

Participatory Water Monitoring Scoping Study and SWAP (Social Water Assessment Tool) Pilot in Ghana

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Research aims:

The purpose of the research was to undertake a scoping study to:

- Identify the stakeholders in the Golden Star Resources Bogoso/Prestea mine site in Ghana
 - Understand their water issues
 - Pilot the newly developed Social Water Assessment Protocol (SWAP) to capture the intersection of a mine site's water management with the local water context beyond its operational boundaries
 - Provide feedback for the developers of SWAP to revise the questions
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IM4DC Action Research Report



Summary of Action Research Activity

Participatory water monitoring scoping study and SWAP (Social Water Assessment Tool) pilot in Ghana

Participatory water monitoring, where community members are involved in a company's water monitoring, has the potential to resolve or avoid conflict. A scoping study was carried out around the Golden Star Bogoso/Prestea mining concession. The main objective of the scoping study was to understand the social context of the region and to establish the value of participatory water monitoring in this region. The scoping study was carried out using the newly developed Social Water Assessment Protocol (SWAP) (Collins & Woodley, 2013). The SWAP is a series of questions classified within 14 themes to capture the intersection of a mine site's water management with the local water context beyond its operational boundaries. The tool had not been applied before, so the study was an opportunity to pilot the SWAP and provide feedback for the developers to refine the tool.

The answers to the SWAP came from a desktop review and a field trip to the region to interview stakeholders. A total of 75 people were interviewed, ranging from representatives of the mining company, a women's group, men's groups, a community based organisation, a farmers' group, chiefs and sub-chiefs, artisanal scale miners (galamsey), local government authorities, key informants and a broad cross section of the community.

The pilot tested a tool that had been developed in Australia and applied it to a developing country. Application of the SWAP showed that the tool had been well designed to capture the key elements of the social context of the region. The outcomes of the pilot were that it refined the SWAP questions. It created a table identifying the data sources and stakeholder groups, which could provide the required information for each theme.

The key results that arose from the SWAP are that the community and the mining company are both reliant on groundwater; the surface water is contaminated from current artisanal scale mining, pesticides from farming and coliforms from a lack of sanitary facilities. There are three groups of suppliers of the groundwater to the community: private suppliers, district assembly and the mining company. In general, there is good access to the water but some communities expressed concerns that water from particular water points, when stored, developed a layer of film which made the water unpalatable. It was known that the groundwater was naturally high in iron, so it points to the residue being an iron oxidising bacteria which is not harmful to drink but does make the water unpalatable.

The SWAP results also showed that there was a complex relationship between the company and the communities, characterised by mistrust on both sides. The company appeared to have many formal structures to facilitate communication with the community; however, several community members disputed this with their responses that complaints were not acknowledged and that community meetings were not taking place. Whilst one of the aims of the study was to see if participatory water monitoring could resolve conflict due to concerns with water monitoring conducted by the company, the results showed that the dominant concern regarding water was outside the intent of participatory water monitoring.

CENTRE FOR WATER IN THE MINERALS INDUSTRY

Participatory Water Monitoring Scoping Study and SWAP Pilot in Ghana

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1 Executive Summary

Participatory water monitoring, a process where community members are involved in company's water monitoring, has the potential to resolve or avoid conflict. A scoping study was carried out around the Golden Star Bogoso/Prestea mining concessions. The main objective of the scoping study was to understand the social context of the region and to establish the value of participatory water monitoring in this region. The scoping study was carried out using the newly developed Social Water Assessment Protocol (SWAP) (Collins & Woodley, 2013). The SWAP is a series of questions classified within 14 themes to capture the intersection of a mine site's water management with the local water context beyond its operational boundaries. The tool had not been applied before, so the study was an opportunity to pilot the SWAP and provide feedback for the developers to refine the tool.

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2 Introduction

Conflicts between communities and mining operations have the potential to stop or delay mining projects. Such conflicts may curtail returns on company investment and deprive the communities of economic development opportunities. Water is often a source of company-community conflict, and arises as a result of disagreements over the impacts of mine operations on the quality and quantity of water. Often, communities want to understand the impact of water taken by the industry and mine water releases on the environment and community water sources.

Participatory water monitoring, a process where community members in conjunction with technical experts and the mining company are involved in defining water quality objectives, sampling design, sample collection, analysis, data interpretation or/and communication to the broader public, has the potential to resolve or avoid conflict. The process involves multiple stakeholders so that they may have ownership and trust in the results and builds their capacity towards understanding mine impacts on water sources. Typically, the stakeholders will be part of a committee that oversees the program. The exact nature of the monitoring and the purpose of the monitoring are to be decided by the committee. Using this process to address the risks of conflict depends on understanding the social context of each operational region. Accordingly, it is essential to conduct a social assessment to identify the stakeholders, to understand their priorities, and to scope the complexity of the issues.

A study was conducted in a region that currently hosts mining activities in Ghana to scope the potential of using participatory water monitoring to resolve conflicts due to mining impacts on water in Ghana. The study site was the Golden Star (GS) Bogoso mine site located in the Prestea/Huni-Valley district of the western region of Ghana. Golden Star is a Canadian gold company with two operating mines in Ghana; the Bogoso concession and Wassa mines. Some communities surrounding Bogoso mine are dependent on the company for their water supply and the company was motivated to pursue the scoping study to assess if it may assist in increasing the communities' long-term responsibility for their water supply.

The scoping study to understand the social context of the region was carried out using the newly developed Social Water Assessment Protocol (SWAP) (Collins and Woodley 2013). The study was an opportunity to pilot the SWAP and provide feedback for the developers to revise the questions.

3 Background

The Social Water Assessment Protocol (SWAP) is a series of questions on 14 themes relating to the community interactions with water sources in order to assist a mine site understand how strategic mine water management decisions may impact on a community's right to water (Collins & Woodley, 2013). The questions relate to water and the physical aspects of the context, the infrastructure for the region, legislative issues, human rights, health, gender roles, and the various types of water uses: domestic, amenities, livelihoods, spiritual, cultural or recreational uses.

The SWAP was developed in response to research that put forward the point that there is a need for mine water management strategies to not infringe upon the human right to water (Kemp, Bond, Franks, & Cote,

2010). The Water Accounting Framework (WAF) had been created to report a mine site's water inputs and outputs in a consistent and simple way (MCA 2012). A feature of the framework is that water inputs, water outputs, water stores and tasks that use water are aggregated. Kemp et al. (2010) recognised that the resultant simplified view of the water system and the Input-Output Statement of the framework could be used as a basis for discussions with local communities. The communities have a visual aid to help them understand how the mine site may affect their access to water. The completed account enables communication between the community and the company; the community can put forward their point of view, and the company can make informed decisions about how they may impact the community's access when the site makes changes to its water management strategy (Kemp et al., 2010).

Whilst the work by Kemp, Bond et al. (2010) provided the initial idea, Collins and Woodley (Collins & Woodley, 2013) further elaborated how the Water Accounting Framework could be used to relate the mine water management system to the community's human right to water; and that was via the Contextual Statement. The Contextual Statement is a reporting statement of the framework and is a qualitative report which discusses the physical context of the mine site. Collins and Woodley (2013) argued that there was opportunity within the Contextual Statement to discuss the social context of the mine site. They created a consistent set of questions – the SWAP – to draw out the social context. The responses to the SWAP can then be summarised to populate the Contextual Statement.

Water account reporting is done regularly at intervals determined by the mine site. Linking the SWAP to the Contextual Statement of the WAF, means that the SWAP will also be done regularly (Collins & Woodley, 2013). The results provided by the SWAP differ from the information gained for a social impact assessment (SIA) in that the SWAP captures the social context of the communities at the time rather than documenting changes due to the mine. Whilst social impact assessments are often only performed at the start of a mine's operating cycle, during expansions or at closure, the SWAP acts as an ongoing review (Collins & Woodley, 2013). It suited the project aims to apply the SWAP to obtain the background information required for the participatory water monitoring scoping study.

The level of participation depends on the complexity of the issues. An issue that has a low level of complexity may only require a simple model of participation from the community such as capacity building of the community to understand the results of a company's water monitoring, or the community may be utilised to make field observations or act as observers of the monitoring process. There has already been participatory water monitoring in the African nations of Zimbabwe, Tanzania and South Africa for the purpose of information gathering for catchment authorities (Gomani et al., 2010; Kongo, Kosgei, Jewitt, & Lorentz, 2010; Nare, Love, & Hoko, 2006)

The greatest level of complexity is when it is used to deal with water challenges that are controversial or are creating conflict. Relationships may have deteriorated such that the company does not carry much credibility with the community. In this instance, the participatory approach may require engagement of an independent technical expert to provide objectivity. Whilst the literature cited above shows that participatory water monitoring has not been used to resolve conflict in Africa, it has been carried out in Peru and Guatemala to manage conflicts between a mine site and the community related to water (CAO, 2007, 2008).

It is not the purpose of this study to map out a monitoring plan or to dictate a participation approach. The scoping study's purpose is to reveal the water issues that are causing concerns in the case study and make a recommendation as to whether a participatory water monitoring approach would assist to resolve these.

Because the questions of the SWAP are designed to understand the social context at the present point in time, it does not address legacy issues. Therefore, it is appropriate to provide some background on the recent history of the concessions. Prestea has been mined since 1873 via private and state owned interests. In the 1980's, the Ghanaian government encouraged privatisation and foreign investment in the mining sector (Hilson & Yakovleva, 2007). JCI Ltd operated the Prestea mine from the 1990's, but closed it in 1998 due to unprofitability. It was then taken over by a coalition of the Prestea workforce called Prestea Gold Resources (PGR). In March 2002, Golden Star Bogoso Prestea Limited (GSBPL) partnered with PGR to manage the mine, but mining at Prestea has not happened since then (Golden Star, 2013). When the underground mine was operational there were over 4000 people employed by the company and when it closed, many turned to artisanal scale mining known in Ghana as galamsey (CHRAJ 2008). The Bogoso gold mine does not have the same legacy issues. Mining has been occurring at Bogoso since 1935. Golden Star bought the mine in 1999 and surface mining is still active now (Golden Star, 2013).

4 Method

The study deployed key informant interviews and focus group discussions using the Social Water Assessment Protocol (SWAP) questions as the instrument for collecting data. The study team also undertook a desktop study and documented key observations during the field visits. Table 1 shows the topics within the the SWAP (Collins & Woodley, 2013). The developers - Nina Collins of the Centre for Social Responsibility in Mining and Alan Woodley of the Centre for Water in the Minerals Industry - provided the series of questions to the authors of the report to pilot the tool but because the developers intend for the SWAP to be commercialized, the questions cannot be provided in the report. Instead, Table 1 gives a description of the thematic areas and the data sources that were used for this study. The term 'context' in the table refers to the study area which must be defined prior to application of the SWAP.

Questions were added to obtain more information on the potential for participatory water monitoring feasibility study and are provided in Appendix A.

Table 1: A description of the topics within each theme of the SWAP (Collins & Woodley, 2013) and the data sources that were used to obtain the results

Theme	Sample of topics within theme	Data sources for current project
Theme 1 Physical water snapshot	Area of the mining lease which may not be the same as the boundary of the study area, water resources of the region, water quality of the region, and the interaction of the mine site with the water resources	http://www.gsr.com/ , extracts from GS Environmental Management Plan, social responsibility and environmental affairs representative from corporate office of GS, community interviewees
Theme 2 Climate	Climate conditions of the region such as rainfall and evaporation, what affect it has on water resources and the mine site and the likelihood of drought and flooding	GS Environmental Management Plan, report provided by district representative of Ministry of Food and Agriculture
Theme 3 Water supply and infrastructure	Water infrastructure, responsibility of supply, sufficiency of supply and access to supply	Social responsibility and environmental affairs representative from corporate office of GS, community interviewees
Theme 4 Local amenities	Water that is used for local amenities such as schools, hospitals, transport and hydroelectricity	Community interviewees, representatives from health at community and district levels
Theme 5 Domestic	Water that is used for domestic purposes – water supply, affordability, volumes, quality and water resources shared with the mine site	Community interviewees, district planning officer
Theme 6 Formal and informal economy	The formal and informal industries that consume water, the industries that interact with water, the size of the industries, the quantity and quality of the water that is used by the industries	Report provided by district representative of Ministry of Food and Agriculture, community and mine site interviewees, field observations

Theme	Sample of topics within theme	Data sources for current project
Theme 7 Indigenous Peoples	If there are Indigenous people in the context, how they interact with water, the cultural significance of the water sources and water resource sharing between the mine site and Indigenous people	Not applicable
Theme 8 Social, cultural and spiritual	Identifies the particular water sources that have social (i.e. recreational), spiritual, religious or cultural significance, how people interact with the water sources on these bases and the values that the community holds for the water sources	Community interviewees including chiefs and elders
Theme 9 Human Rights	To what extent does the study area acknowledge that water is a human right, human rights abuses, identification of marginalised groups with respect to sufficient water access	Desktop review (see references) and interview with a representative from the Commission for Human Rights and Administrative Justice in Tarkwa
Theme 10 Gender	Differences between men and women and: responsibilities for water collection, end uses of water, customary practices that involve water, the water sources men and women draw on, water management at the household/community/government levels, water accessibility and sanitation access	Community interviewees and district planning officer
Theme 11 Health	How many people have access to safe water for drinking, access to sanitation, water-related diseases, health risks associated with artisanal mining	Representatives from health at community and district levels, community interviewees
Theme 12 Other Key Stakeholders	Other stakeholders within the context that have not been previously identified, water volumes used, access to water, interaction between stakeholders	Community interviewees
Theme 13 Interaction Between Stakeholders	Cooperation between stakeholders, water trading, water-related conflicts, site's engagement with the other local stakeholders	Mining company representatives and community interviewees

Theme	Sample of topics within theme	Data sources for current project
Theme 14 Legislation, Policy, Politics	Water policy of the context, contribution of stakeholders to water policies, enforcement of policy and legislation, water resource authorities, water restrictions, water entitlements and licensing	Desktop research of legislation, regulations and policy

The questions were given to Golden Star representatives to answer prior to the field trip, which was carried out from the 20th of October to the 30th of October 2013. During the field trip, other stakeholders were interviewed and further questioning of mine site representatives was conducted. In total, four mine site representatives were interviewed from community relations, the environmental department, and the corporate office. Participants were drawn from communities within the mine site concession. Bogoso and Prestea are the two major towns within the GS Bogoso mine site concession. Currently, the area surrounding Bogoso has active mining so interviews were concentrated around Bogoso and its nearby smaller communities: Dumasi, Bepo, Chujah, Joaben, Kojokrom, Eshereso, and Komsono. Interviews were also conducted at Prestea, Bondaye (near Prestea), and the smaller community of Himan (between Bogoso and Prestea), although large scale mining was no longer conducted near these sites. There are other smaller communities, but it was impractical to visit all of them.

Seventy – five participants were interviewed over 25 interviews. The respondents were company representatives, a women’s group, men’s groups, a community-based organisation, farmers’ group, chiefs and sub-chiefs, artisanal small scale miners, local government authorities, key informants and a broad cross section of the community. Eighteen interviews were with one to two individuals and the rest were conducted in groups. Nearly a third of the respondents were female. The researchers targeted the questions of the SWAP themes appropriate to the particular group or individual being questioned, thus not all questions were asked of each participant. For instance, elders and chiefs were asked about the theme regarding cultural significance of the water bodies. The interviews were structured so that the questions were in the form of a conversation. The research team supplemented the questions and tailored them as necessary.

5 Results

The answers to the SWAP questions have been aggregated and summarised under each theme. The results may appear repetitive because similar information is requested across themes but the questions are posed in different ways. Because the study is acting as a pilot, all information that was gathered in response to the SWAP questions have been provided in the results but not all the information was relevant to the participatory water monitoring study. The discussion section on participatory water monitoring highlights the most relevant information from the results.

Theme 1 Physical Water Snapshot

Golden Star is a gold company with two operating mine projects – Bogoso/Prestea and Wassa - in Ghana. The Bogoso mine is located in the Prestea/Huni-Valley district of the Western Region of Ghana (see figure 1). The SWAP was carried out only in the Bogoso mine project concession.

The concession occupies an area of 1600 ha and encompasses about 16 towns and villages under 6 divisional chiefs, namely Adamanso, Bepo, Kumsono, Appiatse, Eshereso, Bogoso, Dumasi, Kojokrom-Akokobedi Aburo, Juaben, Himan, Chujah, Kwamenuampa, Dumaa, Prestea, Himan, and Bondaye. Bogoso, the district capital (population 36,000)¹ and Prestea (population 31,000)² are towns, the rest are small rural communities. The native language of the people is Akan (Twi and Ahanta).

A representative from the corporate office of Golden Star provided extracts from the environmental management plan to answer the questions within this theme. Sources of groundwater are aquifers associated with the Birimian and Tarkwaian geological sequences. The company extracts groundwater for mining purposes and does not use any surface water other than rainfall and runoff. The groundwater is high in dissolved salts associated with the mineralogy of the area. The groundwater resource is sufficient for the quantity being taken.

Within the Bogoso lease, there are two main river catchments: Mansi River and the Bogyiri River. Both rivers eventually discharge into the Ankobra River.

Within the Prestea lease area, there are four tributaries that also enter the Ankobra River:

- Asuo Kofi - which has been altered by previous mining activities and currently flows through areas of historic tailings storage, with the tailings forming the banks of the channel, rises in Prestea township before flowing through the concession;
- Asisere - which is a water source for Himan village, rises to the south of Prestea in the Bondaye area;
- Bimbong – which rises in the Brumasi area; and
- Subri/Aboabo - which rises on the Tarkwaian ridges that forms the north eastern boundary of the Prestea mining area.

The south of the Prestea concession, in the Bondaye area, is drained by the South Kurapem stream and other tributaries, which flow into the Fure, and Ankasa, and subsequently the Ankobra River.

The Ankobro and Mansi rivers are the prominent surface water resources in the concession. Both rivers are head-watered by Offin River in the neighbouring Ashanti region, but also receive water from numerous nearby streams such as Bogo, Apepre, Asesre and Esheri.

¹ From [http://www.getamap.net/maps/ghana/ghana_\(general\)/_bogoso/](http://www.getamap.net/maps/ghana/ghana_(general)/_bogoso/)

² From <http://population.mongabay.com/population/ghana/2295840/prestea>

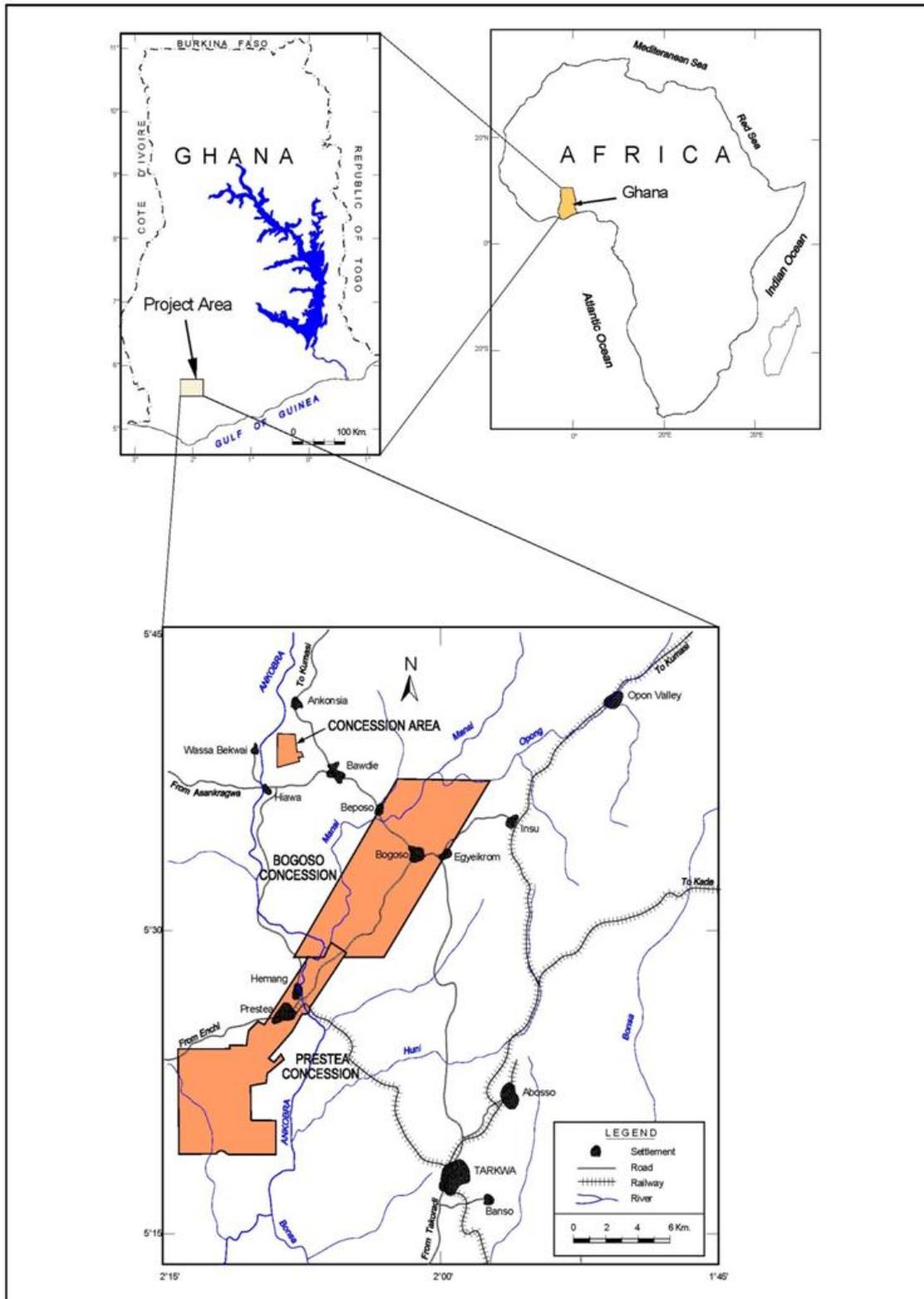


Figure 1: Location of Golden Star (Bogoso Prestea) Limited (GSBPL) mining concessions in Ghana (extract from GS Environmental Management Plan)

Multiple interviewees reported these water bodies are severely degraded and polluted through artisanal small scale mining (ASM) and farming; and are rarely used for any domestic purpose. The main pollutants include sediments and mercury from ASM, coliforms from weak sanitation systems, and pesticides from farming. For most of the local communities that used to rely on surface water, Golden Star has provided access to groundwater with the installation of wells. The company confirmed that regulated diversions of creeks impacted access to surface water in communities such as Dumasi and Chujah so GS provides potable water for these communities.

A representative from the environmental team stated that monthly water quality monitoring of both surface and groundwater is carried out by the company's environmental team for compliance, control reference points and the company's own surveillance monitoring. The results of the compliance monitoring points are provided to the AKOBEN database, which is a Ghanaian government initiative to display environmental results with colour-codes suitable for public understanding.

Theme 2 Climate Conditions

The region is within a rainforest zone with a bimodal distribution of annual rainfall. There is a major wet season occurring annually from April to June, minor dry season July to August, smaller wet season September to November, and a main dry season November to February.

The region is subjected to intense rainfall events. The plant site weather monitoring station, for the period 2002 to 2011, shows a mean annual rainfall of 1,634 mm, ranging from a minimum of 827 mm to a maximum of 2,194 mm. Monthly average rainfalls over that period range from 33 mm in January to a maximum of 253 mm in June.

The mean maximum temperature is 32°C, and mean minimum temperature is 22°C over the 6 year period from 2005 to 2011. The lowest monthly temperature for the period is recorded in July/August, rising to a maximum in February/March, when there is the least cloud cover. Relative humidity is typically in the range of 70% to 90% throughout the year. As a result of the seasonal rainfall pattern, evaporation losses are higher during the dry months of the year.

Daily wind records from the site weather station indicate the prevailing wind directions in the project area in the South, Southwest and Northeast directions.

Theme 3 Water Supply & Infrastructure

The source of the domestic supply is groundwater. Highly-populated towns including Bogoso, Prestea, and Bondaye are serviced with mechanized boreholes. Smaller communities such as Komsono, Esheroso, Kojokrom, and Appiatse access potable water through boreholes/wells fitted with pumps. The Dumasi and Chujah communities, whose surface water resources were diverted by mine operations, rely exclusively on the company's daily trucked water tanks for water. The company has placed water tanks around these communities and treated water from the site is hauled regularly and then discharged into these tanks for community consumption. Adding to these facilities, there are individually-owned open

wells in most communities, and communities rely on them for water especially during breakdowns of the boreholes systems or if the tanker fails to deliver water.

In general, community interviewees reported that majority of the facilities flow adequately and regularly; but they also require more facilities as the existing ones are insufficient to meet Community Water and Sanitation Agency guidelines for potable water access – a maximum of 300 people can be serviced by a borehole (CWSA 2005). Table 2 below profiles the water infrastructure in some selected communities based on answers given by interviewees.

Table 2: Water facilities and issues the interviewees mentioned within their community

Community	Water facilities	Comments made by interviewees
Prestea	Ghana Water Company Ltd and private supplier: small-town water system (mechanized boreholes) and 10 boreholes fitted with pumps Spring water harnessed by GSBPL	Mechanization required to make spring water more accessible.
Bogoso	Mechanized boreholes – private supplier Boreholes with pumps – two constructed by GSBPL. Treated water from Ghana Water Company Ltd. Open wells	About 40% of houses connected to systems and have running water from private supplier Most facilities flowing regularly; and 70% of population have access to potable water Open wells used as complementary sources especially during breakdowns
Bondaye	Mechanized borehole – responsibility has been handed over to community	It serves over 50 households plus 4 standpipes which are communal points Water is treated
Bepo	4 boreholes provided by local authorities	Facilities flowing regularly, but not sufficient for population of community. Water has oily residue and tastes poor. Long queues for water.
Appiatse	2 hand-dug wells 1 borehole fitted with pump	Hand-dug wells do not yield enough water during dry season Water from borehole has oily residue and tastes poor
Komsono	2 boreholes fitted with pumps	One is broken down (provided by local government authority); and water from the one provided by GSBPL contains oily residue, during dry season harder to access water.
Eshereso	1 boreholes fitted with pump 1 hand-dug well Neither provided by GSBPL.	Supply problems when pump breaks down.

Community	Water facilities	Comments made by interviewees
	Esheri Stream	
Chujah	1 Water tank provided by GSBPL	Daily water supplied by water tank 1 poly tank as distribution point Tank is too high to monitor tank cleanliness
Dumasi	6 water tanks provided by GSBPL.	Daily water supplied by water tanks; but high demand during dry season (Nov-Feb) creates shortages. Community cleans tank. Water tanker occasionally breaks down. Unsure of water treatment.
Himan	5 boreholes - 1 of those is mechanised borehole with overhead storage tank provided by GSBPL, community user fees pay for maintenance. Nearby streams	Water from a borehole point contains oily residue

In Ghana, the Community Water and Sanitation Agency (CWSA) and various local district assemblies are responsible for planning and delivering potable water infrastructure in small rural communities; whilst the Ghana Water Company Ltd (GWCL) is responsible for urban water supply. GWCL supplies water to a small section of the Bogoso community. Other water suppliers in the study area include the Prestea/Huni Valley District Assembly (PHDA), Golden Star, and other private companies such as Christ the King Water Company, Nshereba, and Na-Adum. Nshereba and Na-Adum produce and sell sachet water (potable water in small plastic bags), which most people rely on for drinking as they have serious concerns about the safety of the groundwater for drinking due to the presence of a layer of film that is evident when the water is allowed to stand. The community members referred to this film as 'oily' or 'metallic'. We have been told that the groundwater is naturally high in iron and desktop research after the field trip suggests that the residue may be an iron oxidising bacteria (National Ground Water Association, 2009). *If* in fact this is the problem, the water is not harmful to drink but if the water is unpalatable, chlorine treatment is needed (Penn State Extension, 2010).

In the last 20 years, Golden Star has provided about 100 tailor-made water facilities (boreholes/wells with pumps) for the communities depending on population size and ability of the drilling teams to get to the proposed site of the borehole. These facilities have been provided both for impact mitigation from previous stream diversions and for social development purposes. Golden Star wants to hand over responsibility of these water facilities to the community to ensure long-term sustainability.

Overall, many water facilities in the study area are about 5-10 years old and are either malfunctioning or experiencing regular breakdowns. District and company officials/interviewees explained that there are plans to fix and/or expand water facilities in every community, but these efforts are challenged by budget constraints and difficulty with physical access to some communities with the borehole drillers. It is important that the boreholes are drilled, because a representative from the district planning office stated

that the Community Water and Sanitation Agency has a directive that hand dug wells should not be used because the depth is not sufficient for good quality water.

Water monitoring is rarely conducted beyond the initial regulatory tests requirement. Private water suppliers mentioned that they are subject to quarterly sample testing by the Ghana Water Resources Commission.

In communities where water facilities are provided by the company, people are reluctant to impose or pay user fees for water, making it difficult for communities to raise funds to undertake pump maintenance. The company is worried that the community reluctance to pay user fees for water has created a dependency syndrome. In general, people indicated that income levels in the communities are sufficient to pay for water.

Theme 4 Local Amenities

There are several social amenities in the surveyed communities including schools, clinics, hospitals, banks and churches. The majority of the facilities rely on communal water facilities for water. A few health facilities including the Bogoso and Prestea government hospitals have running water from mechanized borehole systems. A representative from District Health reported the water supply system at the Bogoso government hospital was broken down at the time of the field trip.

Sanitation facilities for the disposal of both solid and liquid waste are poor. With the exception of two public water-closet toilets in the Bogoso township that are connected to running water from boreholes; all other public toilets infrastructure are vault-chamber and KVIP (Kumasi Ventilated-Improved Pit) types and are in deplorable condition. Disposal of solid waste in most communities is open-field disposal and has the risk of contaminating streams through run-off.

No community group in the surveyed area relied on water resources – rivers or streams – for transportation.

Theme 5 Domestic

The field data revealed that most people draw on groundwater from boreholes and wells for domestic uses including cooking, washing, and cleaning. Where the groundwater appears to have the oily residue previously mentioned, the majority of interviewees indicated they drink sachet water supplied by private operators. Apart from a significant proportion of houses (estimated at 40% of households) at Bogoso that are connected to running water, households in all other surveyed communities collect their water from communal stand-pipes, boreholes, wells, and less usually, streams. Community members collect and store rain water for supplementary use during the rainy season.

Access to water in the area is generally good, relatively accessible, and facility-user fees are economically affordable. In general, most people travel a distance of less than 400 m with a turnaround time of 15 minutes or less to collect water from facilities. The time spent in collecting water is more (between 30 minutes to an hour) during the dry season. The cost of water varies according to facility and community size. In smaller communities such as Bepo, Komsono, Appiatse, and Eshereso, a tub of water

drawn from communal water points cost between 0.20 to 0.50 Ghanaian cedis³; a bag of sachet water (containing 30 bags of 500 mls of water) is selling at 2.00 - 3.00 cedis; and a 1000 L of piped water at Bogoso from a private water supplier costs 2.00 cedis. Whilst community members reported that the current water user fees are affordable, willingness to pay varied amongst community members depending on the provider. In communities where water facilities are provided by the local district assembly, Ghana Water Company Ltd, and private operators, community members are willing to pay for water. In contrast, communities that are provided by Golden Star are reluctant to pay for water.

In all the surveyed communities, there is no known (or reported) social or legal restriction of any group of people in terms of access to water.

Theme 6 Formal and Informal Economy

The structure of the local economy in terms of the number of people employed is split between agriculture and mining. As per the 2010 national population and housing census, the farmer population in the district is about 82,600 people representing about 52% of the district population⁴. District authorities estimate that this percentage is close to the percentage of people employed in mining. Adding to the number of people that are employed by Golden Star and other regulated mining companies in the district, there are about six active artisanal mining (galamsay) sites in the study area, with each site employing approximately 200 people. In communities such as Bondaye, Juaben, and Prestea interviewees reported that close to 70% of the population are employed in galamsay. Other sectors of the economy include agro-processing (oil palm and cassava processing), commerce and services such as banks and microfinance institutions, telecommunication, consumer wholesale and retail, petty trading, and cottage industries. Livestock is very rare, and where it exists, includes only a few birds and small ruminants such as sheep and goats. Currently, there are about 36 fish farmers in the area, but pollution of surface water means that the fish farming is done in dug-out fish ponds.

With regards to sector interactions with water, the majority of the interviewees consider both formal mining and galamsay as the major water users in the region. Agriculture can be a significant consumer of water but as agriculture is rain-fed and does not require irrigation, it does not extract surface or groundwater. Formal mining extracts groundwater for both direct mine operations (e.g. ore processing, cooling systems) and auxiliary services such as catering and camp management services. Galamsay activities, due to pollution, have a major impact on surface water such as the Mansi and Ankobra Rivers as well as nearby streams.

Theme 7 Indigenous Peoples

This theme is not relevant in this context as there are no people that are recognized as indigenous people in Ghana. This was corroborated with local and company sources.

³ 1 Ghanaian cedi is equal to 0.31 Australian dollar at the time of the report

⁴ Photocopied extract from report provided by district representative of Ministry of Food and Agriculture during field visit. The full reference is not available.

Theme 8 Social, Cultural and Spiritual

Generally, the surface water pollution, due to galamsey, farming and poor sanitation, has rendered surface water resources in the area unsafe for domestic use. Notwithstanding, some rivers and streams remain culturally significant and are regarded as symbols of community history, clan identity, social cohesion and spiritual protection. The Chief of Dumasi commented that “*The water bodies are the reason the Dumasi community settled here*”.

In most surveyed communities, interviewees narrated the spiritual connection they share with the gods that are associated with nearby streams and rivers. For example, the Bogo stream at Bogoso, Nsuo Kofi at Prestea, Mansi River and Eshere stream at Eshereso; Achesua and Afiada Nsuo at Dumasi, etc are all regarded as gods by the local population. These gods have cultural protocols which community chiefs/priests strive to preserve and protect. At Eshereso, oral tradition prescribes that no person is allowed to collect water from the Mansi River on Tuesday and Eshere on Wednesday. Men can swim or bathe but women aged 18 years and over are not allowed to visit Mansi River on those days. Those who violate these protocols suffer prescribed punishment as determined by the chief. Similarly, the chief and people of Dumasi perform annual libation and sacrifice to pacify “Achesua and Afiada” stream gods, as they believe that these pacifications guarantee’s the community’s spiritual safety. The creek diversion means that the sacrifice takes place on dry land where the water used to flow.

Adding to the traditional values attached to some rivers and streams, water also facilitates important religious practices in the area. For the Catholic Church, water is involved in the sacraments – Baptism and Eucharist. Baptism cleanses the soul and the physical act of cleansing is believed to wipe away sins. In Baptism, water is either sprinkled or poured on the person; or he/she is dipped into the water. In this area, no dipping is done by church and the priests’ uses borehole water for these religious activities.

Currently, there is no viable recreational activity connected to the rivers and streams in the surveyed area. Apart from isolated instances when children swim in nearby rivers (e.g. swimming in Arura river at Dumasi around May – Aug), no other water-facilitated recreational activity takes place.

Theme 9 Human Rights

In Ghana, the human rights landscape is fairly well-established with laws and institutions to promote and protect fundamental rights and freedoms, and/or remedy alleged violations. The Commission for Human Rights and Administrative Justice (CHRAJ) is the national institution responsible for promoting and protecting fundamental rights and freedoms and administrative justice in the country. The Commission was established by Act 456 of the 1993 Constitution with a three-fold mandate: as a human rights institution; administrative justice (Ombudsman responsibility), and an anti-corruption agency.

The right to water is not explicit in the constitution of Ghana. However, the right to clean water is embedded in the country’s constitutional provisions on civil rights and liberties and the UN convention on economic, social, and cultural rights, which Ghana has ratified. Under the laws of Ghana, the obligations arising out of the ratified international covenants have constitutional status (CESR, 2002).

The district CHRAJ office at Tarkwa reported that local communities have, in the past, lodged complaints of human rights violations against mining communities. Table 3 shows the case which relates to Golden Star.

Table 3 Complaints of Human Rights Violations against Golden Star Ltd

Complaint	Investigation
<p>There were two parts to this complaint. The Chief (Nana Kojo Amponsah) and others of Anikoko alleged that leakage and overflow of contaminated water from GS tailings had rendered nearby crop-land unproductive. The second was that the compensation received from Golden Star for a reclaimed fish pond was not enough.</p>	<p>The investigation by the Crop Research Institute of the Council for Scientific and Industrial Research (CSIR) was pending at the time of the field trip, but by the time the report was written, the matter resolved and it was determined there was no link. On the latter complaint, CHRAJ found that the terms of the agreement for the compensation had been accepted so it was done according to the law.</p>

There have been no other officially reported human rights violations other than spot complaints from community members during CHRAJ's public education in the communities. The CHRAJ official offered the viewpoint that some victims might not report cases as they misconstrue the office as a law court and are unaware of the free services that CHRAJ offers.

With regards to restricted access to water, Article 12(2) of Ghana's 1993 constitution stipulates non-discrimination in access to resources and opportunities. Interviewees reported there is no discrimination with respect to access to water. However, in communities where water facility-user fees are applicable, community members who are economically disenfranchised are unable to pay.

Theme 10 Gender

Gender is a social construct; and defines the roles and responsibilities ascribed to men and women in a specific socio-cultural setting through the socialization process. Like many other communities in Ghana, there are gender-specific as well as shared roles and responsibilities for men and women in the communities in this area.

Typically, the communities in this area are patriarchal, but this does not affect control and access to clean water and sanitation facilities. Generally, access to water and sanitary facilities is non-discriminatory. Both men and women have equal access to communal facilities except those who are unable to pay user fees. Even then, people that are unable to pay facility user fees rely on their social support network systems for access. Communal toilet facilities often make equal room for men and women. Similarly both men and women have equal access to acquire productive resources including land as long as they are able to pay. Sometimes, women choose to express their ownership of land through their male relatives or partners.

At home, women (mostly assisted by children) perform most of the daily household chores including cooking, cleaning, washing, and bathing; and are responsible for collecting and storing water for both

household and communal use. All the respondents agreed that women and children are responsible for collecting water at the household level.

With regards to participation in economic activities, men dominate the formal sector of the local economy including mining and farming. In terms of the informal sector, artisanal mining is a male-youth business and women dominate in agro-processing, food vending, petty trading, and retailing of consumer goods.

At both policy and community level, the role of women and men is fairly distributed in the management of water facilities. At the district level, the Water and Sanitation Department is responsible for overseeing water facility management. The office is gender neutral as officials are recruited on merit. The Community Water and Sanitation Agency (CWSA) is the main government agency responsible for policy and planning for water for small towns and rural communities in Ghana. Regulations require each small town to have a Water Board and rural communities to have Water and Sanitation Management (WATSAN) teams, which have the responsibility for managing water and sanitation facilities. In this context only Prestea/Bondaye have water boards. The rest of the communities excluding Bogoso have Water and Sanitation management teams. The district planning officer stated that local regulations require 40% of the people in the WATSAN committees to be female, which corroborates the desktop review (Community Water and Sanitation Agency, 2005). The field trip showed that women were represented in the community WATSAN teams, and in the Bepo WATSAN, comprise more than 50% of the representation.

Theme 11 Health

The district planning officer estimated that 80% of the district population has access to clean water although this may not take into account local community concerns about the oily residue and problems with taste in some groundwater sources (see Table 2). Almost all the respondents attest that everyone has access to water; but more facilities are required for adequate supply. Health officials in this area confirmed that the predominant diseases in the district are: malaria, diarrhoea, cholera, upper respiratory tract infections, skin infections, worm infestations, urinary tract infections, and anaemia. Out of this list, only upper respiratory and urinary tract infections are not water related diseases. Malaria is a mosquito borne disease but still waters contribute to mosquito breeding. Anaemia is a side effect of frequent malaria attacks and poor nutrition. Health authorities at both the community and district levels suspect that mercury is in the surface water from galamsay and that contact with such water bodies could give rise to skin irritations. Poor water and sanitation systems may also give rise to diarrhoea, worm infestations and cholera.

Theme 12 Other Key Stakeholders

Operators/stakeholders in water within this context include the publicly owned Ghana Water Company Ltd, the Ghana Community Water and Sanitation Agency (CWSA), and the Prestea/Huni-Valley District

Assembly (PHDA); operating alongside the following private sector operators; Golden Star, Christ the King Water Company, Nshereba water company, and Na-Adum water company.

The Ghana Water Company (GWCL) is a public, state-owned, limited liability company and the sole urban water provider in Ghana⁵. In this area, GWCL supplies piped water to only a section of the Bogoso township; and interviewees reported that the company's operations are negligible, although they recognise the company's attempts to expand.

The Christ the King Water Company (CKWC) operates a mechanized borehole system and provides water to about two-third of Bogoso. On average, the CKWC provides 2.5 million litres of piped groundwater every month, directly reaching about 200 households and other communal points. The other private operators Nshereba and Na-Adum produce and sell potable quality water in plastic sachets which many people use for drinking water.

Theme 13 Interaction between Stakeholders

Generally, the site's engagement with local communities is three-tiered: the Community Consultative Committee (CCC); the Community Mines Consultative Committee (CMCC); and the Mediation Committee.

The Community Consultative Committee (CCC) is a grassroots committee and specific to each of the 16 mine-impacted communities. Its purpose is to provide a platform for discussing community development projects, addressing grievances, and sharing information. The committee includes company representatives, community leaders such as the Chief or *Odikoro*, Unit Committee Chairman, and representatives of various interests groups in the community such as youth, market women, opinion leaders, farmer representatives, religious representatives (Muslim and Christian), and Assembly members. Membership is by invitation. According to the GS representative, meetings are held monthly and take place in the community. Contrary to this claim, none of the respondents that were interviewed from the community were aware of these meetings, which could indicate that either the meetings were not happening or the community representatives were not giving information back to the broader community.

The Community Mines Consultative Committee is a higher-level committee compared to the CCC. Its roles are to discuss matters that are across multiple or all communities and to decide which community projects are funded by the company's development fund. The composition includes company representatives, the local government leadership (i.e. District Chief Executive, District Coordinator Director, District Planning Officer, the Social Welfare Officer), the Member of Parliament (MP), urban or area council chairpersons, and all six divisional chiefs in the area. The decision on which project(s) to prioritize is informed by the amount in the development fund for each year. The CMCC meets quarterly.

The role of the Mediation Committee is related to governance. The Mediation Committee gives credence to the various agreements that the company signed with the communities in October 2012. These include the social responsibility agreement, the local employment agreement, and the relationship and

⁵ <http://www.gwcl.com.gh/pgs/aboutus.php>

sustainable livelihood agreement. The agreements detail the guiding principles of the site's interaction with the communities. The committee acts as a sanctioning body for the agreements because if either the company or the community acts outside the terms of the agreement, the party can be taken to court. The Mediation Committee provides the last opportunity for addressing grievances internally before the commencement of legal proceedings, so it is only convened as necessary. To date, the Mediation Committee has not met over a case. The committee includes five senior managers of the company with decision making responsibility, an independent moderator, the District Chief Executive, the MP, six divisional chiefs, and the two primary chiefs of the region. The composition of the Mediation Committee is designed to ensure that an issue is viewed from the lens of traditional and legal governance. There may also be lawyers present; one representing the community and the other representing the company but both are paid by the company.

Apart from the committees to respond to grievances, the site also has community information centres manned by community liaison officers, through which aggrieved stakeholders may lodge complaints. Complaints are compiled at the office by an administrator and then each complaint is given to the appropriate department for a response. The company aims to respond to each complaint within two weeks. Despite all the formal structures to link the company with the community, there is deep-seated mistrust between the site and the community as multiple interviewees reported that the company had previously failed to respond to their complaints and grievances. One respondent felt that the company did not respect them.

Theme 14 Legislation, Policy, Politics

The *Water Resources Commission Act 1996* established the Water Resources Commission (WRC) as the sole regulator of water resources including groundwater and surface water. The primary responsibility of the WRC is water resource development and management. To this end it is in charge of processing of water rights and permits, data collection and disseminating, pollution management, granting discharge permits, collaborating with other agencies and monitoring programs for the conservation of water resources. Permits are required for water withdrawals (*Water Use Regulations, 2001*). To extract groundwater, which is a source of water for both the company and the community in this context, licenses are needed (*Drilling License and Groundwater Development Regulations, 2006*). There is a requirement that the water quality is tested and results sent to the WRC. The company also has to comply with the *Environmental Protection Agency Act 1994*.

Policies denote the direction and objectives of the government. The *National Water Policy* (Ministry of Water Resources Works and Housing, 2007) covers both groundwater and surface water. It is an overarching document explaining how the acts and government departments relate to each other.

Whilst not policy, *Gender and Water Resources Management Strategy* (Water Resources Commission, 2011) has been developed to increase gender considerations into the field of Integrated Water Resource Management beyond participation in committees and boards.

The *Small Communities Water and Sanitation Policy* (CWSA, 2005) is quite a detailed document on the provision of sanitation and water supply to rural communities. The District Assembly is responsible for the supply of water and sanitation, but the community has input and control of the process via the WATSAN committee. The committee is made up of community members, with women comprising at least 40% of the committee. The policy document advises that the community be responsible for a small portion of capital cost (5%) and all of the operation and maintenance. WATSAN is responsible for setting of the prices. Of relevance in this context are the recommendations in the policy that one borehole should supply no more than 300 people and people should have access to 20 L/day with no more than a 500m walk to water (CWSA, 2005). In general, these service levels are not being met.

Participatory Water Monitoring

General questions were asked of the participants about their concerns with regards to water supply and water quality, whether they had access to company water monitoring results and whether they were interested in a participatory approach to water monitoring. Where participants did not understand the term 'water quality', the term 'water safety' was interchanged. The questions did not specify whether the water was surface water or groundwater.

None of the participants beyond the mining company were aware of company water quality monitoring results, thus the subsequent questions on whether there was trust in the results and the format of the results were not applicable. Some reasoned that they trusted that the company was monitoring water because large companies are governed by legislation.

Table 2 showed that respondents from the following communities had concerns with taste and colour of the groundwater: Bepo, Appiatse, Komsono and Himan (see Figure 1). Comments amongst the communities were that some people would be interested in knowing the results on a regular basis and felt the results could best be delivered by an independent body. One respondent noted that the process could be an avenue to improve communication between GS and the community. Women showed the most interest in knowing about water quality. However, the absence of complaints in Table 3 in some communities showed that respondents interviewed were satisfied with the water quality in their particular community. Their perception was based on taste and the fact that the groundwater had been used for a long time without any adverse effects. It must be emphasised that the company is not the only organisation providing groundwater to the communities, so the respondents were commenting on the water safety of the groundwater in the region.

The mining company has used participatory processes before for noise blast monitoring. The surveyed community appreciated the opportunity to be involved, but there was an anecdote mentioned that the company took the monitors away without explanation. When a company representative was interviewed, it was explained that the blasting had moved to another area, but this had not been communicated to the community.

The barriers to Participatory Water Monitoring that were identified by mining company representatives were that:

- costs can escalate when people are reimbursed for their time,
- some water tests will not give immediate results so may not be as effective as the blast monitoring program and that
- community members are busy earning a living and lack time to participate.

The mining company representatives were supportive of measures that handed back the responsibility of water supply to the community. For instance, Dumasi is undergoing a relocation process due to mine expansion, but the community will be responsible for infrastructure maintenance and how the water is managed. A key informant from Dumasi indicated that people are prepared to pay for water under this circumstance whereas previously, when the water was brought in by tankers, the water was provided by GS.

Local authority representatives confirmed that complaints had been made to the company and District Assembly about the groundwater and there is interest in knowing water quality results. If the water quality results were from the company, a local authority representative said that you cannot rely on data provided, but must investigate yourself. The Water and Sanitation Office at the District Assembly level is stretched to simply provide water and lacks capacity to monitor water quality.

There was some overlap regarding responses on the appropriate composition of the committee, if a participatory water monitoring process was deemed suitable for this context. The company respondents suggested people from the company's environmental team, the community relations department, District Assembly, regional representatives of the Water Resources Commission and the Community Water and Sanitation Agency (CWSA). Local authorities suggested chiefs, representatives from District Assembly and the water board. The women's group who was interviewed said they would select someone within their own community to follow the initiative through. The idea that women could be responsible for water monitoring was echoed by another community respondent.

Only one respondent from the community discussed ideas for the protection of surface water in detail. They included encouraging children not to enter into galamsey and to teach them about the environment. A participatory process could be beneficial to the community as long as it teaches people how to utilise the water safely. The informant suggested market days as the best time to deliver information to the community.

6 Discussion

The study acted as a pilot for the Social Water Assessment Protocol. While the answers provided the contextual understanding to determine whether a participatory water monitoring program would be of benefit in this region, the study also represented an opportunity to provide feedback for improvements to the tool.

The developers, Collins and Woodley, envisaged it as a tool for the mining company to use to link mine water management strategy with the social context of the region. The range of themes is comprehensive and the ability to answer every question would not be found within the company. As was done in the pilot,

the company would have to use a combination of desktop study and interviews to obtain the answers (Collins & Woodley, 2013).

Desktop research should cover conventional site social/operational/obligatory studies (depending on the country context) including environmental and social impact assessments, socioeconomic studies, rapid assessment survey reports and health impact assessments. The data from the desktop sources can be corroborated by interviews.

Issues on gender, social-cultural, and indigenous issues connected to water are better assessed through primary data – specifically focus group sessions. On average, it took an hour and half to facilitate a focus group on inter-related themes in a conversation. There are a number of questions spanning different themes that are repeated to draw out an aspect of the theme, which is useful as different people will give different viewpoints. But if the one person is given all the questions to answer, the questions are repetitive so it would be best to target themes to relevant stakeholders or office holders for interviews.

Table 4 has been created and gives suggested data sources – both primary and secondary - for the themes. Table 1 showed what data sources were used for the pilot study but the information in Table 4 is intended to be more widely applicable.

Table 4: Themes of the SWAP linked with possible data sources and stakeholders

Theme	Suggested sources of data
Theme 1: Physical water snapshot Theme 2 Climate	Company's Water Management Plan, Environmental Impact Assessment
Theme 3 Water supply and infrastructure	Socioeconomic assessment reports, Environmental and social impact assessments, government reports and interviews with local authorities
Theme 4 Local amenities	Government reports, interviews with local authorities
Theme 5 Domestic	Environmental and social impact assessments, government reports and interviews with local authorities and domestic users
Theme 6 Formal and informal economy	Rapid assessment reports; ESIA reports, national surveys, interviews with stakeholders from livelihood sectors
Theme 7 Indigenous Theme 8 Social, cultural and spiritual	Interviews with members of indigenous groups and community members
Theme 9 Human Rights	Human rights commission
Theme 10 Gender	Interviews with community
Theme 11 Health	Health impact assessments, government reports, interviews with local authorities

Theme	Suggested sources of data
Theme 12 Other key stakeholders	
Theme 13 Interaction between stakeholders	Site Stakeholder engagement strategy/register; site stakeholder mapping report; grievance management procedure, company reports, interviews with stakeholders
Theme 14 Legislation, Policy and Politics	Government acts, policies, regulations

The pilot identified gaps in the tool.

- In Theme 1, when establishing the geographical reach, there should be a question that identifies the communities;
- A theme on reporting and disclosure; and
- A theme on legacy issues.

The first point relates to the boundary of the study and makes explicit which communities the SWAP was applied to. The study area does not have to be the mine site lease area. Census data could be used to give the population of the area - disaggregated into gender and age - to help understand potential effects of population pressure on water facilities.

The theme on reporting and disclosure is of relevance because the information a company discloses is part of risk management strategies. The disclosure of a site’s net water consumption, treatment and discharge, water reuse, provides opportunities and evidence for mitigation and continuous improvement. It would also be important to specify the standards or initiatives that the company reports to. It cannot be assumed that only the sites reporting to the MCA Water Accounting Framework will be using the SWAP because the functionality of the tool is broader than this.

During the interviews, respondents sometimes referred to Golden Star by the names of the previous companies which owned the mines. It would be useful to have questions on the history of mining in the study area and mine ownership in order to appreciate present-day issues. Interviews with respondents in Prestea were dominated by legacy issues. There was much anger over promises made by previous companies, but as their complaints did not relate to water beyond the comments in Table 2, they are not present in the report.

The following points are to fine-tune the questions. The feedback has been given to the SWAP developers and the next revision of the SWAP questions may address them.

Questions that ask for percentages are difficult for people to answer in an interview format because it implies they have knowledge of statistics. If a percentage must be known then the tool could suggest that this information should be drawn from reports or census data rather than a prompt question in an

interview. If the question must be asked during an interview, then it should be modified to ask the respondent for quantities or amounts.

A question in Theme 11, Health, asks for 'water-specific community health issues'. It is suggested that the user of the SWAP tool asks a broader question first, i.e. the common diseases or health issues and then should narrow down to water related ones because the question as is, does not reveal whether the water-related health issues are significant in the region. Similarly, there should be a broader question for Theme 6, Formal and Informal Economy, to determine the major livelihoods of the context and then ask about those which use water to provide a better understanding of the structure of the economy. The questions within the Formal and Informal Economy theme delineated between the two types but without exception, interviewees did not distinguish between formal and informal economies when providing answers.

It is suggested that the following questions are added to themes:

- Theme 9 Human Rights - List the institutions responsible for investigating human rights abuses and the extent to which people utilise the institutions to assist them.
- Theme 10 Gender - Average distance and turnaround time for collecting water.
- Theme 12 Other Key stakeholders - List the institutions including NGOs and those within civil society with an interest in water and the environment and to what extent do the communities rely on them for information.

In summary, the themes and questions themselves require only minor revision but the usability of the SWAP questions would be improved if questions could be segregated within the themes by those that are to be answered from desk-top data sources and those that are to be answered by interviews and that questions are framed accordingly.

The SWAP drew out that the primary concern of the communities was whether the groundwater was safe to drink, but GS was not the sole provider of groundwater. The report authors did not undertake any monitoring so it has only been inferred that the oily residue many respondents found in their groundwater is from naturally occurring iron-oxidising bacteria. Should further research or water quality testing be undertaken in the study area, this should be verified. Another finding of the SWAP was that even though there were many formal structures in place to facilitate communication, the relationship between the GS and the community was strained. A participatory water monitoring process can be a strategy to resolve conflict when the conflict is due to the perceived impact of mining on water bodies. Because the concerns of the community are outside the intent of participatory water monitoring, the conclusion is that the need for it is low in this instance.

7 Conclusion

The application of the series of questions in the Social Water Assessment Protocol (SWAP) tool showed that the tool was an effective and systematic way to draw out the social issues of the communities that surrounded the Bogoso/Prestea Golden Star mine site concession. The outcomes of the pilot were that it

refined some questions but most importantly, the pilot created a table identifying the data sources and stakeholder groups that could best provide the information required for the SWAP tool.

In this application - the participatory water monitoring scoping study - it showed that whilst there was a high degree of surface water contamination due to agriculture, lack of sanitation and artisanal scale mining, the issue of water quality/safety of the groundwater was the community's major concern because this was their current water source for domestic use. It appeared that the need for a participatory water monitoring program was low in this instance because the company was not the sole provider of groundwater and furthermore, the issues that exist between the company and the community related to communication rather than controversy over water monitoring.

Women showed the most interest in knowing and understanding water quality results which reflects that they have more responsibility for the provision of water for domestic use. The desire within the community to understand the safety of the water they use represents an opportunity for the company to educate people on water quality which may help improve the relationship between the community and the company.

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Appendix A Participatory Water Monitoring Questions

What concerns do you have regarding water?

Have these concerns been expressed to the relevant stakeholders? Examples are district assembly, Golden Star, Member of Parliament, etc. If yes, are they being discussed?

Are you made aware of the results of the company's water monitoring program? If so, are the results in a format that is easily understood? Do they address your concerns?

How regularly do you get this information?

From who (or source) do you normally get information about results of company's water monitoring? Do you trust this source? Why?

If there are gaps in the water monitoring information that you receive, what water monitoring results would you like to see?

What benefits do you see in a participatory water monitoring approach?

What kind of problems can you see in the approach?

Who do you find appropriate to adequately represent you in a participatory water monitoring process?

What aspects of monitoring should you or the representative be involved in - sampling, testing, communication of results?

Appendix B Summary of report for community members who participated in survey

As per the project proposal, in addition to report delivery, tailored summaries were to be provided to stakeholder groups to communicate the aspects of the work that they were most interested in and to show how their input contributed to the project. The three broad groups identified were informants at the district level, Golden Star and community members. Dissemination of results was via email or mail for the first two groups and Justice Oponng, the field trip interpreter, agreed to disseminate the results for the community. The total report was provided to mining company representatives, and the executive summary to informants at the district level. The executive summary for the community has been rewritten in a style to enable Justice Oponng to easily communicate the results.

Executive summary for community members

We carried out a study around the Golden Star Bogoso mine to understand how the community and the mining company uses water and the water supply facilities that were in the area. We wanted to see what the community knew about the company's water monitoring and if they would be interested in participating in monitoring. We interviewed 75 people from the: mining company, a women's group, men's groups, farmers, chiefs and elders, galamsey, local government agencies and the community. The towns and villages we visited were: Bogoso, Dumasi, Bepo, Chujah, Joaben, Kojokrom, Eshereso, Komsono, Prestea, Himan and Bondaye.

We found that the community and the mining company use groundwater because the surface water is polluted from galamsey, chemicals from farming and from a lack of toilets in the area. There are three groups of suppliers of the groundwater to the community: private suppliers, district assembly and the mining company. Generally, people can access and pay for groundwater but some communities expressed concerns that their water points contained a film when they stored the water and couldn't drink it because of the taste. In those communities, most people bought drinking water and used the groundwater for cooking and bathing. We didn't conduct any testing of the water but we think that the film is from a bacteria which feeds on iron but without testing we don't know for sure. If it is true, the film is not harmful to drink but makes the water taste bad.

The company said they held Community Consultative Committee (CCC) meetings once a month at each of the 16 towns and villages in the mining area but none of the people we interviewed, knew about the meetings. The company also said they followed up on complaints within 2 weeks but people within the community did not agree. Better communication between the company and the community is needed here to improve this relationship.