2.0 PROJECT DESCRIPTION

As indicated in **Section 1.0** (*Introduction*)**,** the Company proposes to develop a gold mine at the Akyem Gold Mining Project (Project) site in the Birim North District of the Eastern Region of Ghana. The primary components associated with the proposed Project are illustrated on **Figure 2-1** and include:

- An open pit,
- Waste rock disposal facility,
- An explosives storage facility,
- A mill and processing plant and attendant administrative offices,
- Sodium cyanide recovery system,
- A water storage facility that is fed by water derived through a pumping station and pipeline routed from the Pra River,
- A tailings storage facility,
- Sediment control structures and surface water diversions and
- Ancillary facilities (haul and access roads, equipment maintenance facilities, employee accommodation camps and other related mine service facilities).

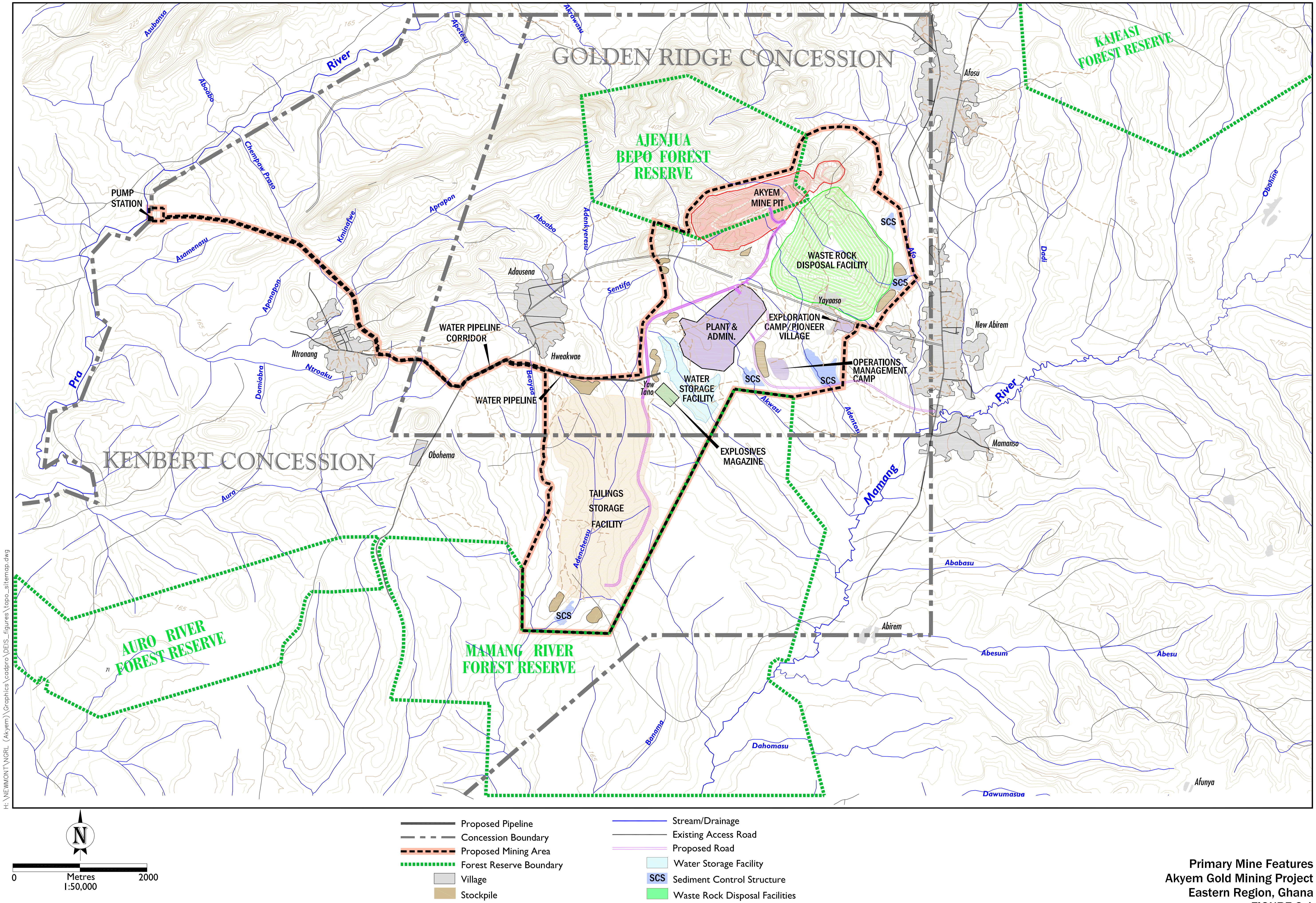
The proposed Project would involve extraction of gold ore from the Golden Ridge and Kenbert Concession areas located in the Birim North District **(Figure 2-1)**. Current reserves associated with the Project are estimated at 116 million metric tonnes of ore containing approximately 7.7 million ounces of gold. On completion of mining, the proposed closure and decommissioning plan involves recovery of waste rock from the disposal facility and placement in approximately half the length of the pit such that less than one kilometre of open pit (along its long axis) remains at full build-out of the Project.

The proposed Project falls under the category of Mining in a Production Forest Reserve. Relevant guidelines pertaining to this Project category will be followed, including minimising disturbance of land, minimising displacement of people and reclaiming disturbed areas.

The total Proposed Mining Area would consist of 1,903 hectares of development area that includes 475 hectares of designated buffer zones and controlled farm land which would not be impacted by surface disturbances. Within the proposed development area, actual open pit disturbance within the Ajenjua Bepo Forest Reserve would be approximately 74 hectares, or approximately 13 percent of the total Reserve. The Proposed Mining Area boundary that encompasses the proposed mine-related surface disturbances, including surrounding buffer zones, is shown on **Figure 2-1**. Proposed surface area requirements associated with the primary mine components are summarized in **Table 2-1**.

2.1 PRIMARY PROJECT COMPONENTS

The proposed Project would include an Initial Phase that would involve site clearing and erection of camps to accommodate construction workers, a Construction Phase during which the primary features associated with the Project would be installed and constructed,



Primary Mine Features
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE 2-1

and an Operational Phase when mining and ore processing would occur. It is expected the former two phases would be completed in approximately 30 months while the latter phase would be ongoing for 12 to 13 years beyond the Initial and Construction phases. The post-mining phase of the project is described in **Section 8.0** (*Closure and Decommissioning*). The primary components associated with the Initial, Construction and Operational phases of the proposed Project are described below. Additional information regarding several of the proposed mine components and processes is included in **Annex B**.

TABLE 2-1
Surface Area Requirements by Primary Project Component
Akyem Gold Mining Project

Project Component	Hectares (approx.)
Open Pit	139
Waste Rock Disposal Facility	246
Tailings Storage Facility	419
Water Storage Facility	56
Water Pipeline Corridor from Pra River (8.5 kilometres long x 20 metres wide)	17
Sediment Control Ditches and Sediment Control Structures	35
Process Plant, Mill, Administrative Offices, Mine Services (Warehouse, Vehicle and Equip. Maintenance Shop, Explosives Magazine, Laboratory, Fuel Station, First-aid Clinic)	85
Haul and Access Roads	21
ROM PAD	5
Laydown Yards, Topsoil Stockpile, Sand Borrow, Power Line Corridors and Other Potentially Disturbed Areas (1)	397
Operations Management Camp	8
Subtotal Mine-Related Disturbance	**1,428**
Buffer Zone(2)	15
Other Undisturbed Areas within Proposed Mining Area	460
Total	**1,903**

(1) "Other potentially disturbed areas" include those areas within the Proposed Mining Area that cannot be ascribed to a particular mine or process feature but that will possibly be disturbed at some time during Project development.
(2) Buffer zone includes the area between western open pit and the ABFR (50 metres wide).

2.1.1 INITIAL PHASE

During this phase of the Project, several activities would be conducted to plan for and prepare the Proposed Mining Area for actual on-site construction of mine and mill facilities. The more significant of these include planning access to the site for supplies and materials to be used in the Construction Phase of the Project as well as initially clearing the land of vegetation and constructing initial accommodations for construction workers.

SITE ACCESS

The port of entry for the Project would be in Tema, located 20 kilometres east of Accra. Goods and supplies would be transported on the major road from Accra to Kumasi which passes through Nkawkaw, located 40 kilometres northeast of the Project. The road from Nkawkaw to New Abirem, near the Proposed Mining Area, is sealed with tar and in relatively good condition.

SITE CLEARING AND INITIAL CAMP CONSTRUCTION

Site preparation in support of Project development includes construction of access roads, removal of merchantable timber, clearing, grubbing and salvaging growth media (top soil and subsoil) for future use in reclamation. A Preliminary Site Clearance Plan is included in **Annex B-1** and is summarized in **Section 7.0 (***Provisional Environmental Management Plan*). Construction of camps to house workers would also be among the initial activities to be completed. During early development stages of the Project, removal of timber resources would occur both inside and outside of the portion of the Ajenjua Bepo Forest Reserve to be impacted by the development of the open pit. The Company would conduct timber removal in accordance with Ghanaian regulations and requirements and would strive to maximize the utilization of this resource.

To determine the necessary steps and procedures for timber removal, the Company has had several formal meetings with the Forest Services Division personnel at the district level and an informal meeting with the Forest Services Division Regional Manager and Director of Operations. The notes from the formal meetings are provided in **Annex B-2** as is the agreed upon approach to conducting timber removal within the Proposed Mining Area. Additionally, the Company has reached an agreement for the enumeration and inventory of timber resources with the District Forest Services Division Office. This agreement is likewise included in **Annex B-2**.

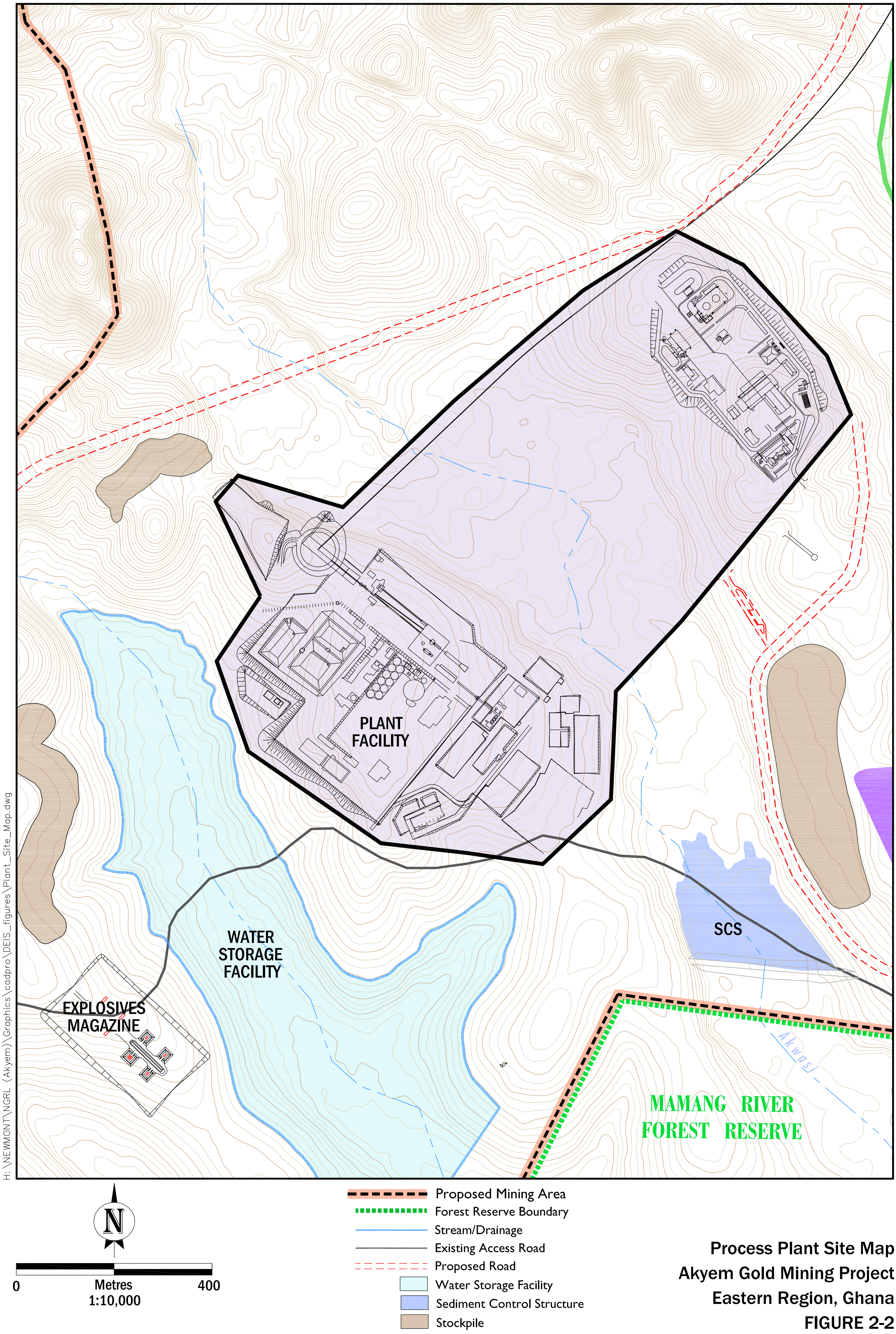
2.1.2 CONSTRUCTION PHASE

During the Construction Phase of the Project, all components of the development needed to accommodate ore processing and waste rock disposal would be installed. Operations at these facilities would commence once these components are functional, have been inspected, and have met established commissioning requirements. These major components have been segregated by those associated with processing and water management operations as well as facilities that are ancillary to the overall Project.

PROCESSING FACILITIES

Processing Plant

The Processing Plant would be designed to process 8.8 million metric tonnes of ore annually consisting of both run-of-mine (ROM) primary and oxide ore. A map of the Processing Plant and mill site is shown on **Figure 2-2**. The Processing Plant would treat a blend of oxide and primary ores during the initial period of operation. The oxide reserves would be fully processed by about year 3 of operations after which only primary ore would be



Process Plant Site Map
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE 2-2

processed. Physical characteristics of ore, the presence of free milling gold and metallurgical test work were used to develop an ore processing plant flow-sheet design **(Figure 2-3)**. In general, the process includes primary and secondary crushers, a semi-autogenous grinding (SAG) mill, hydrocyclones (to size the materials), a ball mill, leach-feed thickening tanks, a Carbon-in-Leach (CIL) circuit (to dissolve the gold), cyanide recovery circuit, carbon recovery systems and a stripping/refining facility (to produce the gold product). The recovered gold would be stored in a room that is protected by various surveillance and security systems prior to shipment of the gold off-site. Additional information regarding the process the Company proposes to use to extract gold from the ore is included in **Annex B-3**.

The process plant would be constructed and operated to minimise cyanide use to the extent possible, thereby limiting concentrations of cyanide in the mill tailings and process solution ponds. Several measures (e.g., management of cyanide concentration in process solutions, fencing, hazing) would be taken at all facilities to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions. A generalized description of the cyanide management and treatment programme is included in **Annex B-4**.

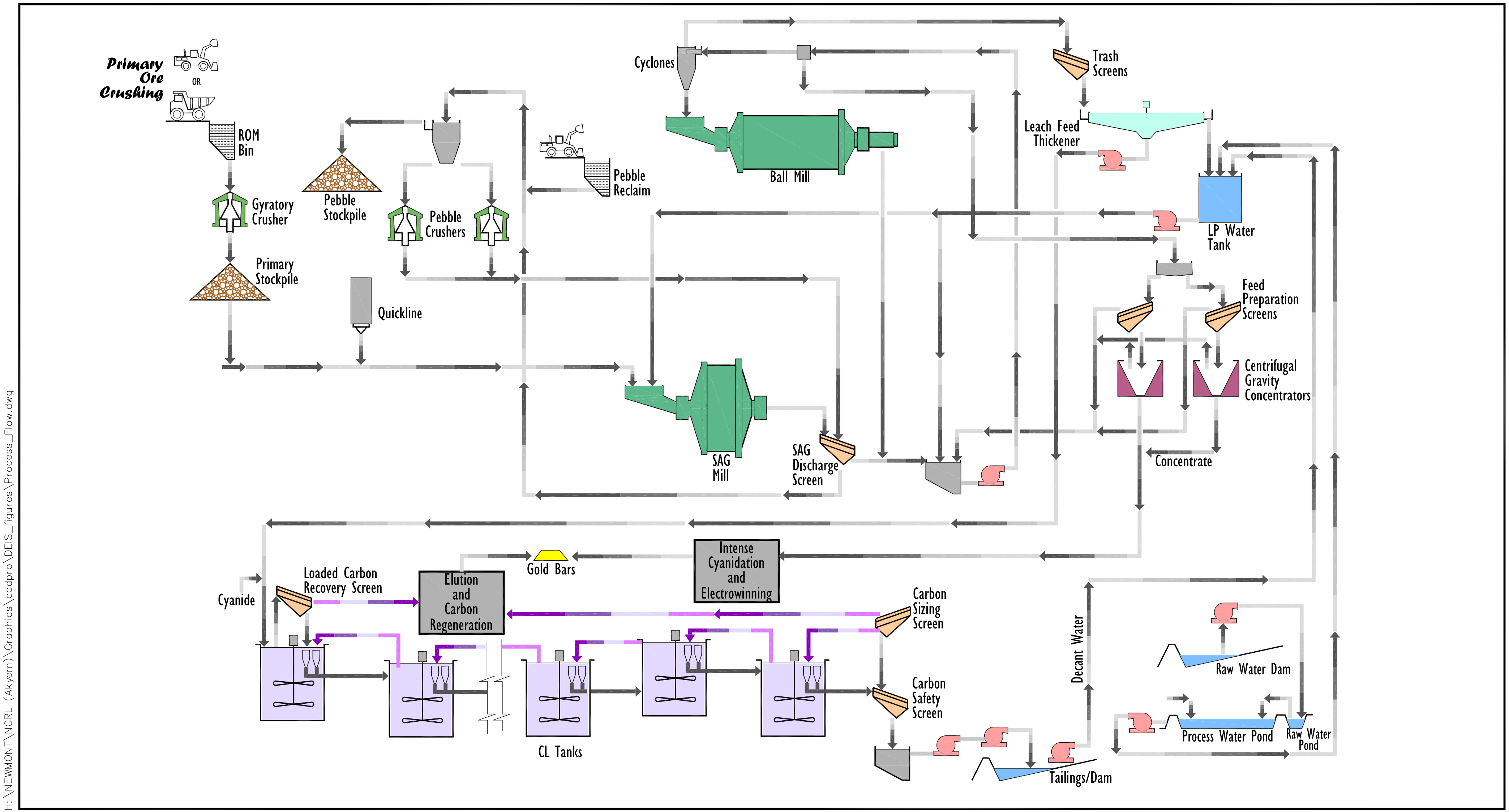
Tailings Storage Facility

The Tailings Storage Facility would be constructed initially as a cross-valley storage facility and located as shown on **Figure 2-1**. As the tailings impoundment increases in size over time, the facility would have embankments constructed to contain tailings on all four sides of the impoundment **(Figure 2-4)**. Tailings would be delivered to the storage facility via an aboveground pipe placed in a high-density polyethylene- (HDPE-) lined trench.

A pipe containing decant return solution from the supernatant pond would be placed parallel to the tailings pipeline in the same lined trench. A HDPE- lined event pond would be constructed to accommodate tailings and/or decant return solution in the event of a pipeline rupture. The Tailings Storage Facility would be developed to be state-of-the-practice, using rotational, subareal tailings deposition and would be designed, constructed and operated in accordance with the Company's Standards for Tailings Management (proprietary information) and relevant sections of the Minerals and Mining Act (2006) and Ghana Mining and Environmental Guidelines (1996) which govern design, construction, operation and closure of mining facilities. The general construction method for the facility would be as follows:

- Initially, the proposed tailings basin would be prepared for construction by salvaging timber, clearing and grubbing the surface of vegetation and then stripping and stockpiling topsoil. Throughout most of the basin, this would typically leave a surface of modest relief composed of saprolite (weathered in-place bedrock consisting predominantly of clay and quartz) that ranges from 5 to 40 metres in thickness. The upper surface of saprolite would be scarified and compacted.

- In some parts of the basin, there would be a natural drainage network consisting of fluvial channels underlain by higher permeability alluvial sand and gravel. Throughout the proposed tailings basin, this drainage network of alluvial material would be trenched to a depth of approximately one metre and a system of interconnected



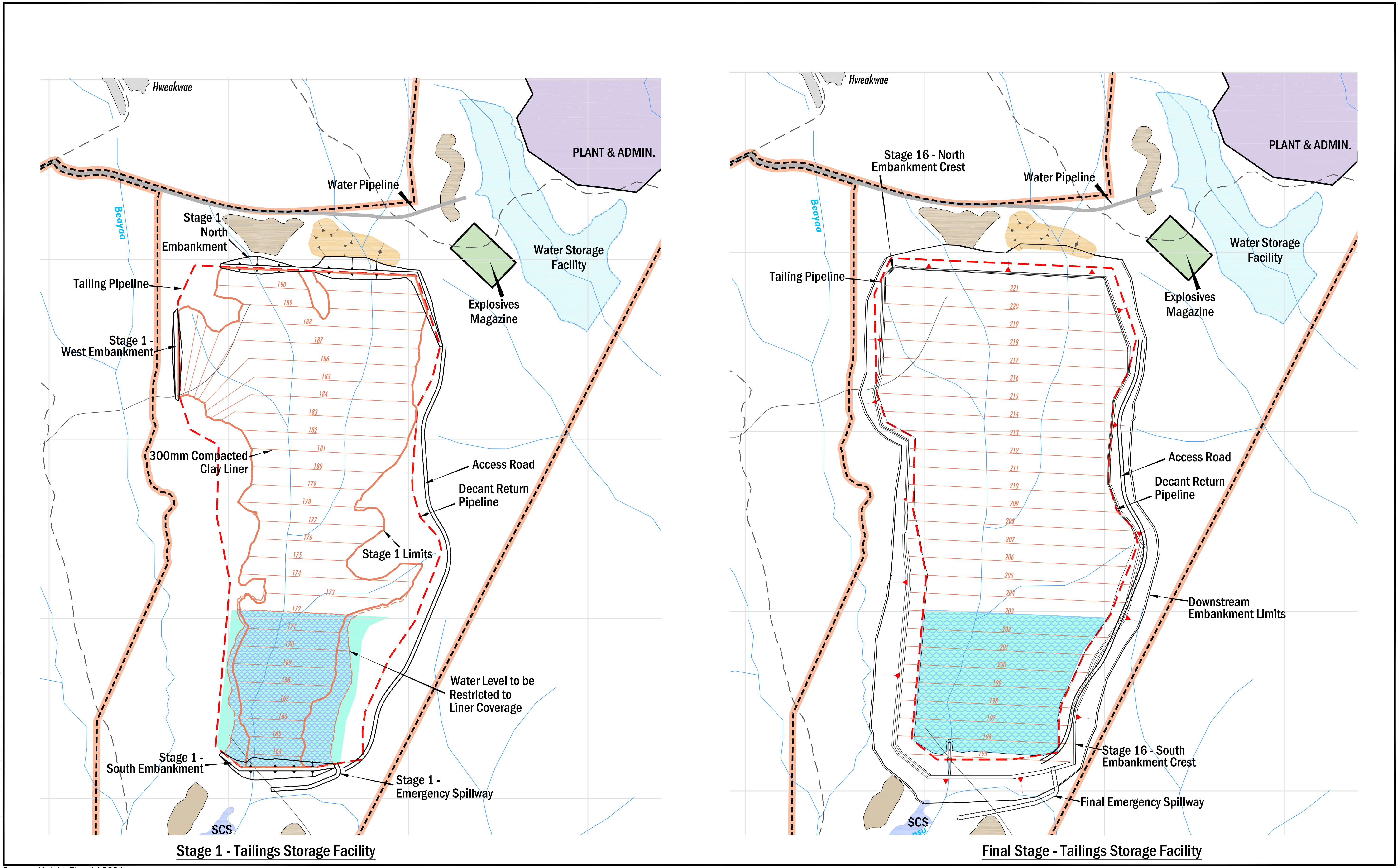
Pump

Cyanide

Carbon

Splitter Box

Process Flow Diagram
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE 2-3



Source: Knight Piesold 2004

N

0 Metres 1000
1:20,000

- Tailings Beach Contours (metres above mean sea level)
- Stream/Drainage
- Existing Access Road
- New Haul Road
- Proposed Mining Area
- Extent of 1.5mm HDPE Liner
- 1:25 Yr. Supernatant Pond Area
- Water Storage Facilities
- Sediment Control Structures
- Stockpile
- Dump

Tailings Storage Facility for Stages 1 and 16
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE 2-4

H:\NEWMONT\NGRL (Akyem)\Graphics\cadpro\DEIS_figures\TSF_Layout_Stage1_16.dwg slotted drain pipe would be placed in the lined trenches and covered with a filter fabric. The drainage trenches would then be backfilled with sand. This network of pipes would flow to an HDPE-lined collection basin constructed in alluvial sand/gravel near the upstream end of the southern tailings embankment.

- A low permeability cutoff wall would be constructed immediately downstream of the collection basin to control downstream migration of water through or under the southern embankment from the collection basin or the tailings impoundment. Cutoff trenches would be excavated through alluvial material into the underlying saprolite foundation material beneath the upstream toe of all embankments.

- Cutoff walls would be raised with each additional lift of the embankments to ultimate height of the Tailings Storage Facility. The downstream collection basin for the under-drain system would have a pump-back tower constructed into the basin to allow solution to be pumped back to the supernatant tailings pond or plant facility. The combination of under-drain piping network, collection basin, and pump-back systems is collectively referred to as the Leachate Collection Recovery System (LCRS). The LCRS collects seepage from below the tailings facility liner system should a leak occur or excess seepage be detected. This system is described in greater detail in **Annex B-5**.

- The tailings impoundment would be designed to contain the volume of precipitation associated with a 100-year, 24-hour storm event without spillage. Run-on diversion ditch systems would divert water upstream of the tailings impoundment around the facility.

The facility would be designed and operated with all water returned for use in the ore processing circuit and no water discharged to the environment. The entire facility would be surrounded by a one metre mesh/barbed wire fence to prevent access by fauna and domestic livestock. Design criteria for the tailings storage facility are presented in **Table 2-2**.

Chemical and Reagent Requirements

Operation of the processing plant will require the use of various chemicals and reagents to both support gold extraction and to operate equipment at the plant site. The primary chemicals and reagents to be used at the facility include:

- Lime – Quicklime would be delivered in 20 or 40 tonne road tankers which would be pneumatically unloaded directly to a 400 tonne silo. The quicklime would then be metered from the silo onto the SAG mill feed conveyor.

- Sodium Cyanide – This compound would be delivered to the site by road trains containing two bulk isotainers, each containing approximately 22 tonnes of cyanide. Each isotainer would be sequentially connected to the on-site sparging tank which would be filled with barren eluate or process water. The water would then be circulated through the sparge tank container to dissolve the sodium cyanide.

TABLE 2-2 Design Criteria for Tailings Storage Facility Akyem Gold Mining Project	
Component	**Criteria**
Total Capacity	141 million dry tonnes
Annual Production Rate	8.5 million dry tonnes
Tailings % Solids in Plant Discharge	
Oxide Ore	Varies from 90% to 100%
Primary Ore	Varies from 10% to 100%
Base Permeability	
Lined Areas Under Solids	1 x 10^{-6} cm/sec
Lined Areas under Supernatant Pond	Approx. 1 x 10^{-12} cm/sec. (equivalent to untreated concrete)
Tailings Solid Density	
Oxide Ore	2.73 tm^3
Primary Ore	2.77 tm^3
Tailings Settled Density	1.0 – 1.3 tm^3
Tailings Final Dry Density	1.4 – 1.5 tm^3

gcm^3 = grams per cubic centimetre; tm^3 = tonnes per cubic metre; cm/sec= centimetres per second.
Source: Lycopodium (2004).

- Caustic – Caustic would be delivered in 1 tonne bags which would be lifted by monorail hoist to an enclosed bag breaker above a caustic mixing and storage tank. The caustic would be mixed with raw water for use in the process.

- Hydrochloric Acid – This acid would be delivered in bulk 20 kilolitre isotainers and would be pumped into a concentrated acid storage tank. The concentrated acid would be transferred from the concentrated acid storage tank to the dilute acid storage tank on a batch basis. Raw water would be added to achieve a 3 percent concentration.

- Activated Carbon – Fresh activated carbon would be delivered in 500 kilogram bulk bags which would be lifted by monorail to the chute above the regenerated carbon transfer vessel/quench tank. Fresh carbon would then be pumped to the carbon sizing screen to remove carbon fines before adding it to the processing circuit.

- Flocculant – Flocculant would be received in 1 tonne bags and manually added to the dry hopper of a package mixing plant. The powder would be pneumatically fed to a cyclone mixer and mixed to the desired solution strength before transferring into an aging tank. The flocculant would then be diluted to a solution strength of 0.025 w/v prior to adding to the thickener feed.

- Hydrogen Peroxide – This chemical would be stored in three 24 kilolitre bottom unloading ISO containers. A skid mounted pump set would be used to dose hydrogen peroxide at the required rate.

- SAG Mill Balls – The 125 millimetre SAG mill grinding media would be delivered in bulk and stored in the SAG ball bunker. SAG balls would be loaded into the SAG ball feeder storage hopper by front end loader. SAG balls would be metered onto the SAG mill feed conveyor.

- Ball Mill Balls – The 80 millimetre and 65 millimetre ball mill grinding media would be delivered in bulk and stored in the ball mill ball bunker which would be located on the periphery of the grinding building. Grinding media would be charged to the ball mill using an electromagnet suspended on a hoist and contained within a stainless steel tube. Balls would be picked up from the bunker, lifted to the ball charging level and dropped into a ball charging chute and pipe that would direct the balls into the ball mill feed distribution box and into the ball mill.

Systems and plans would be put place to manage these and all other chemicals and reagents used at the facility to ensure protection of workers at the plant and the environment. A Spill Prevention, Control and Response Plan would guide the management of these chemicals and reagents as well as define necessary worker training programs to be implemented at the site.

Cyanide Management

The Company would adhere to strict protocols in handling and managing sodium cyanide to prevent excursions to the environment. Several mitigations are offered to prevent accidental releases of sodium cyanide or respond in the event of a release.

- The Company is a signatory to the International Cyanide Management Institute (ICMI) Code and abides by this code relating to cyanide production, transport, handling and storage, mining operations and decommissioning, worker safety, emergency response, training, and public consultation and disclosure. An independent Institute oversees responsible use of cyanide by users world-wide and conducts routine audits of participating companies. The Company would seek to certify the Project under the ICMI Code requirements and continue its participation in audits conducted by the ICMI for the Project. The Company would develop and implement a cyanide management plan that adheres to all the requirements of the ICMI code. (See **Annex B-4**).

- Sodium cyanide would be transported in dry form only, and in special isotainers.

- The countercurrent decantation process designed for the Project, and currently installed at other mine facilities in Ghana, uses rinse water in multi-stage thickeners to reduce the cyanide concentrations in the tailings. The system recovers and recycles cyanide in the plant, as well as providing recovery at the end of process due to increased residence time. Implementation of this system would decrease the concentrations of cyanide in the Tailings Storage Facility to ensure protection of human health and the environment.

- The Company would maintain a supply of calcium hypochlorite or similar chemical for detoxification of cyanide. Calcium hypochlorite is an oxidant and this chemical is commonly used to oxidize cyanide resulting in breaking the carbon/nitrogen bond that forms cyanide.

- Pipelines transporting sodium cyanide solutions near the processing plant would be constructed within trenches that are lined with a geosynthetic plastic to provide secondary containment that would capture any spills or leaks that may occur.

- Measures that could be used to protect wildlife in the tailings storage facility include maintenance of cyanide concentrations at levels below that considered to affect wildlife (50 milligrams per litre). Mitigation measures that would be affective in reducing wildlife contact with the tailings area include hazing programs and installation of predator decoys.

- The design for the Tailings Storage Facility incorporates special liners that prohibit downward migration of cyanide in the tailings, effectively preventing movement into the underlying groundwater system.

- Pump-back wells would be installed prior to placement of tailings in the storage facility to provide a means to arrest contaminated groundwater from the Tailings Storage Facility should the need arise.

Waste Management

Several types of waste will be generated during operations associated with the Project. These include lubricants, diesel fuel, oily water, containers and drums, sewage, solid waste, explosives, chemicals (beyond those described above) and medical waste. More detailed descriptions of these waste types as well as a generalized plan for managing the wastes is included in **Annex B-6**.

WATER MANAGEMENT FACILITIES

Water Storage Facility

A Water Storage Facility, covering an area of approximately 56 hectares and with a design capacity of 2.29 million cubic metres, would be constructed between the Process Plant and Tailings Storage Facility **(Figure 2-1)**. A separate but much smaller water pond would also be constructed adjacent to the plant site. Water from these impoundments would be used for elution, reagent make-up, cooling and process water make-up.

Pra River Pipeline

An amount of water, governed by an abstraction permit to be issued by the Water Resources Commission, would be pumped from the Pra River to the Water Storage Facility during the wet seasons (late-March to late-July, and late-September to mid-November) and routed to the processing plant for subsequent use in the mill and for other uses. Pumping would be conducted at rates and in a manner to ensure there would be no impacts on aquatic resources. The pipeline would extend approximately 8.5 kilometres from the Pra River to the processing plant (**Figure 2-1)**. A construction corridor would be required to facilitate placement of the pipeline, a new access road and an overhead power line. A possible alternative to constructing this pipeline is use of water recovered through dewatering activities associated with mine pit development. The Company has plans to install test wells within the next few months to determine if this source of make-up water is feasible.

Sediment Control Structures

Sediment Control Structures would serve an integral function in the storm water management plan for the Project. A total of five structures (under waste rock disposal Scenarios B and C, **Section 2.1.3**, *Operational Phase*) would be located to form relatively small basins to collect sediment and runoff from upstream construction and mining activity sites **(Figure 2-1)**. Impounded water would be used for dust suppression or released to natural drainages, provided water quality in the basins meets applicable discharge standards. If water quality issues are identified, water from the Sediment Control Structures may be used as makeup water in the ore processing circuits or would be treated to meet appropriate water quality standards and discharged. Sediment would be periodically removed from these basins and stockpiled for later use in site reclamation.

Surface Water Diversion System

Surface water diversion systems or channels would be constructed, as necessary, to intercept and divert natural run-on water from flowing into/onto the mine pit, tailings storage facility, waste rock disposal facility and ore stockpiles. These channels would divert natural run-on water from precipitation back into natural drainages downgradient from disturbed areas or into Sediment Control Structures or other small sediment catchment basins as needed. The intent of the diversion system design is to minimise the amount of water retained in sediment catchment basins and maximise the amount of water that is returned to the natural drainages. The design criteria for surface water management ditches and diversions would be based on the following:

- Runoff Quantities for Permanent Structures - Designs for drainage areas greater than 10 hectares would ensure the 25-year, 24-hour flood, as determined by computer models, can be sustained by the system.

- Runoff Quantities for Temporary Structures (less than one year life) – The design criteria for drainage areas greater than 20 hectares would use 10-year, 24-hour flood, as determined by HEC-1 SedCAD computer models or the rational formula. More intense storm events may be required if the severity of failure is high.

An explanation of the Company's process to account for water sources and needs associated with the Project through development of a water balance for the facilities and associated modelling are included in **Annex B-7**.

ANCILLARY FACILITIES

Ancillary facilities associated with the Project would include a laboratory, warehouse, equipment fuelling and maintenance area, topsoil stockpiles, explosives magazine, mine services area, utilities and worker accommodation facilities. The mine services area would be located north of the plant site and include the administration office, security post, first aid clinic, heavy equipment workshop, light vehicle workshop, tyre shop, wash down bay, water services and mine control facilities **(Figure 2-1)**.

Electrical Power

Approximately 2.7 MVA of electrical power would be required during construction for the Project. Power would be supplied from an existing Electricity Company of Ghana 34.5 kV overhead line system connecting Nkawkaw and Kwae. A section of this line is adjacent to the road between New Abirem and Adausena, which crosses the Proposed Mining Area.

The main operations power supply would be provided by a dedicated 161 kV line routed to the site from the Volta River Authority's Nkawkaw substation located approximately 50 kilometres northeast of the plant site. The new power line would be constructed parallel to the existing 34.5 kV line described above. A 161/11 kV substation would be constructed at the mine site and power distributed over 11 kV lines from the substation. The 11 kV rated power distribution system would be used to reticulate power to the various plant area substations and large motor drives, and the services from two centrally located separate high voltage switchboards, which would be interconnected at completion of the construction phase.

Emergency power for essential services would be provided by diesel generators for the plant site and the Operations Management Camp.

Medical Unit

A clinic would be constructed as part of the construction camps and would be retained through the life-of-mine. The medical clinic would provide first-aid and medical treatment for workers supporting the Project. An ambulance would also be acquired for use at the mine site.

General and Mine Administration

A general and mine administration building would be constructed adjacent to the process plant. The structure would be provided with potable water, electricity and amenities connected to a sewage treatment plant. Offices for mine equipment maintenance personnel and contractors would be provided at the mine workshop.

Plant Warehouse, Workshop and Administration

The plant workshop, warehouse and administration building would be located within the plant security area. Facilities would include an electrical and machine shop area, a tools and rigger store and a receiving area.

Explosives Magazine

An explosives magazine would be located between the Tailings Storage Facility and Processing Plant area (**Figure 2-1**). The site would be fenced, bermed and lighted with 24-hour security and operated in accordance with Explosive Regulation 1970, L.I. 666. The explosives magazine would be constructed with adequate containment, drainage and environmental controls to prevent accidental release of materials to the environment.

Fuel Services

Fuel needed to support operations at the Project site would include the following:

- 2 fuel unloading pumps,
- 2 diesel storage tanks each of 1000 cubic metres capacity,
- 2 heavy vehicle fuel dispensing pumps and bowsers,
- 1 light vehicle fuel dispensing pump and bowser,
- 2 fuel transfer pumps to the plant area,
- Concrete pads for fuel unloading from road tankers and refuelling vehicles,
- Concrete bunded area for the storage tanks and
- 1 sump pump which will discharge to a oil/water separator.

The access roads to the refuelling station will be configured such that the travel paths of the mining fleet and road tankers/light vehicles do not cross. A Spill Prevention, Control and Response Plan would guide the management of fuel used at the site as well as define necessary worker training programs to be implemented at the site.

Fire Services

Water for fire suppression would be obtained from the water storage pond at the plant site. A diesel-driven pump would start automatically on loss of water pressure to provide a secure fire service to the plant area, mine service area and accommodation villages.

Laboratory

A minerals assay laboratory would be constructed within the general administration area. Laboratory facilities would include:

- Sample preparation area for mill and grade control,
- Offices,
- Metallurgical laboratory,
- Environmental laboratory,
- Fire assay area,
- Balance room,
- Wet chemical laboratory,
- Lunch room and toilets and
- Chemical store.

Security

Four levels of security would be employed across the site:

- **Low-level security** would consist of manned security huts and boom gates to control vehicle access to the Proposed Mining Area.

- **Medium level security** would consist of security fencing around key project infrastructure facilities with security huts, boom gates, and turnstiles to control vehicle and personnel access. Areas encompassed by medium security include the mine workshop, and administration buildings.

- **High-level security** would be comprised of a double security fence, with digital closed-circuit cameras to monitor access to the treatment plant and associated facilities. Access would be limited to plant personnel via the main security and change house facility.

- **Maximum security** would include an additional security fence, manned security room, electronic access, and digital closed-circuit cameras to monitor the gold room building. Access would be limited to gold room personnel and senior management only.

Accommodations

Accommodation facilities for the Project would include:

- Exploration Camp,
- Construction Camps,
- Security Camp and
- Operations Management Camp.

The first contractors on site would be camp construction and earthmoving contractors. These contractors would likely rent accommodation in nearby settlements for their workforce. The Company's construction management team would be temporarily housed at the existing Exploration Camp until the Construction Camp becomes available.

Two construction camps are proposed. One would house construction employees holding trade classification or above and would be located adjacent to the proposed process plant site. It would be sized to accommodate 200 to 250 persons, with provision to expand to house 300 persons if required. The second would also be located adjacent to the proposed process plant site to accommodate construction contractors (skilled and semi-skilled labour) and be built as a temporary facility to be removed at completion of the Project construction phase.

The Security Camp would be located adjacent to the construction camps and house approximately 150 security personnel.

The Operations Management Camp would be located immediately southeast of the plant site and would also be used for construction accommodation as it becomes available. This accommodation would consist of 30 to 40 houses. As operations personnel are mobilized to the site, they would be housed in the construction camp or village, depending on availability of rooms.

Sewage Treatment Plant

Sewage waste streams originate as effluent from bathroom facilities, laundry facilities and kitchen operations. Kitchen grease will be removed by grease traps prior to discharge of the water into the sanitary waste water system. Grease will be mixed with absorbent material and managed as a solid waste.

Sewage generated within the Proposed Mining Area (plant, mine administration, exploration and construction camps, Pioneer Village, Operations Management Camp) will be drained and pumped to package sewage treatment plants for treatment. Effluent from the treatment plant(s) will not be discharged into watercourses. Effluent will be tested to demonstrate the treatment systems are functioning as designed and meet applicable discharge requirements. Treated effluent will be discharged to the Tailings Storage Facility.

If during construction the need for remote facilities arises, these situations will be addressed by either through installation of properly designed and installed septic tanks or use of mobile units. Effluent from mobile units will be discharged into the package sewage treatment plants and disposed as described above.

2.1.3 OPERATIONAL PHASE

Mining associated with the Project would be conducted to optimize the extraction of the ore reserve and minimise impacts to people in the area and the environment. Given current financial conditions and the state of knowledge regarding the ore body associated with the Project, the Company proposes to remove a total of 512 million metric tonnes of material, including 116 million metric tonnes of ore and approximately 396 million metric tonnes of waste rock to recover approximately 7.7 million ounces of gold. Mining would occur at an average rate of approximately 38.5 million metric tonnes per year (up to 8.8 million metric tonnes of ore and 29.7 million metric tonnes of waste rock annually) to produce approximately 0.5 million ounces gold annually over a 15-year mine life. The rate at which mining occurs will be less than the average of 38.5 million metric tonnes per year during the early and latter stages of mine development and higher than the average during the middle years of operation.

Open Pit

The proposed open pit would be an elongated structure containing a larger western lobe and a much smaller eastern lobe, connected near the surface. The combined lengths of the lobes would be approximately 2,560 metres and the pits would cover an area of approximately 139 hectares. The ultimate dimensions of the western lobe of the pit at full build-out would be approximately 1,920 metres long, 900 metres wide and 480 metres deep (maximum depth) **(Figure 2-1)**. Approximately 74 hectares of the overall pit would be located in the Ajenjua Bepo Forest Reserve. Ore and waste rock would be drilled and blasted in benches that are developed sequentially to facilitate loading and hauling from the pit. Benches would be established at approximately 4- to 6-metre vertical intervals with working bench widths varying from 40 to 100 metres including safety berms and haul roads. Blasted ore and waste rock would be loaded into 150-tonne off-road, end-dump haul trucks using 16 cubic metre shovels, backhoes and 11 cubic metre front-end loaders.

Haul trucks would move within the pit using roads on the surface of benches with ramps extending between two or more benches. Water resulting from precipitation falling within the pit would flow to a sump in the bottom of the mine pit and be pumped to surface storage facilities for use in processing or dust suppression during operations. Groundwater inflows to the pit would be largely intercepted using dewatering wells with the minor amount of groundwater that may not be intercepted by the dewatering wells collected in sumps at the base of the mine pit. All intercepted groundwater and collected precipitation would also be used for dust suppression or routed to surface storage facilities for use in processing.

Explosives used for blasting would be stored separately from other mine-related materials and supplies in a secured area located between the tailings storage facility and the processing plant facilities **(Figure 2-1)**.

Drill cuttings would be collected during blast hole drilling and analyzed to determine gold content to separate ore from waste rock. These cuttings would also be used to provide samples for metallurgical testing and ongoing geochemical characterization of the waste rock to determine the chemical characteristics of water that may come in contact with the material. The blasted rock material would then be loaded into haul trucks for transport to waste rock disposal facilities or the primary ore crushing facility.

To minimise the amount of waste rock to be disposed of in surface facilities, the Company has evaluated opportunities for maximizing concurrent waste placement in completed pit areas during operations and integration of waste placement in the pit area as part of the closure and decommissioning plan **(Section 8.0)**. Concurrent waste rock placement in the eastern pit lobe and a portion of the eastern end of the larger western open pit is feasible and would be conducted during the last 3 to 5 years of active mining operations. Concurrent waste rock placement and reclamation of this eastern lobe of the pit would provide approximately 19 hectares of useable land (under full build-out). Waste rock placement in a portion of the western open pit under full build-out (see discussion under *Waste Rock Disposal Facilities,* below) would result in reclamation of an additional 51 hectares of land surface that would be relatively flat and free-draining, resulting in a total of 70 hectares of reclaimed surface area within the combined pits. Pit closure and reclamation would be conducted in a manner to provide long-term stability of the reclaimed area, appropriate vegetative cover and proper surface water management.

Haul Roads

Haul roads developed in the Proposed Mining Area would be up to 30 metres wide (standard running width) in order to safely accommodate haul truck traffic. Efforts would be made by Project designers to reduce the widths of the haul roads to minimise land disturbance. Haul roads would be constructed with a maximum gradient of 10 percent and maintained on a continuous basis to ensure safe, efficient haulage operations and to minimise fugitive dust emissions. Haul roads would be designed to exit the pit in areas that would not impact Ajenjua Bepo Forest Reserve land. The roads would be constructed using in-situ material; however, oxide or non-acid generating mine waste rock would be used, as necessary, for construction or routine maintenance. Other roads used by lighter operations vehicles to gain access to the mine pit and various other areas proximal to the mine would be constructed to an average width of 6 metres using in-situ materials and waste rock similar to haul roads. All roads would be constructed incorporating adequate drainage and sediment controls including installation of water bars, straw bales, silt fences and/or rip rap within roadside drainages and along exposed roadsides to minimise erosion and sediment movement.

Waste Rock Disposal Facilities

Two general approaches for waste rock disposal would be associated with the open pit mining during the operational phase of the Project: (1) concurrent placement of waste rock in the relatively small eastern lobe of the mine pit as described above, and (2) disposal of waste rock in a facility outside the open pit in an engineered structure. Approximately 20 million metric tonnes of waste rock out of the total of 396 million metric tonnes would be placed in the eastern lobe of the open mine pit concurrent with mining during the last 3 to 5 years of active mining in the pit. This area would be reshaped to ensure surface runoff is routed appropriately and revegetated as part of the site reclamation. The majority of the waste rock generated during the life-of-mine (approximately 376 million metric tonnes), however, would be placed in a Waste Rock Disposal Facility located proximal to but outside the open pit area (**Figure 2-1**).

Waste rock would be placed by end-dumping down an advancing angle of repose face (1.4H:1.0V) in successive horizontal lifts of approximately 18 metres, depending on topography. Ultimately, the waste rock disposal facility would be re-contoured and reclaimed at an overall average slope of 3.0H:1.0V. Surface water runoff ditches would be constructed around the base, sides and upslope positions to divert surface water runoff away from the waste rock disposal area and into sediment control structures. The features would be reclaimed in accordance with the generalized Project closure and decommissioning plan (see **Section 8.0,** *Closure and Decommissioning*) and a more detailed closure and decommissioning plan yet to be prepared.

Waste rock characterization conducted using standard static and kinetic testing protocols indicate limited acid generation potential from the waste rock materials. Detailed information on the rock characterization studies is included in **Annex C-3** (*Geology and Geochemistry*) and **Annex D-6** *(Geology and Mineral Resources)*. The bulk of the proposed mine pit shell lies within geologic formations that exhibit acid neutralizing potential. Analysis conducted to date indicate that approximately 97% of the waste rock samples tested are non-Potentially Acid Generating (non-PAG) and these samples represent 384 out of 396 million metric tonnes of total waste rock that would be produced from the Project. The Company would continue to sample, test and classify waste rock in accordance with protocols set out in the EPA-approved Environmental Management Plan to determine acid generating potential of waste rock. Additional information on the Company's methods for evaluating Potentially Acid Generating waste rock is included in **Annex C-3**.

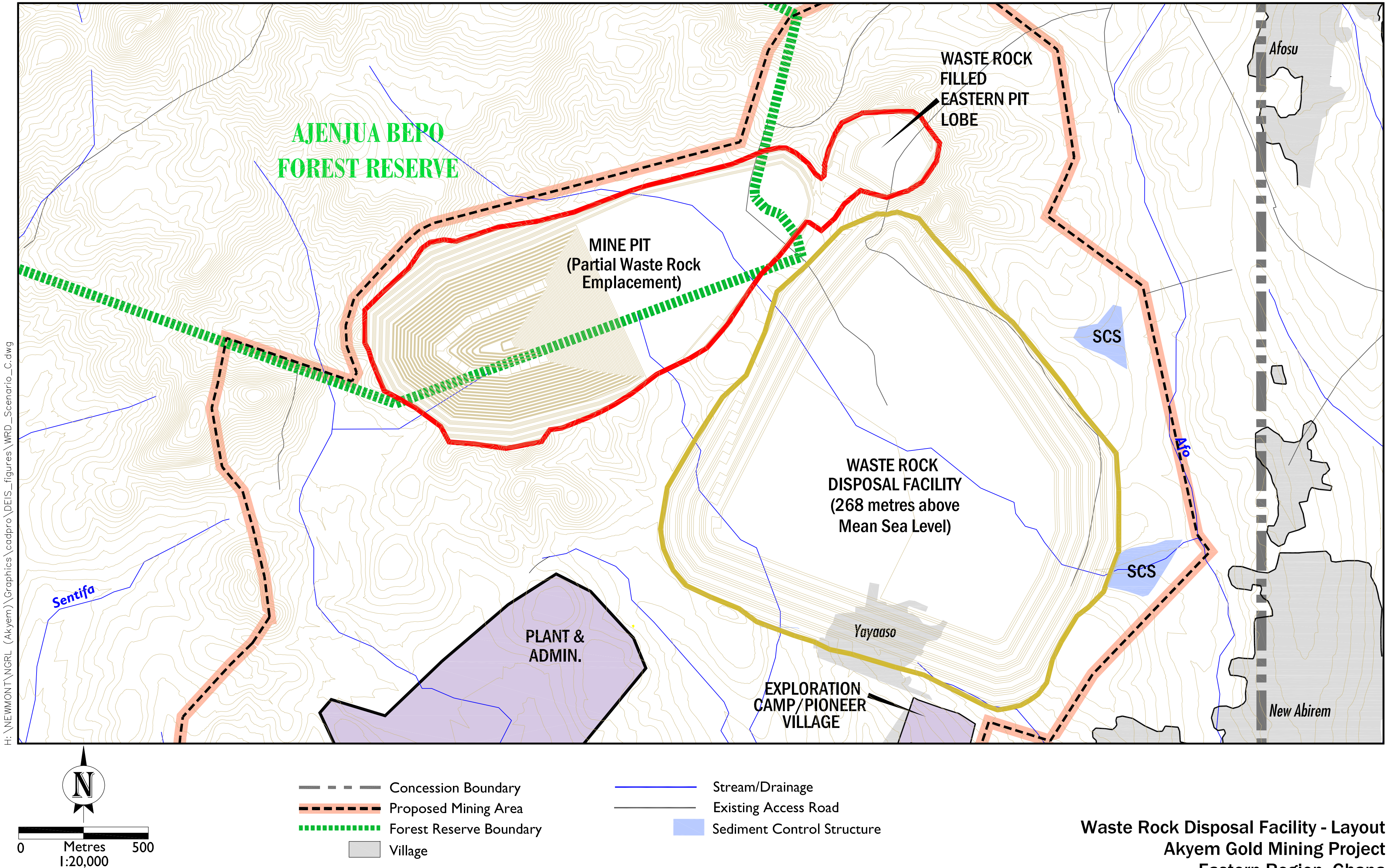
Following mining, the pit closure and decommissioning operation would involve loading haul trucks using front end loaders and other appropriate equipment and transporting waste rock via haul roads to selected disposal areas in the open pit. Placement would be conducted in a manner to provide long-term stability of the reclaimed area, establishment of a vegetative cover and surface water management. Appropriate measures (including construction of fences, posting of warning signs, and conducting periodic safety patrols) would be taken to prohibit human access to the reclaimed area and open pit.

A major component of the preliminary closure and decommissioning plan is to place waste rock in approximately one half of the larger western open pit (assuming full build-out) using waste rock obtained from the Waste Rock Disposal Facility (see **Section 8.0**, *Closure and Decommissioning*). **Figure 2-5** depicts the approximate configuration of the outcome of this plan. Waste rock placement in a portion of the open western pit would occur once the Company can demonstrate to the EPA that human health and safety and environmental conditions would not be compromised through completion of such an action. In the event placement of waste rock in the eastern portion of the western open pit is determined by EPA and area residents to be unacceptable, the Company could modify this portion of the closure and decommissioning plan to provide for an acceptable closure alternative for the open pit and waste rock disposal facility. Details of the approach for conducting waste rock placement would be presented in the final closure and decommissioning plan for the Project.

Placement of waste rock in the open pit has been identified by the Company as a key closure and decommissioning objective based on the following criteria and considerations: (1) proximity of the local population to pit area to ensure overall safety, (2) importance of maintaining agriculturally productive land proximal to local populations and (3) minimisation of the visual impacts to residents of communities located east of the mine pit. Further discussion of the basic tenets of waste rock placement in the open pit concept proposed by the Company is included in **Section 8.0** (*Closure and Decommissioning)*. The conditionality of waste rock placement in the eastern portion of the western open pit is based on ensuring long-term protection of human health (safety) and the environment. The configuration of the open pit post-closure topography would result in the long axis of the western open pit being about one kilometre, or approximately one-half the length of the western open pit that would result from full build-out.

2.2 HUMAN RESOURCE NEEDS

Construction of the Project would require up to 30 months to complete. The Company's experience indicates employment during construction would peak at approximately 3,300 workers. The short-term employment mix of construction contract workers at any one time could include up to 1,155 skilled, semi-skilled and unskilled workers from within the affected communities. Company policy dictates that unskilled labour would be recruited from within the area of mine development and construction contractors would be required to source unskilled labour locally.



Waste Rock Disposal Facility - Layout
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE 2-5

Recruitment of employees for the Project operations would focus on providing employment opportunities for local area residents. Except for positions requiring special qualifications and/or experience, employment of qualified applicants would be by the following order of priority:

- Current Project employees,
- Villages and hamlets within 5 kilometres of the Project,
- Eastern Region and
- Ghana.

From experience, the Company expects that once mining operations commence, employment associated with the Project would total approximately 3,200 permanent Ghanaian workers and approximately 100 expatriates, with 25-30 percent of the workforce coming from the local communities. Contractors would augment this workforce to provide laboratory, vehicle and equipment maintenance, catering and transport services. The Company anticipates in excess of 10,000 applicants for the limited number of positions. The recruitment and selection process would commence in the latter stages of project construction, prior to commissioning the processing plant.

The progressive transfer of management responsibilities from expatriates to Ghanaian nationals is a key corporate objective, and the number of expatriates is expected to decrease significantly by Year 5 as national staff begin to replace expatriate supervisors and managers.

In response to the need for recruiting a skilled operations labour force, the Company, in conjunction with NVTI, would develop training programmes that prepare local residents to compete for available skilled positions. The Study Area has a farming-based economy with limited regional industry and a general shortage of skilled labour. The Company recognizes that importation of required skill levels would likely have a disruptive effect on local communities resulting in undesirable social and economic pressures. In response, the Company would institute training and development programmes that would consist of the following key features:

- Maximizing local area employment opportunities where the definition of "local" would be determined during consultation with local chiefs, opinion leaders and youth leaders.

- Developing a selection process that would require trainees to be local and targeting 18 to 26 year olds. Testing would assess cognitive ability, mechanical aptitude and language comprehension.

- Creating a centralized competency based training system – this system would provide for a training needs assessment and developing and implementing training and development programmes targeted at job requirements and formal certification and accreditation.

- Constructing appropriate training workshop and classroom facilities and securing required equipment and training aids - the facility would be used for training in all areas, including safety and loss prevention, supervisory and management training, general training such as computer software, clerical and warehousing.

The Company anticipates this approach would have cost and efficiency implications, particularly at start-up, but is considered essential to achieving its social responsibility commitment. In the long-term, maximising the use of local labour resources would reduce administration costs and also costs related to relocation, accommodation and transport.

2.3 ALTERNATIVES

Alternatives to certain aspects of the proposed Project (as described above) were developed during the course of designing the mine and mill and were intended to mitigate, minimise or eliminate potential adverse environmental and/or social impacts associated with the proposed action. Alternatives not selected for further analysis were eliminated because the options were either technically or economically infeasible or provided no environmental or social advantage over the proposed Project or other alternatives. The No Action Alternative is also reviewed in this document as a basis for comparison and to describe the potential consequences if the Project were not authorized.

2.3.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the Project would not proceed at the discretion of the Company or would not be approved by government agencies. In this event, the Company would not develop the defined ore reserves, construct the Tailings Storage Facility, construct ore processing and ancillary mine facilities or place waste rock in a disposal facility. Potential impacts predicted to result from development of the Project would not occur.

Under the No Action alternative, the existing lifestyles of area residents would be maintained at current levels and social and economic development opportunities afforded by the Project would not be realized. The increased employment opportunities and enhanced incomes are anticipated to change lifestyles and create greater economic stability and security. Given the high levels of expectations for employment in the area and the associated improved standards of living, there is also likely to be high levels of disappointment. The opportunity for the Government of the Republic of Ghana to realize revenue by royalty payments, collection of income taxes or distribution of cash related to dividends would not be realized.

2.3.2 ALTERNATIVES CONSIDERED

Several alternatives were considered by the Company in their evaluations of various components of the Project, to both reduce impacts on the environment and social conditions in the Study Area and to optimize engineering aspects of the Project. A summary of the major alternatives considered follows.

ALTERNATIVE TAILINGS STORAGE FACILITY LOCATIONS

The Company considered several alternative locations for the proposed Tailings Storage Facility for the Project as presented in the Draft EIS (NGRL 2008). All locations analyzed would provide adequate storage capacity to contain the amount of tailings necessary to support the Project.

Rationale for Selecting the Proposed Alternative

All locations evaluated for the Tailings Storage Facility would result in a similar total amount of land disturbance and a comparable amount of impact to existing wetlands, groundwater resources and number of residents. The site proposed by the Company provided the greatest benefit with respect to the shortest distance to the processing plant and the furthest distance from population centres that may be impacted beyond those already impacted by the Project (e.g., Old Abirem and Obohema).

The relatively rural nature of the proposed location, distal from public roads and population centres, also provides easier control over public access and relatively better overall public safety and security. The relatively shorter travel distance (and shorter travel times) is important to the Company because the probability of traffic accidents during which deleterious substances could be released to the environment is reduced compared to the other alternatives. In addition, there are construction and operational cost savings realized by maintaining a consolidated footprint for the overall Project complex as is provided by the proposed site because of shorter hauling distance for embankment construction and tailings and return water pumping distances.

ALTERNATIVE WATER STORAGE FACILITY LOCATIONS

Seven options for location of the Water Storage Facility were evaluated during the Feasibility Study phase of project planning. The final site selected was determined based on the following criteria: (1) minimise land acquisition by compacting the Project foot print,; (2) construct only one water dam; (3) consider a design that required a 5-month pumping period from the Pra River; (4) create a design that could accommodate a total water storage of 2.29 million cubic metres; and (5) ensure the water dam and reservoir would not impact the Forest Reserve areas.

Rationale for Selecting the Proposed Alternative

Sites considered but dismissed from further analysis offered no advantage over the selected location. Some sites would have required a longer pipeline from the Pra River, while others would involve greater surface disturbance and displacement of two villages, which would have resulted in additional resettlement issues. The proximity of some alternative reservoir locations to villages was identified as a detriment by heightening public health issues due to the reservoir serving as a possible breeding environment for malaria vectors. By moving the water storage facility to its present location (between the Tailings Storage Facility and plant/administration complex) from the location proposed in the 2005 Draft EIS (GRRL 2005), approximately 75 hectares of land within the Proposed Mining Area can be utilized as controlled farmland.

ALTERNATIVE WASTE ROCK DISPOSAL AREAS DESIGN

Two general approaches were considered in designing the waste rock disposal areas for the Project. The first, which aims at minimising the disturbance footprint during construction, results in the waste rock disposal areas being constructed with more lifts and higher elevation. As a result, less land would be available for post-closure land uses such as farming and crop production because of the steepness of the reclaimed slopes. The second approach included construction of a of a lower profile waste rock disposal facility for the Project that would be increase in the number of hectares directly disturbed by the footprint of the disposal site but the lower profile would result in maximising the amount of post-closure land surface that would be amenable to accommodate post-mine farming and crop production.

Rationale for Selecting the Proposed Alternative

The preferred waste rock disposal site provides certain advantages over others evaluated including: (1) a relatively smaller area of disturbance, resulting in less land disruption and attendant impacts to the environment and croplands, while providing for a resultant height (post-closure) similar to other scenarios evaluated and (2) elimination of the need to construct a bypass road around the Western Waste Rock Disposal Facility as this facility would not be required.

ALTERNATIVE OPERATIONS MANAGEMENT CAMP LOCATION

The Operations Management Camp would be reduced in size and relocated from the previously proposed location near New Abirem.

Rationale for Selecting the Proposed Alternative

Under this alternative, the Operations Management Camp was reduced in size from 40 hectares to 8 hectares and was moved to a new location, closer to the project administration facility as compared to plans submitted in prior draft version of this EIS (GRRL 2005). This change in location for the Operations Management Camp was made to minimise the area of disturbance associated with the Project. Additionally, the preferred location, closer to the plant site, provides synergy opportunities for distribution of utilities, security and waste management.

ALTERNATIVE WATER SUPPLY

In lieu of constructing the water supply pipeline from the Pra River, as currently envisioned, it may be possible to provide adequate water for the processing plant and mill from dewatering activities associated with mine pit development. Insufficient data are currently available to determine if groundwater is available at a sufficient volume and rate to accommodate these water needs. The Company would conduct additional groundwater studies in the vicinity of the proposed mine pit to determine if such an alternative water supply is feasible. In consideration of this possibility, Company representatives have contacted the Water Resources Commission to solicit their input to this decision. It is envisaged that the information required to make this decision would be available before a commitment to construct the water supply pipeline is required.