

ANNEX B

SUPPORTING INFORMATION FOR PROPOSED PROJECT DESCRIPTION SECTION

ANNEX B-I

PRELIMINARY SITE CLEARANCE PLAN

PRELIMINARY SITE CLEARANCE PLAN

Introduction

Site preparation in support of Project development would include clearing land in advance of access road and construction worker camp installation. In completing this activity, merchantable timber, both inside and outside of the Ajenjua Bepo Forest Reserve, would be removed. Clearing, grubbing and salvaging of growth media (topsoil and subsoil) for future use in reclamation would be completed and sediment control structures, including run-on diversion ditches and run-off collection ditch systems, would be constructed.

This Preliminary Site Clearance Plan identifies the methods and locations of clearance activities that would be employed to clear land in preparation for construction of the various project components for the Akyem Project (Project). The Site Clearance Plan will be implemented in conjunction with the Company's internal Construction Environmental Management Plan (CEMP) through which engineering, operations, environmental, social and contractor personnel can interact during construction planning efforts to manage and minimise environmental effects during construction activities. The CEMP will be developed once an Environmental Permit has been received and prior to initiation of site clearing activities.

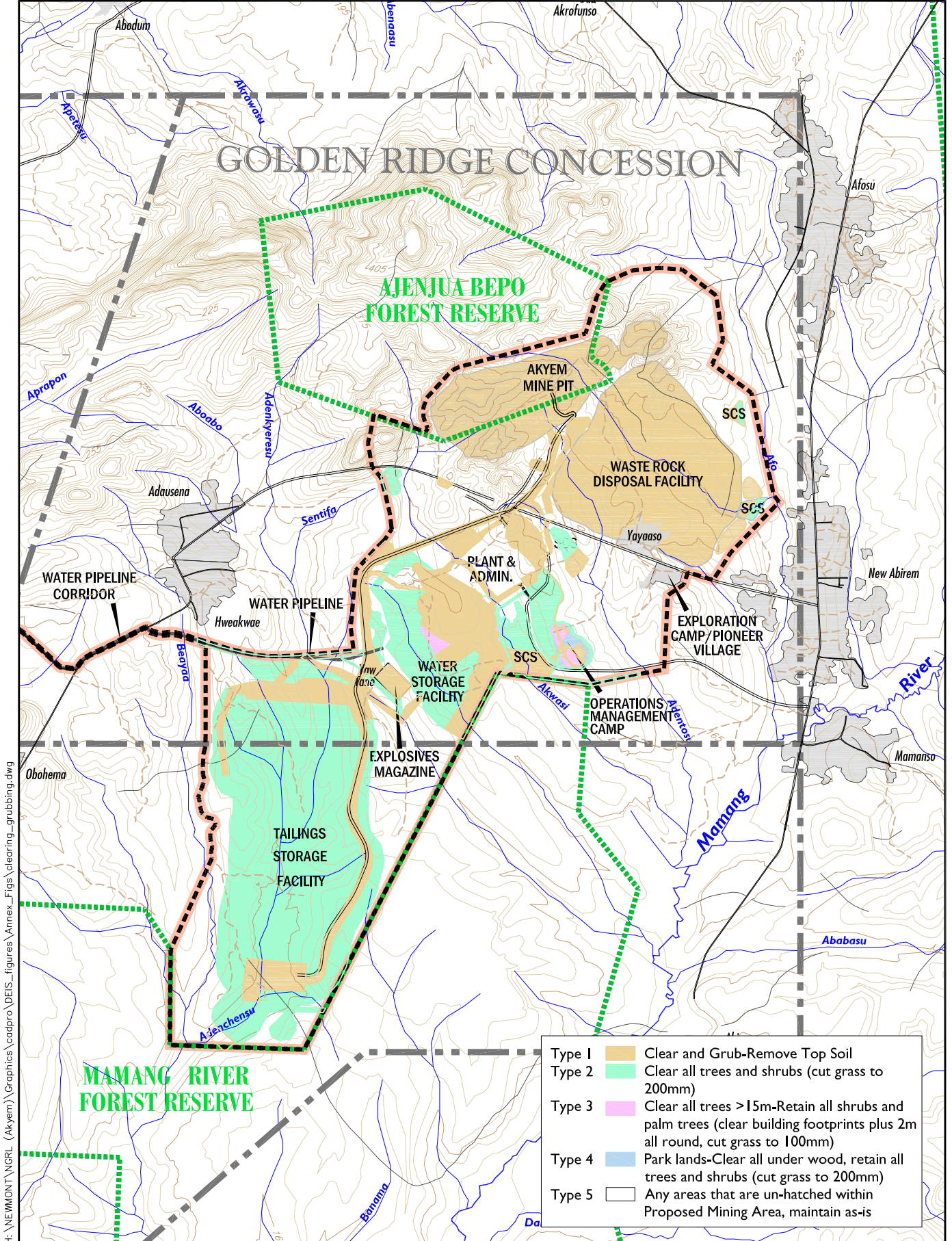
The Mining Area has been divided into specific areas at which specific types of clearing and grubbing operations will be conducted (**Figure BI-1**). A schedule for clearing will also be developed to ensure site clearance is conducted in the proper sequence to support the construction sequence.

Site Clearance Approach

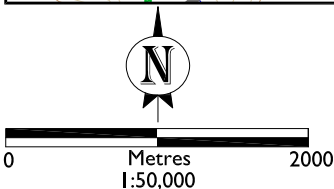
The Preliminary Site Clearance Plan will apply to all proposed mine facilities and components. These components include lay down areas for storage of construction materials, camp villages, Process Plant site, the ore pad, Sediment Control Structures, Tailings Storage Facility, Waste Rock Disposal Facility, open pit area and haul roads and access roads.

Site clearance activities include the following:

- Construction plan setup: definition of grids/work sequence, based on construction priorities,
- Implementation of BMPs (Best Management Practices) for sediment control during site clearing activities,
- Official count/classification of trees (Environmental Department) and concessionaire,
- Identification of timber logs dump zone (for commercial logs temporary stockpile),
- Tree felling and cross cutting,
- Bush clearing and grubbing; vegetation mowing,



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- Proposed Pipeline
- - - Concession Boundary
- - - Proposed Mining Area
- Forest Reserve Boundary

Preliminary Site Clearance Plan
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE B1-1

- Survey of topsoil stockpile areas to ensure capacity is in line with volume estimations,
- Preparation of access roads linking stripping zones to topsoil stockpiles,
- Log and stump removal (to new logs dump) for pit and haul roads development,
- Topsoil removal and pilling (in situ),
- Haulage of topsoil to stockpiles,
- Berm toe of stockpiles to collect soil moving from stockpile and prevent run-on water from contacting soil and
- Seeding soil stockpiles to reduce erosion of soil from wind and water.

Figure BI-1 shows the Preliminary Site Clearance Plan for selected project facilities and components. As indicated on **Figure BI-1**, the Company will minimise the amount of area that would be cleared and grubbed, to the extent possible. This approach will allow existing vegetation to continue to bind soil and reduce soil movement from the general Project area. Land clearing methods vary and are dependent on the type of facility to be constructed at each site. In some cases, clearing actions would result in removal of all vegetation and salvage of all available soil and growth media. Other sites only require removal of timber and mowing understory vegetation.

Site Clearance Sequence

A schedule for site clearance activities that identifies the sequence of land clearing will be developed after receipt of the Environmental Permit for the Project. In general, the sequence of land clearance will be conducted as follows:

- Access roads and laydown areas to stage construction materials,
- Staff village site – housing for workforce,
- Processing Facility site – clearance to facilitate pre-loading of subsoil materials to prepare for foundation construction,
- Open pit site – clearing/grubbing and soil salvage – excavation of borrow material to be used in construction of various facilities including sediment control structure dams, tailings storage facility starter dams, water storage facility dam and roads and ancillary facility yard areas,
- Water Storage Facility site,
- Water pipeline route,
- Tailings Storage Facility site and
- Waste Rock Disposal Facility site.

Environmental Best Management Practices

The Company will employ BMPs to control erosion of areas of the Project site where clearance activities and soil salvage has occurred. These practices include the following:

- Construction activities will be closely monitored such that vegetation disturbance will be avoided outside the designation project area,
- Suitable location for any temporary sediment/erosion controls will be identified,
- Natural creek areas which are likely to be intercepted by clearing and stockpiling activities will be identified,
- Non-commercial cross-cut logs will be used as fences for sediment control in the same disturbed area,
- All works will be confined to designated area (parking and vehicle turnaround areas, and access routes),
- Drainages intercepted by clearing operations will be diverted around disturbance areas and allowed to flow into appropriate channels and
- Daily inspections will be conducted during clearing and stockpiling to ensure effectiveness of controls.

Sediment Control

- Temporary sediment control ponds will be constructed at the local sources of sediment generation and the clarified effluents from these structures are directed to filter through jute matting and other brush materials. Sediment trapped in these facilities will be removed and returned to soil stockpile areas.
- During construction, permanent sediment control structures will be constructed at the positions agreed in the Project's EIS. Any additional sediment control ponds required during the mine life, which is not in the project EIS must be communicated to the EPA for approvals.

Erosion Control

- Seeding will be done in areas to assist in erosion protection, when necessary,
- The site shall be inspected regularly for soil erosion, and any identified areas stabilized as soon as practicable,
- Vehicle and equipment movement in waterlogged areas will be avoided or minimised, if practicable and
- Cleared vegetation will be stored along the edge of the site to act as brush barriers.

Concurrent reclamation would be performed during site clearance activities, as areas disturbed through development are no longer required to support site functions. This would include reclamation of exposed road cuts and fills and access roads and temporary storage areas.

Efforts would be expended to maximise retention of secondary forest outside the mine facilities. The Forestry Services Division would be consulted regarding this effort prior to site clearing activities occurring.

Waste Management

Several types of waste would be generated during site clearance activities including household waste, non-toxic industrial waste (tyres, discarded metal parts and fittings, plastic packaging and containers), waste oil, filters and solid waste. Waste disposal would be conducted in accordance with Ghanaian requirements and the Company's waste disposal protocols. The Company would monitor waste generation and disposal condition and should conditions warrant, the Company would implement additional waste minimisation, treatment and disposal measures for waste.

Solid, non-hazardous waste would be disposed in a landfill constructed within an area to be developed to host the proposed waste rock disposal facility. **Annex B-6** includes a Preliminary Waste Management Plan the Company intends to implement during the post-construction phase of the Project.

Hazardous Waste

A waste is considered hazardous if it demonstrates one or more of the following characteristics -- ignitability, corrosivity, reactivity or toxicity. No hazardous wastes would be generated during site clearance activities.

Sewage Disposal

Self-contained portable toilets would be used during the site clearance period of the Project. The toilet service would be provided by a vendor who would maintain the systems appropriately and dispose of sewage in accordance with Ghanaian regulatory requirements.

The Company would install a sewage treatment plant in conjunction with construction of camp accommodations to minimise the time portable toilets would be used at the site. The sewage treatment plant would be operational before occupancy of the construction camp.

Fuels Management

Diesel fuel would be stored on-site in above ground storage tanks. During the site clearance phase of the Project, a temporary secondary spill containment basin (bunds) would be constructed around bulk storage tanks to contain 110 percent of the volume of the largest tank. Secondary containment would meet the Company's minimum permeability standard which is equivalent to untreated concrete. All ancillary piping would be constructed above ground to facilitate frequent inspections and rapid repair should an accidental release occur. Company personnel would be instructed in operation and

maintenance of equipment to minimise accidental discharge of fuel. A spill prevention and containment plan for the fuel storage area would be developed. Meteoric water that falls within the containment basin would be treated through an approved oil/water separator designed to meet applicable discharge criteria.

Methods, procedures and protocols will be developed to address spill prevention, control and response to releases. Company personnel will be educated on the hazards and risks associated with onsite activities during the site clearance phase of the Project including the following areas;

- Petroleum products management,
- Response to explosions, fires and medical emergencies,
- Personnel training and
- Implementation of procedures.

ANNEX B-2

**FOREST SERVICES DIVISION
MEETING NOTES**

**NEWMONT GOLDEN RIDGE LIMITED
AKYEM GOLD MINING PROJECT**

FSD APPROACH -3

MINUTES OF PRELIMINARY / PREPARATORY MEETING HELD WITH FOREST SERVICES DIVISION, FSD-KADE

Date: - Thursday, 15th December, 2005.

Venue: - District Manager's Office – FSD, Kade.

Time: - 09:30 HRS.

Present: - Mr. Bempah, District Manager, FSD, Kade.

Mr. Enrique Rodriguez, (Site Manager, NGGL) Akyem Project.

Mr. Kwame Afari-Amponsah, (Site Engineer, NGGL) Akyem Project.

1.0. AGENDA

- (1). Formal Introduction of General Layout Map of NGRL Mine Concession to FSD-Kade.
- (2). Brief Account of Key Milestone of NGRL Mining activities.
- (3). Trees Inventory/Enumeration by FSD-Kade and Compensation.
- (4). Technical Information Requirements.

2.0. Matters Arising

2.1.0. Introduction of General Layout.

The Site Manager presented a copy of the General Layout Map (for the meeting only)

And introduced briefed the meeting about the limits of the Mine Concession and Operation areas to include the Plant Site, Mine Services, Water Storage Facilities (WSF),

Tailings Storage Facilities (TSF), River Pra Intake Facility/Corridor, Haul Roads and

Diversions, etc, etc.

The Site Manager explained that the total Land Take for the mining activities was estimated at approximately 2,150 hectares and this will NOT necessarily mean all the trees would be affected during both the construction and operation stages.

2.2.0 Project/Construction Key Milestone.

The Site Manager briefed the meeting about the project execution with emphasis on Commencement and Completion dates as priorities under consideration with the involvement of FSD-Kade as a major partner before and during construction stages.

Site Manager explained that the planned date of 30th Nov. 2005 for the release of the EIS approval by EPA had delayed and it had been forecasted at 31st Dec.

2005. He further stated that despite the unexpected circumstances the Key Milestones for the Mine Lease and Start of Construction activities remained up to date unchanged as 31st Jan. 2006 and 1st April, 2006 respectively.

2.3.0 Trees Inventory/Enumeration and Compensation.

The Site Engineer acknowledged receipt of the Cost Estimates at the meeting as submitted by FSD-Kade and stated that vetting/evaluation had completed and a reasonable amount/figure had been accepted and approved as compensation for every hectare of trees inventoried/enumerated, documented and presented as official report and record.

The Site Manager informed the meeting that as per the expected date of 31st Jan. 2006 for the Mine Lease, FSD-Kade would initially be expected to start on a Crushed Inventory Programme covering an approximate area of 400ha. This he explained would enable construction activities to start as scheduled to achieve the goals of the Key Milestone.

The District Manager, FSD-Kade, stated that the region has only two (2) groups for trees inventory /enumeration and confirmed the need for approval from the regional office to transfer the second group to the district for assistance and timely completion of the exercise. He however assured the meeting that his outfit would not cause any delays to the Construction Programme/Schedules as presented.

2.3.1 Stumpage Fees/Royalties & Compensation to Concessionaires.

The Site Engineer stated that the inventory/enumeration of trees would enable the FSD to compute demand stumpage fees from concessionaires before they were permitted to evacuate timber from the stockpiles of NGRL. This he explained was the applied procedure for the Ahafo Project.

Further, it was explained that NGRL (Newmont) as a Mining Company would NOT deal in timber business and would not be expected to compensate concessionaires previously operating in the Mine Lease area. NGRL (Newmont) therefore would only harvest the trees (economic/non-economic), cut to marketable lengths, stockpiled at safe and accessible areas ready for evacuation by FSD/Concessionaires, all at the expense of the mining company.

Also it was stated that NGRL (Newmont) was preparing a Timber Management Plan for effective utilization of young trees and branches considered as waste for the possible benefit of the impacted community.

On the issue Royalties as raised by the District Manager, FSD-Kade, the Site Manager explained that NGRL (Newmont) would not deal in payment of royalties to local chiefs as was been practiced by the concessionaires.

2.4.0 Technical Information Required Requested By FSD-Kade.

2.4.1 Map(s) of Mine Concession

A General Layout map showing all the boundaries was presented to the meeting as per Item 2.1.0.

2.4.2 Depth of Excavation (Pit)

The Site Manager stated that information on depth of excavation would be provided at the next meeting. It was further stated that due to anticipated deep level during operations an open channel had been proposed to divert storm water from entering the open pit to water course and finally discharging into the Mamang River.

2.4.3 Operational Effect on Vegetation.

The Site Manager stated that hazardous chemicals to be used during the mining operations would not be exposed to the environment and would not affect the vegetation, and also that appropriate measures had been taken to control Dust. The Site Manager promised to submit extracts of the EIS to FSD-Kade for study and records.

2.4.4 Use of Explosives.

The Site Manager assured the meeting of the use of explosives for rock blasting during operation and explained that adequate safety measures had been established to control especially flying rocks during blasting.

It was further stated that the company's Health, Safety & Environmental policies are of major concern to NGRL during construction and operation stages.

2.4.5 Effects on Water Bodies & Channels.

It was explained that NGRL would only harvest water from the Pra River, Boreholes and Pit de-watering by means of electrical pumps to water reservoirs and tanks for use at the plant/camp sites during mill processing and as portable water for consumption.

It was stated that NGRL had already applied for the necessary permit(s).

It was also stated that the Tailings Storage Facility (TSF) was sited on a small stream whose had been proposed to be redirected to finally empty into the Maaman stream.

The Site Manager assured the meeting of high level policy applications at all levels of the works.

2.4.6 Effects on Existing Roads.

The Site Manager informed the meeting that the existing New Abirem - Aduasena road would be affected at a stretch where the area had been proposed as a waste dump as indicated on the map. It was explained that a diversion of the road had been selected and designed for construction.

The meeting was briefed about a future possible diversion through the proposed Senior Management Village as indicated on the General Layout Map.

3.0 NEXT MEETING

The Site Manager agreed to convene another meeting scheduled for 25th/26th January, 2006 at the same venue and time with The Deputy Regional Director, FSD-Koforidua, in attendance.

Recorded By: - Kwame Amponsah-Afari (Site Engineer-Akyem Project)

SUMMARY OF AGREEMENT FOR TIMBER REMOVAL AKYEM GOLD MINING PROJECT

Four classes of timber will be removed during the site preparation phase, including:

- Merchantable and Non-Merchantable timber within the Ajenjua Bepo Forest Reserve.
- Merchantable and Non-Merchantable timber outside the Ajenjua Bepo Forest Reserve and within the Mining Area.

For timber removed within the Ajenjua Bepo Forest Reserve, the following guidelines will apply:

- Timber from this area is wholly the property of the state under the control of Forestry Commission with the Forest Services Division as caretaker.
- Permit for entry and harvesting of timber is to be obtained from the Forest Services Division.
- Inventory/Enumeration of all Category A timber is performed by Forest Services Division (District/Regional or both) as instructed by the region ('as stated above') and provides official report detailing all species and sizes.
- The Company for the services above inclusive of 'stumping fees.'
- Tree felling, logging, and stockpiling, with merchantable and non-merchantable timber separated at approved location form part of the Statement of Work (SOW) for the selected contractor by his own team or nominated subcontractor who has been inducted and provided with acceptable personal protective equipment.
- Evacuation/Sale of this category of timber from the stockpile is the sole responsibility of Forest Services Division, with notice to and supervision of the Company for safety reasons. Sale could be made to Saw Millers/Concessionaires at the resolve of the Forest Services Division.
- The Company manages and disposes of Non-Merchantable timber/branches that are not needed by the Forest Services Division.

Outside of the Ajenjua Bepo Forest Reserve, the following guidelines apply:

- The category of timber from this area is the property of the Forestry Commission (including the Forest Services Division) and Concessionaires that have a valid 'Property Mark' Certificate issued by the Forest Services Division.
- Permit of entry and harvesting is covered by the Approved Concession for general operations/Mine Lease as applied for and awaiting the release.

- The Company pays for detailed report for Inventory/Enumeration to the Forest Services Division (inclusive of Services/Stumping Fee)
- Tree felling, logging, and stockpiling guidelines are the same as those used for timber inside the reserve.
- Valid concessionaires with prior introduction by the Forest Services Division will remove timber only from his/her concession and with authority by the Forest Services Division for those outside his/her concession all from the stockpile.
- The Company manages and disposes of all leftovers.

ANNEX B-3

PROCESSING PLANT DESIGN EXPLANATION

PROCESSING PLANT DESIGN EXPLANATION

As indicated in Section 2.1.2, 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. ROM ore would be hauled by truck from the open-pit mine and placed on the ROM ore storage pad or directly into the ROM hopper. ROM primary and oxide ore would be blended in the mill feed to optimize the process plant throughput. Crushed ore would be transported by conveyor to a stockpile. Dust suppression sprays and dry dust collection systems would be installed on the respective crushing circuits and all ore transfer points. Crushed material would be reclaimed from the stockpile and transported by conveyor to the semi-autogenous grinding (SAG) mill. The ground material would then pass through a vibrating screen to separate material larger than 10 millimetres in diameter; this material would be transferred to a cone crusher for further size reduction and returned to the SAG mill.

Product from the vibrating screen would be pumped through a closed circuit system of hydrocyclones and a ball mill where the material is further reduced to a product size of 80 percent 75 micron. Lime and water are added during the grinding process.

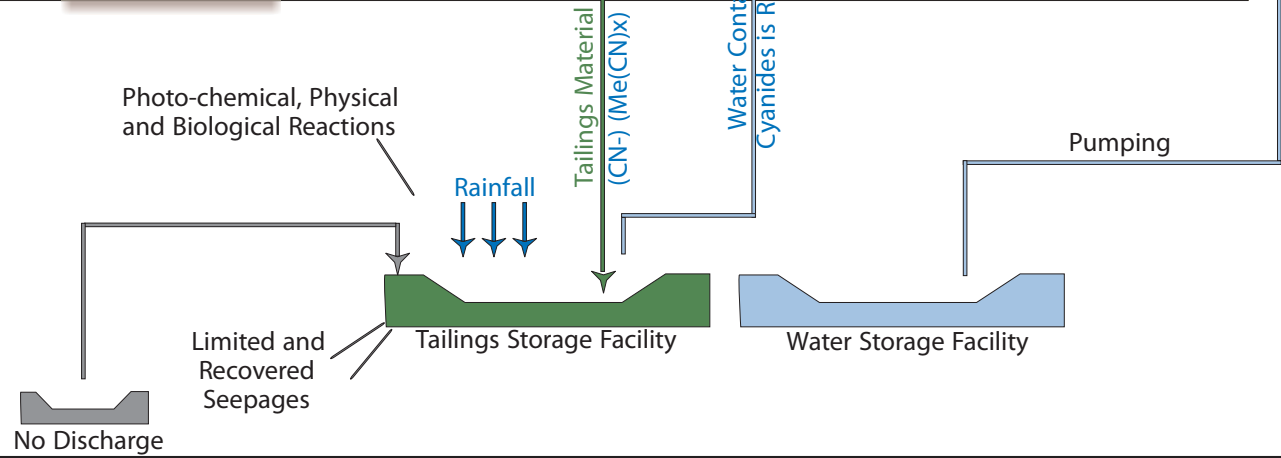
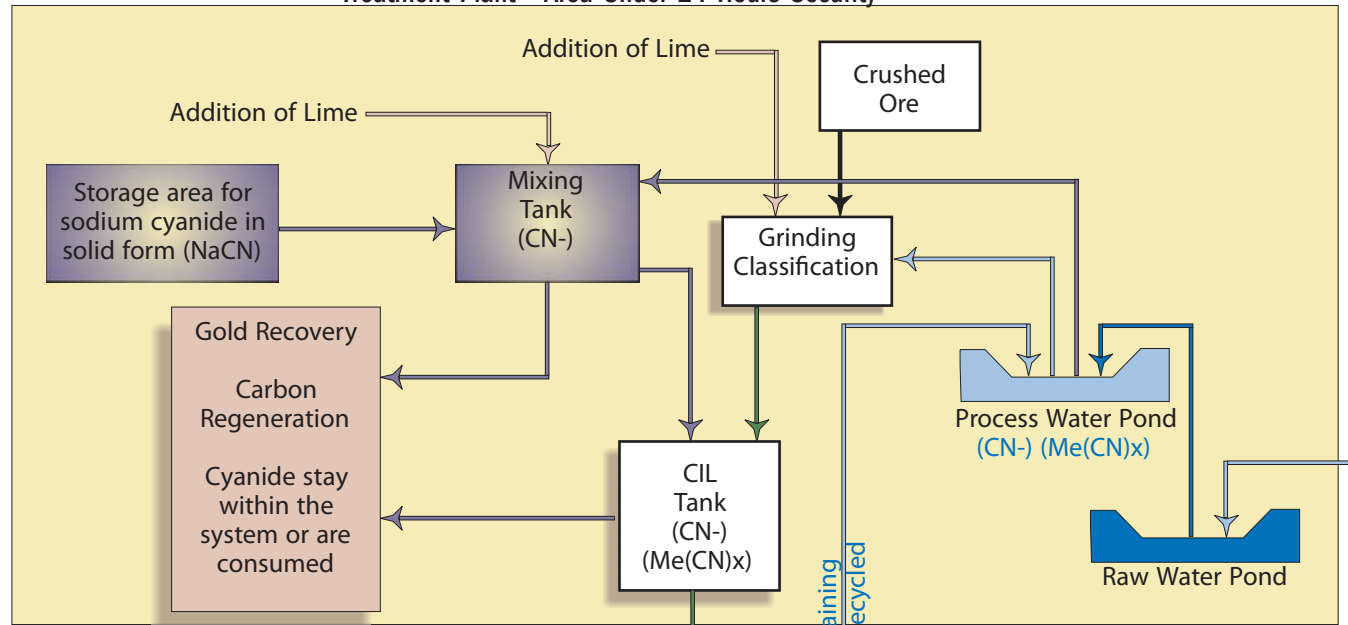
Two outlets from the hydrocyclone distribution system have the ability to supply ore slurry, known to contain free milling gold, directly into centrifugal gravity gold recovery circuits. Each circuit incorporates a feed preparation screen and gravity concentrator. Gravity concentrate would be transferred to a storage cone and then periodically transferred to the batch intensive cyanidation reactor using a centrifugal pump.

Ore slurry from the hydrocyclones would be transferred to a thickener where the slurry would be dewatered from approximately 30 percent solids to 50 percent solids. Excess water is recycled back to the grinding circuit. Thickened solids would be pumped to the Carbon-in-Leach (CIL) circuit. The CIL circuit consists of 11 interconnected tanks, each with a capacity of approximately 3,250 cubic metres. Thickened slurry would gravity flow through the series of tanks. Lime to control pH of the slurry would be introduced with the main thickened slurry inflow and by additions to the first few tanks. Cyanide to dissolve the gold would be added to the first few tanks in the circuit. Fresh, regenerated carbon that adsorbs dissolved gold would enter the circuit at the last CIL stage tank and be pumped counter-current to the slurry flow. A pump would be used to transfer slurry and gold-laden carbon from the CIL tanks to a loaded carbon recovery screen. The washed loaded carbon would gravitate to the stripping plant near the gold recovery room. The CIL circuit is shown on **Figure B3-1**.

Discharge from the CIL circuit would be washed with reclaim water from the tailings facility through two thickeners. The wash will reclaim residual cyanide and gold values from the tailings solution. The cyanide concentration in the washed solids will decrease the free and WAD cyanide concentrations from approximately 125 ppm to less than 50 ppm.

The CIL tanks would be constructed on concrete ring beams in a self-contained area with a sloping concrete floor. Any spillage from the circuit would flow to one of four sumps located on the periphery of the containment area and would be pumped back to the processing circuit or to the carbon safety screens for disposal to the tailings storage facility.

Treatment Plant - Area Under 24 Hours Security



Carbon-in-Leach Circuit
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE B3-1

A 7,000 cubic metre event pond would be constructed to contain overflow from containment areas within the process plant (milling, thickening, CIL, and tailings). Overflow from containment areas would be directed to the event pond via drainage channels. Two sump pumps located in the event pond would return water collected to either the tailings tank or the processing circuit.

Activated carbon impregnated with gold, would be periodically removed from the circuits and transferred to the stripping/refining facility, where gold is separated from the carbon. Barren process solution, the solution resulting after adsorption of gold onto carbon containing lime and cyanide, is recycled back into the process system.

The gold room recovery and refining facility consists of an acid wash carbon-stripping circuit, electrowinning circuits, and carbon regeneration kilns. Gold contained in the gold-bearing solution (electrolyte) resulting from acid wash stripping the activated carbon is transferred to electrowinning cells, where a direct current is passed through stainless steel anodes and stainless steel mesh cathodes cause the gold in solution to plate onto the cathodes. The cathodes are washed with high-pressure spray water and the gold slime recovered in a frame filter press. The gold sludge filter material is then dried in ovens and direct smelted with fluxes in a diesel-fired furnace to produce doré bars. The barren carbon would be transferred to a carbon regeneration kiln circuit for reuse.

The stripping and gold room areas would normally operate 7 days per week. The gold room design is based on full security surveillance by a security guard and a second level of surveillance by remote control cameras with remote viewing and recording facilities.

All process piping within the grinding, CIL, and gold recovery circuits would be constructed above ground to facilitate frequent inspections. All process piping would be constructed with secondary containment to prevent accidental release of process fluids to the environment.

Once initial operations are underway and water begins to accumulate in the tailings impoundment, process water would be principally obtained from tailings decant return and run-off from within the tailings impoundment. Makeup water required for the milling process could also be provided from the fresh (raw) water storage facility or from a process water pond used to temporarily store process water. The process water pond would be a double-lined 15,000 cubic metre facility with a leak detection system.

ANNEX B-4

CYANIDE MANAGEMENT AND TREATMENT PROGRAMME

CYANIDE MANAGEMENT AND TREATMENT PROGRAMME

The Company's cyanide management practices are largely derived from the International Cyanide Management Code (ICMC). All aspects of the ICMC would be implemented at the Project. Cyanide-related facilities would be managed in such a manner as to protect workers, the community and the environment including primary environmental receptors of air, water (surface water and groundwater), soil and flora.

The process plant and tailings storage facility would be constructed and operated to minimize cyanide use to the extent possible, thereby limiting concentrations of cyanide in the mill tailings and process solution ponds. All facilities would be operated to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.

While experience at other Ghanaian operations, including Newmont's Ahafo Mine, indicates that free and weak acid dissociable (WAD) cyanide levels are usually less than 50 milligrams per litre in supernatant ponds of tailings storage facilities, this management strategy usually relies on photo-degradation of cyanide and tight process controls to ensure levels of cyanide in the supernatant tailings pond are maintained at this level. However, the Company is committed to complying with the ICMC which requires a contingency programme to ensure that risk to wildlife is minimized. In the ICMC, the 50 milligrams per litre concentration of WAD cyanide is considered the generally safe maximum concentration for most forms of wildlife. Risk analysis indicates that unless the concentration of WAD cyanide is discharged to the facility at 50 milligrams per litre or less, then excursions above 50 in portions of the pond are likely. These excursions can happen during night time, when there is no photo-degradation, and/or at the beach where the tailings stream enters the supernatant pond before photo-degradation has time to take effect. Therefore, the Company will incorporate a cyanide management and treatment system to facilitate discharge of tailings with WAD cyanide concentrations below the recommended 50 milligrams per litre level to demonstrate its social responsibility and commitment to protect workers, community and the environment. To achieve the 50 milligram per litre level, discharge from the CIL circuit would be washed with reclaim water from the tailings facility through two thickeners. The wash will reclaim residual cyanide and gold values from the tailings solution. The cyanide concentration in the washed solids will decrease the free and WAD cyanide concentrations from approximately 125 milligrams per litre to less than 50 milligrams per litre.

ANNEX B-5

TAILINGS STORAGE FACILITY CONSTRUCTION AND SEEPAGE CONTROL

TAILINGS STORAGE FACILITY CONSTRUCTION AND SEEPAGE CONTROL

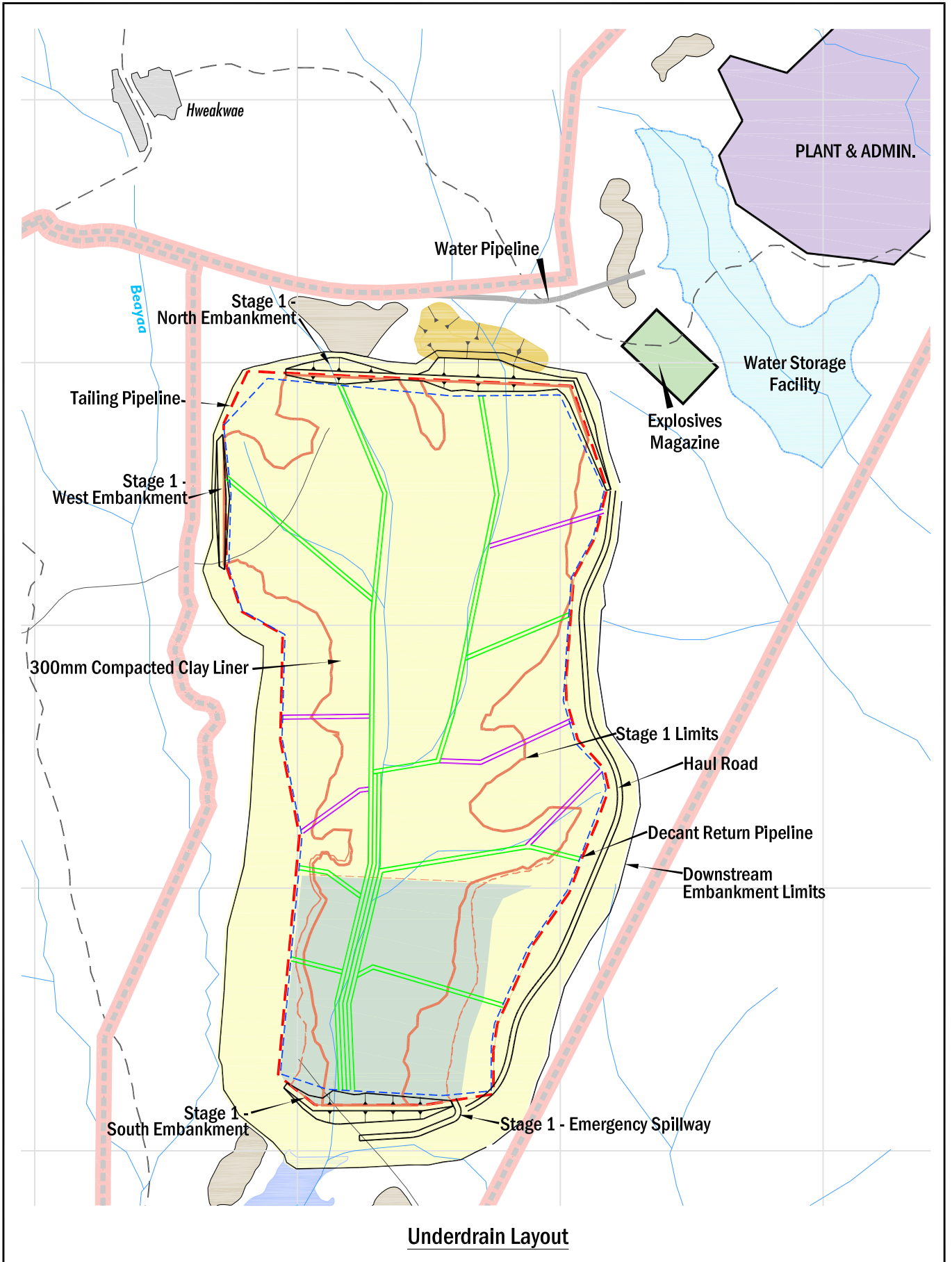
As described in the EIS text, minimizing seepage from the proposed Tailings Storage Facility is important to the Company in achieving a number of water management goals, including:

- Minimizing the risk of contaminating surface water and/or groundwater resources by degraded water seepage from the impoundment or leakage from the impoundment into the under-drain system;
- Maximizing return of water to the plant facility for reuse in ore processing; and,
- Maximizing settled density of tailings material by dewatering.

In order to accomplish these goals, several seepage control features would be incorporated into preparation of the drainage basin and the tailings storage facility design. These include seepage control, in the form of low permeability layers, cutoff trenches, and underdrain collection systems described below. Values referenced are provided in Knight Piesold (2004) for Project feasibility and in Appendix 10 of the Feasibility Study Update prepared by Lycopodium (2004). Construction of the tailings storage facility is described from bottom to top as follows:

1. 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 (0.5 metres) would be scarified and compacted.
2. 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 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 (**Figure B5-1**).
3. 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 (if present) into the underlying saprolite foundation material (1 to 5 metres, depending on location) beneath the upstream toe of all embankments (**Figure B5-2**).

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Underdrain Layout



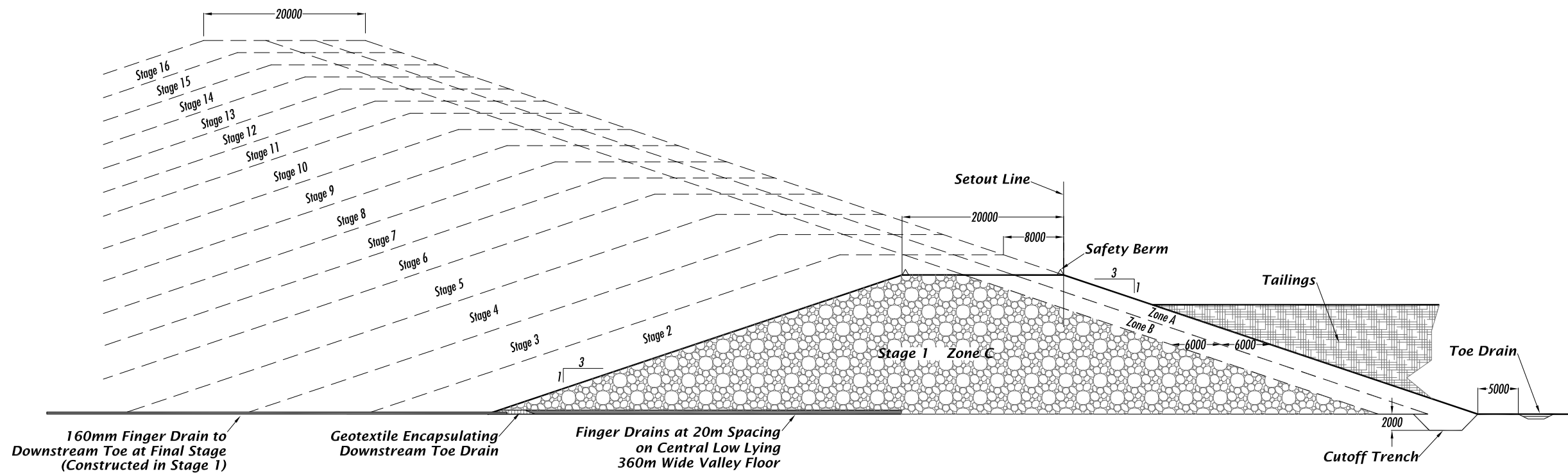
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Source: Knight Piesold (2004).

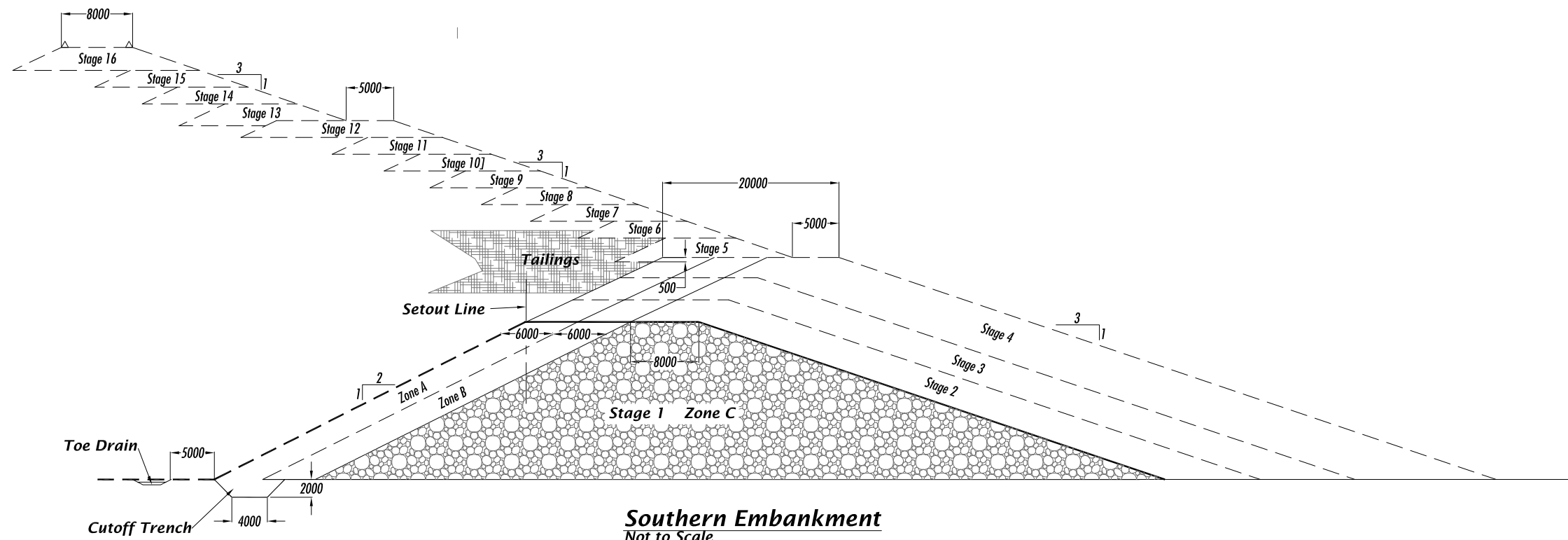
- Stream/Drainage
- - - Access Road
- - - Toe Drain
- 100mm Draincoil
- 160mm Draincoil
- Extent of 1.5mm HDPE Liner
- Water Storage Facility

- Village
- Stockpile
- Dump

**Tailings Storage Facility
Underdrain System
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE B5-1**



Northern Embankment
Not to Scale

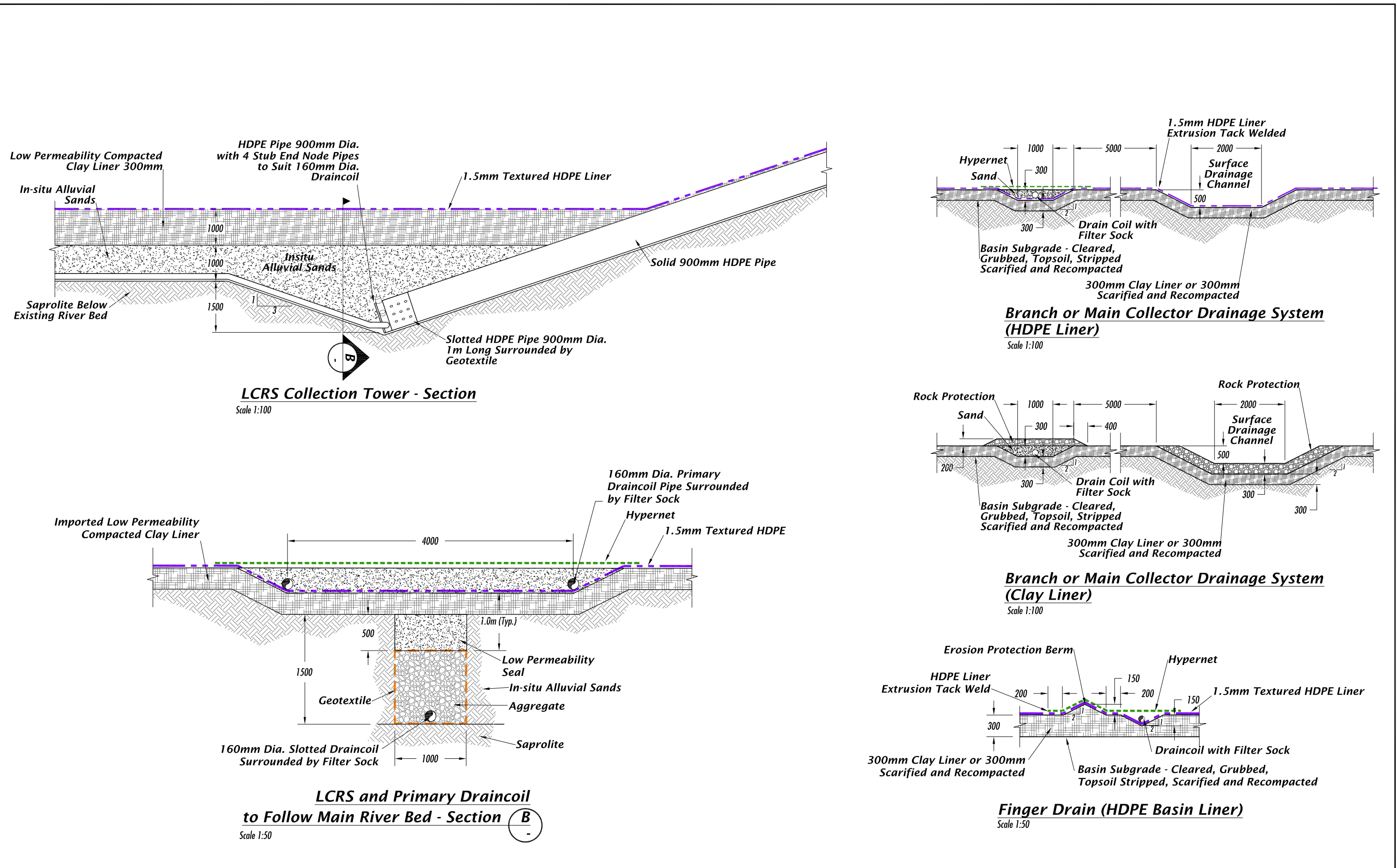


Southern Embankment
Not to Scale

Source: Knight Piesold (2004).

4. Cutoff walls would be raised correspondingly 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 (**Figure B5-3**). 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.
5. A low permeability soil liner would be placed over the prepared basin substrate and under-drain system. The soil liner would be compacted to attain a minimum permeability of 10^{-8} metres per second. This would be accomplished either by scarifying and compacting the upper 0.5 metres of saprolite material or by placement of two 150 millimetre layers of imported material, each compacted to meet the required permeability. In the centre of the valley and along larger tributaries, this would require construction of a low permeability soil liner over alluvial sand and gravel deposits of the LCRS system (**Figure B5-3**).
6. A 1.5 millimetre-thick HDPE liner would be placed over the compacted low permeability soil layer from the upstream face of the southern embankment and extend over approximately 98 hectares beneath the supernatant pond. The HDPE liner would reduce seepage from the supernatant pond (**Figure 2-4**). The liner would cover an area large enough to contain processing decant wastes and meteoric precipitation from a 1-in-25 year wet event or 25 year/24 hour storm event superimposed on average annual rainfall conditions.

The under-drain collection system would be constructed in stages over either the HDPE liner or the compacted soil layers throughout the basin area (**Figure B5-1**). The under-drain system would be designed to reduce the phreatic surface on the tailings basin and the area immediately upstream of the embankment. The design of the under-drain system optimizes the natural north-to-south slope across the impoundment area (about 18 metres of relief). The under-drain system would consist of three drainage networks: main collector drains, branch drains, and finger drains. Details concerning layout of the tailings impoundment under-drain system are shown on **Figures B5-2** and **B5-3**. Collector and branch drains would be constructed over the basin liner and consist of drain-coil pipe embedded in a sand layer. The branch drains would feed to collector drains, which flow directly into the collection sump located at the embankment toe. Finger-drains would be constructed on about 25 metre spacing over compacted soil layers. Drain-coil pipe would be placed in 200 millimetre-deep 'V' drains surrounded with sand and wrapped with geotextile. The finger-drains would connect to branch and collector drains.



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Source: Knight Piesold (2004).

7. Drains also would be constructed along the upstream toe of all embankments (**Figure B5-2**). Toe-drains would allow solution from tailings to flow away from embankments and provide increased stability of the embankments during initial and future stages. The toe-drain would consist of a 160 millimetre drain-coil pipe placed in 300 millimetres of drainage material (Zone F) at the base of each toe; this in turn would be covered by competent rock to provide erosion protection. The toe-drains would ultimately drain to the under-drain collection tower for recycling.

The Tailings Storage Facility would be designed to contain storm events of return period up to 1 in 100 years. In the event that a storm exceeding the design event occurs, discharge from the facility would be controlled via an emergency spillway. The emergency spillway would be designed to handle storm events of Average Recurrence Interval (ARI) of 1 in 500 years. New spillways would be constructed with each successive lift of embankment. The spillway constructed at closure of the facility would be designed to control discharge resulting from a Probable Maximum Precipitation (PMP) storm event (**Figure 2-4**).

ANNEX B-6

**PRELIMINARY WASTE MANAGEMENT
PLAN**

PRELIMINARY WASTE MANAGEMENT PLAN

The following includes the framework for a Solid and Hazardous Waste Management Plan to be implemented prior to mining associated with the Project. The discussion focuses on the principal waste streams developed through implementation of the Project. This preliminary plan will be refined after issuance of the Environmental Permit to provide specificity on how all waste streams will be identified, handled, and disposed to ensure the Company complies with all appropriate Ghanaian and Company standards.

Used Oil and Lubricants

Principal generators of used oil and lubricants (i.e. motor oil, gear oil, hydraulic fluid and brake fluid) would be vehicle and earth moving equipment. Temporary storage of used oil and lubricants would be accomplished using an above ground steel tank(s) with secondary containment. Except during transportation, oil drums would be located within areas with secondary containment.

Most, if not all, of the used oil and lubricants will be taken off-site to a licensed waste disposal or recycling facility approved by the Company. This may occur as part of an agreement with the oil supplier or may be managed independently by the Company.

Absorbent materials and spill response equipment would be located at the primary storage areas and on trucks used for transporting oil and lubricants. These materials would be used in the event of spills or leaks. Oily clean-up materials will be treated at the volatilization pad and disposed of within the designated "inert" waste disposal area of the Waste Rock Disposal Facility. Untreated clean-up materials will not be deposited directly within the Waste Rock Disposal Facility.

The volatilization pad facility will consist of a concrete slab, surrounded by concrete berms (for containment) and covered with a roof to prevent runoff, runoff and ponding of surface water. Contaminated materials will be mixed using lightweight mechanized equipment on a periodic basis to facilitate volatilization of petroleum hydrocarbon compounds. After testing for residual hydrocarbons the material will be disposed of by burial within the designated area of the Waste Rock Disposal Facility.

A temporary hazardous waste storage facility will be constructed to cater for the Project's needs during the early stages of construction. This facility will have a concrete floor, block walls and a roof. Storage will be controlled and logged. Disposal will be via approved local oil re-processing companies.

Diesel Fuel

Diesel fuel will be the primary fuel supply used for the Project during construction and operation. Minor amounts of gasoline will be supplied for light vehicles and power tools.

In the early stages of construction, limited quantities of fuel may be transported to the site in approved metal containers (e.g., 200 litre drums or jerry cans). Materials or soil contaminated during refueling operations will be treated at the volatilization pad prior to disposal.

Transport of bulk diesel to site will be accomplished via trucks contracted by the fuel supplier and distribution of diesel will occur at suitably constructed refueling stations and from mobile tanker trucks during construction.

Fuel storage will be contained in a bund with 110 percent capacity of the largest storage tank plus a 10-year 24-hour rain event. Secondary containment for fuel tanks, including the walls and floor, will be designed to be impervious to fuel for 72 hours. A roof would be constructed over the secondary containment to eliminate runoff, runoff and ponding of rainwater.

Small fuel spills may occur during fuel transfer into and out of tanks, or during vehicle and earthmoving equipment refueling operations. Measures for spill containment and absorbent materials for spill cleanup will be provided at each pumping station and storage tank location to address potential spills.

Oily Water

Oily water is generated as a result of rainfall in fuel storage tank secondary containment areas, and as a result of cleaning operations at maintenance shops and vehicle washing facilities. Oil-water separators will be provided at the main fuel storage facility.

Oily water generated at washing bays and mine maintenance shop areas will be piped via gravity flow (if possible) to oily water retention basins. After sedimentation of solids in these basins, oil and floating debris will be skimmed using vacuum methods before discharge of the water. Recovered oil will be placed in the tanks used for storing used oil and transported offsite to an approved disposal or recycling facility.

Oily water retention basins will be sized to accommodate a 10-year 24-hour precipitation event for 24 hours (basin spillways will accommodate a 25-year 24-hour event) and will have controlled discharge via manual valves to an American Petroleum Institute- (API-) type oil-water separator to discharge through a storm water drainage pond to surface drainage. Effluents will have no visible oil sheen, and contain a residual oil concentration not exceeding 10 milligrams per litre.

Vehicle washing facilities located at the maintenance area may utilise a concrete sedimentation basin (or equivalent) coupled with an API oil-water separator and vehicle wash recycle system, as far as practicable, for water conservation during dry seasons. Otherwise, effluent will be directed to the oily water separation system.

Oil removed from the oil-water separators via vacuum trucks will be placed in the tanks for storing used oil, or in drums within a bermed area, prior to being transported off-site for authorized disposal or recycling.

Containers / Drums

Most materials will be transported using standard shipping containers, which will be trucked to the appropriate areas for emptying and distribution, cleaned if necessary, and returned empty to the vendors for reuse.

Empty packaging and drums will be stored in bermed areas and will be cleaned and/or drained prior to recycling or disposal. A decision to recycle any drum or packaging materials will be made in consideration of the nature and potential hazards posed by the residual quantities of the original contents.

Packaging and drums not deemed suitable for recycling will be crushed for disposal (as inert waste) within the designated area of the Waste Rock Disposal Facility or used to store wastes (e.g., used oil) prior to removal for offsite disposal. Drums used to store hazardous and non-hazardous wastes will be labeled appropriately and stored in designated areas for the type of materials contained.

Sewage

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 /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 local properly designed and installed septic tanks or mobile units. Effluent from mobile units will be discharged into the package sewage treatment plants.

Solid Waste

Solid waste will consist of bulk non-hazardous and hazardous waste. Most construction waste will be generated during the Initial phase of the Project, although minor volumes of waste from construction activities will continue to be produced throughout the life of the Project.

Non-hazardous waste will be disposed of on-site while hazardous waste will be transported off-site to a facility approved by the Company for the recycling or final disposal of hazardous substances.

Non-hazardous waste includes putrescible waste and rubbish such as domestic waste as well as inert industrial waste generated during construction and maintenance activities.

Putrescible waste (i.e., food scraps) and rubbish will be generated in the offices, kitchen, camp and eating areas. Inert industrial waste will be generated throughout the mine and will consist of such materials as piping off-cuts, drained containers (i.e., with no residual liquids), scrap metal, paper, wood, concrete and textiles.

Domestic waste and inert industrial waste will be separated at source and disposed of via different methods. Inert industrial and domestic waste will be buried in designated areas within the Waste Rock Disposal Facility. Putrescible domestic waste will be incinerated within an on-site facility, which will have the approval of the corresponding Ghanaian agencies.

A temporary hazardous waste storage facility will be constructed on site consisting of a covered (roofed) concrete pad with walled perimeter. Hazardous wastes will be placed in drums and labeled for off-site disposal or recycled at an approved facility. Waste oil and lubricants will be stored in accordance with procedures described above.

Used tyres will be used as berms along the haul roads and any excess tyres that require disposal may be deposited with the inert solid waste within the Waste Rock Disposal Facility.

Soil contaminated with petroleum products (diesel, gasoline), oils and lubricants and absorbents will be treated using a volatilization (bio-remediation) pad using procedures described above. Once treated these materials will be disposed of in the Waste Rock Disposal Facility.

A salvage yard will be developed for the reception and sorting of recyclable/reusable materials. This yard will be secured with a fence and contain designated areas for sorting and storage of different types of materials (e.g., metal, wood, plastics). Secondary containment will be provided in areas where rainwater seepage may become contaminated.

Explosives

Several explosive products and diesel fuel will be stored in the designated Explosives Magazine in the Proposed Mining Area. Ammonium nitrate and emulsion are the only two products that pose a risk of spillage. Dry ammonium nitrate will be stored in woven bags within shipping containers. Spills of ammonium nitrate that may occur as bags are removed from the shipping containers will be recovered and used in the blasting operation. Soil contaminated with ammonium nitrate will be managed as solid waste using procedures described above. Spills at the ammonium nitrate fuel oil (ANFO) plant silos will be handled in an identical manner.

The emulsion plant will mix water and an emulsifier to form a desensitized explosive emulsion for blasting operations. Due to the propriety nature of the emulsion composition, the emulsion plant will be operated by a contracted explosive supply company. The operator will be responsible for ensuring all waste is handled in an approved and acceptable manner.

The diesel tank at the Explosives Magazine will comply with the secondary containment criteria as specified for fuel storage tanks (see above). A valved discharge pipe will prevent storm water being released until visual inspection confirms that there is no oil sheen. Spills will be vacuumed out of the containment area. Leaks or spills at the Magazine's diesel-powered fire water pump will be contained within a berm. Oily liquids will be recovered using procedures described above. Absorbent materials will be used in the event of minor oil spills and allowance will be made for these materials in spill equipment inventory at the site. Absorbent materials and any contaminated soils will be treated at the volatilization pad prior to disposal within the designated area of the Waste Rock Disposal Facility.

Chemicals in General

The plant will use a wide range of chemicals, both in bulk and also in smaller quantities in the laboratory. As all bulk chemicals are consumable items, waste will only occur in the event of an accidental spill.

Where contaminated material can not be safely reintroduced into an appropriate process stream, all chemicals and contaminated materials will be collected and put into suitable sealable containers or drums. These drums or containers will be temporarily stored in the hazardous materials store until they can be either returned to the supplier or removed from site by an approved disposal contractor (see *Solid Waste* section above).

The laboratory would perform routine quantitative analyses for metallurgical and environmental monitoring purposes. Waste streams will consist of organic and non-organic material.

Inorganic laboratory wastes will be disposed of in the Tailings Storage Facility. Metallurgical and nonhazardous waste streams generated from analytical testing will be disposed into a separate chemical waste sewer discharging to a neutralization tank. Waste water will be neutralized (pH of 6.5 to 8.5) and discharged to the Tailings Storage Facility.

Organic laboratory wastes will be stored in 200 litre drums and be disposed of by the supplier or an approved contractor in accordance with procedures described above.

Medical Waste

Both non-hazardous (inert) and hazardous waste will be generated at the clinic. Non-hazardous waste will be sent to the designated areas within the Waste Rock Disposal Facility.

The management and disposal of the hazardous (including biologically hazardous) waste will be the responsibility of the Company-contracted medical services provider. Hazardous waste will be stored in containers for off-site disposal at authorized facilities. Sharps and syringes will be stored in containers specifically designated for this purpose to prevent accidents during storage and transport. All containers will be labeled. The provider will be required to keep a detailed log of all hazardous waste storage and movements, which will be regularly inspected. The disposal process will also be subject to regular audits.

ANNEX B-7

WATER BALANCE MANAGEMENT AND MODELLING

WATER BALANCE MANAGEMENT & MODELLING

The management of water within the Project Area is a critical aspect of the design. To understand and control the flow of water around the site, a site water management plan was developed. The management plan incorporates the following components:

- Tailings Storage Facility
- Water Storage Facility
- Waste Rock Disposal Facilities
- Mine Pit
- Pra River Pumping Station
- Processing Plant Site
- Sediment Control Structures
- Associated pipe work and pumping systems

The tailings storage facility would store the tailings generated in the ore treatment process. For the water management model, inputs into the tailings storage facility included water in the slurry from the plant and rainfall runoff from the tailings and pond surface and surrounding catchment. Outputs from the tailings storage facility include evaporation losses, seepage losses, and water returned to the plant as process make-up water through a pumped system.

The water storage facility is the main source of clean water for the plant, supplying the water requirements for reagent mixing and any shortfalls in process water supply from the tailings storage facility. The water storage facility will be topped up with water from the Pra River pumping system, as necessary. The water management model allowed for inputs into the water storage facility consisting of rainfall runoff from the water dam pond surface and catchment area, pit dewatering, and water discharge from the pipeline from the Pra River pumping station. Outputs from the water storage facility include evaporation losses, seepage losses, water returned to the plant as clean make-up water (pumped system) and water discharged via the water dam spillway.

The mine waste dump would be developed down slope from the pit with runoff reporting to the sediment ponds and subsequently released to the environment. However, if the quality of the water is lower than the quality required for release into the environment, seepage water from the waste dump sediment ponds can be collected and sent to the tailings storage facility.

The water recovered from the pit consists of groundwater seeping into the pit and runoff from rain falling on the pit area. Pit dewatering was conservatively estimated to be approximately 44 cubic metres per hour with only a small upstream catchment included in the modelling. If the pit dewatering rate is higher than estimated, the required water volumes from the Pra River can be reduced. Both the rainfall runoff and pit dewatering streams would be pumped into the Water Storage Facility.

The Pra River pumping station would consist of a pump(s) installed in the Pra River approximately 8.5 kilometres from the processing plant. The pump would deliver water to the Water Storage Facility through a buried pipeline. In the modelling, water extraction from the river was limited to the peak five month period of river flow (May to October) in each year.

The plant site was modelled with inputs consisting of water contained within the ore, water returned to the plant from the tailings storage facility and water pumped to the plant from the water storage facility. Outputs consisted of water discharged to the tailings storage facility in the slurry and water used for dust suppression. During the wet season and throughout wet years, the tailing storage facility can supply the majority of process water required. During most dry seasons, it would be able to supply only a portion of the total requirement after which additional water requirements are provided from the water storage facility.

WATER BALANCE MODELLING

PARAMETERS

As part of the modelling of the site water management, a number of parameters were used as input into the model. Rainfall data used for the site was from Afosu which is approximately 5 kilometres from the site. A yearly rainfall of 1,376 millimetres was used for the average modelling case. An average yearly evaporation of 1,471 millimetres was generated from data from the Obuasi site, the nearest reliable source (100 kilometres from site). The throughput and ore blend data are summarized in **Table B7-1**.

TABLE B7-1				
Throughput and Ore Blend				
Akyem Gold Mining Project				
Year	Throughput (Mtpa)	Ore Blend (% Oxide)	% Solids	% Moisture in Ore*
2010 (second half)	4.1	81.4	47.8	14
2011	9.5	53.1	49.9	11
2012	9.5	22.3	49.9	8
2013	9.5	5.7	49.9	6
2014	8.1	13.1	47.8	7
2015	8.3	0.6	47.8	5
2016	8.5	0	47.8	5
2017	8.5	0	47.8	5
2018	8.5	18.6	47.8	7
2019	8.5	0	47.8	5
2020	8.5	0	47.8	5
2021	8.5	0	47.8	5
2022	8.5	0	47.8	5
2023	5.4	0	47.8	5

* Based on 5% Moisture in Primary Ore and 17% Moisture in Oxide Ore

SITE WATER MANAGEMENT RESULTS

Results of water management analysis and modelling indicate that water in the Water Storage Facility, plus water pumped from the Pra River, would be required to supplement the water recycled from the Tailings Storage Facility to operate the plant associated with the Project. The Water Storage Facility was sized to have sufficient capacity to ensure an adequate water supply through the dry season until the next wet season. The critical condition was a two-year-long 1 in 100 recurrence interval dry sequence occurring over the first two years of the operation. The required capacity for the water dam storage facility was determined to be 2.1 million cubic metres.

The model was run for a range of climatic conditions and the following conclusions were reached:

- For average conditions, the water balance for the Tailings Storage Facility is negative for the first four years, with the supernatant pond reduced to the minimum pond size each dry season. After this period, the facility has a positive water balance and the minimum pond size increases each year. The maximum pond size increases each year with a maximum size of 2.44 million cubic metres in the final year. There is no water shortfall under average conditions. The average water balance for the proposed Project is shown in **Figure B7-1**.
- Under the 1 in 100 year recurrence interval dry sequence scenario, the demand from the Pra River during the first three years is 696 million litres in 2009, 2,285 million litres in 2010, and 1,994 million litres in 2011 followed by 103 million litres for each year of the remaining period of operation.

Precipitation/Run-off

Pit Dewatering

Pra River Pumping

Ilway

FACILITY

Evaporation and
Entrained with Solids
541 m³/h

Yearly Average Flows for Year 6
Based on 8000 h/year

Water Balance Model
Akyem Gold Mining Project
Eastern Region, Ghana
FIGURE B7-1