any wrong methodology applied, but for bureaucracy and lack of decentralisation within the Minerals Commission.

LIST OF REFERENCES

Asklund R. & Eldvall B. (2005), *Contamination of water resources in Tarkwa Mining Area of Ghana*. KFS AB, Lund 2005, Sweden.

Boachie-Yiadom T. (2010), *Aspects of hydrography of the lower reaches of the Sweet Kakum River System*, A dissertation presented to the department of Fisheries & Aquatic Sciences, University of Cape Coast, Ghana. Page 5

CEPIL (2008), *Training Manual for Human Rights Paralegals*. PICOT- Sierra Leone.

Feurt, C.B., (2008), *Collaborative Learning Guide for Ecosystem Management*. Wells National Estuarine Research Reserve, 342 Laudholm Farm Road. Wells, ME 04090. Page 7.

http://en.wikipedia.org/wiki/Properties_of_water. Last sourced on 04/04/2012

<http://yourwaterneeds.com> from en.wikipedia.org, Last sourced on 04/04/2012

MTDP (2010 – 2013) Tarkwa Nsuaem Municipal Assembly

Obiri S. et al., (2011) Human Risk Assessment and Epidemiological Studies from Exposure to Toxic Chemicals in Tarkwa-Nsuaem Municipality, Prestea Huni Valley District and Cape Coast Metropolis, Ghana, Centre for Environmental Impact Analysis.

Ofori-Amanfo K. original Thermex (1997) glass retort – watch your gold until end of process.
PMMC – OFFICE, TARKWA

Oti D. (2012) Water quality – A national security and safety issue, an article featured in the Daily Graphic on Thursday, April 12, 2012.

The Ghanaian Times, No 16671, ISSN: 0855-1502, pages 1 & 4.

www.ghananewsagency.com

APPENDICES

APPENDIX 1: QUESTIONNAIRE

Semi-structured questionnaires were used in soliciting information from the field which fed into the research report. The Major respondents and their questionnaire samples are categorised below:

GWCL

- *How long has illegal mining (galamsey) been in operation in the municipality?*
- *Has the water quality been affected by activities of illegal miners? Y/N*
- *If yes, how?*
- *Do you envisage any health implications with respect to the water quality?*
- *What other challenges are you faced with as a result of the illegal mining activities?*
- *Within the time frame of the intrusion of illegal mining in the river, have there been changes in the quantity of chemicals involved in the water treatment? If yes, can you give the cost equivalence or implications?*
- *Apart from the effects of the illegal mining activities, what other factors lead to water shortage in the municipality?*
- *How has the production capacity of the water production plant been affected?*
- *What measures have been taken to control the situation?*
- *How do you think that the activities of the small scale illegal miners around the river could be halted?*

MC

- *Is there any data/database on both legal and illegal miners?*
- *What measures has the commission taken to tackle issues relative to illegal mining in the municipality?*
- *Is the commission aware of the illegal mining activities happening within the Bonsa River?*
- *What are the known implications?*
- *Are there any anticipated implications?*
- *How has the water quality been affected?*
- *Do you envisage any health implications with respect to the water quality?*
- *Is the Municipal Assembly aware of the situation?*
- *What has been the commitment by the appropriate authorities to tackle the situation?*
- *How do you think that the activities of small scale illegal miners around the river could be halted?*

PBO

- *What major activities do you engage in?*
- *How are your main activities related to water production?*
- *Do you have any problem with water production in the municipality?*
- *What are the problems?*
- *How is your outfit challenged with respect to water quality?*
- *What about water shortages?*
- *What is your current estimated profit on a monthly basis?*
- *How much difference do you realise when water shortages are encountered?*
- *What have been the adverse effects of the water shortage on your business?*
- *What do you think should be done about the situation?*

EPA & WRC (district)

- *Is the agency/commission aware that illegal mining activities are currently on-going within the Bonsa River?*
- *What have been the observed physical characteristics changes of the river?*
- *How has the water quality been affected?*
- *Do you envisage any health implications with respect to the water quality?*
- *What measures have been taken to control the situation?*
- *Is the Municipal Assembly aware of the situation?*
- *What has been the commitment by the appropriate authorities to tackle the situation?*
- *How do you think that the activities of small scale illegal miners around the river could be halted?*

TNMA

- *Is municipal assembly aware of illegal small scale mining activities within the municipality?*
- *How long has illegal mining (galamsey) been in operation in the municipality?*
- *Have there been complains coming from private companies where they generate revenue from?*
- *Has revenue mobilisation trend changed or been affected over the years?*
- *Has the water quality been affected by activities of illegal miners? If yes, how?*
- *Do you envisage any health implications with respect to the water quality?*
- *What measures have been taken to control the situation?*
- *How do you think that the activities of the small scale illegal miners around the river could be halted?*

STUDENT GROUPS

- *What have been the observed changes in the river?*
- *How do you use the water/ how does water help you within the municipality?*
- *How have you been affected by the water shortages in the municipality?*
- *What have been the major causes of water shortage in the municipality?*
- *How do you cope with water shortages?*
- *How has the water quality been affected?*
- *Do you envisage any health implications with respect to the water quality?*
- *Is the Municipal Assembly aware of the situation?*
- *What has been the commitment by the appropriate authorities to tackle the situation?*
- *How do you think that the activities of small scale illegal miners around the river could be halted?*

INDIVIDUALS AND OTHER FOCUSED GROUP DISCUSSIONS

- *How important is water to you?*
- *How have you been affected by the water shortages in the municipality?*
- *What have been the adverse effects of the water shortage on your business?*
- *What is the cost implication to your work/job?*
- *What have been the major causes of water shortage in the municipality?*
- *How do you cope with water shortages?*
- *How has the water quality been affected?*
- *Do you envisage any health implications with respect to the water quality?*
- *Is the Municipal Assembly aware of the situation?*
- *What measures have been taken to control the situation?*
- *What has been the commitment by the appropriate authorities to tackle the situation?*
- *How do you think that the activities of small scale illegal miners around the river could be halted?*

APPENDIX 2: picture of THERMEX Glass Retort



glass retort

watch your gold until end of process

- more gold
- reuse of mercury
- no mercury emission

After an amalgamation process, the material is placed in the evaporator vessel ①.

ThermEx® is heated with

- Charcoal
- Propane

Original ThermEx®

New

Mercury is One of the Worst Problems in artisanal gold mining“.

Mercury is a killer - ThermEx® protects

ThermEx® is a maintenance-free, small glass-retort, specifically developed for artisanal gold miners.

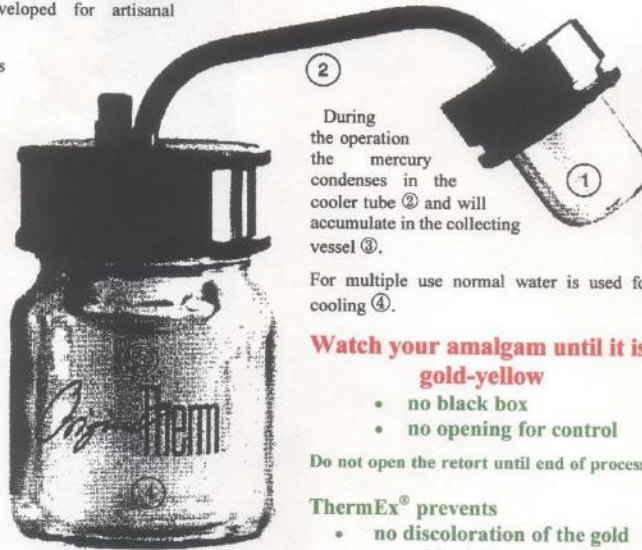
ThermEx® prevents emission of mercury vapor into the environment when the gold containing alloy is heated.

ThermEx® was developed in Germany and multiply tested. Serviceability and fluid tightness, were proved by independent experts.

ThermEx® weighs about

1 kg.

ThermEx® is manufactured meeting ultimate quality standards which are strictly controlled.



During the operation the mercury condenses in the cooler tube ② and will accumulate in the collecting vessel ③.

For multiple use normal water is used for cooling ④.

Watch your amalgam until it is gold-yellow

- no black box
- no opening for control

Do not open the retort until end of process.

ThermEx® prevents

- no discoloration of the gold
- no gold sticking to the walls of the retort.

ThermEx® was presented during the Special Session of the United Nations
23rd to 27th June, 1997, New York
The Earth Summit +5

MR. KWEKU OFORI-AMANFO
PMMC - OFFICE

TARKWA

TEL/FAX: 0362 276