GENCAPD PROJECT

MINERS' ENVIRONMENTAL OFFICER'S REPORT
On
FIELD TRIP TO NORTH-WEST DISTRICTS
07 July to 21 July 2003

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Georgetown

TABLE OF CONTENTS

Page No.

1.0 Introduction……..1

2.0 Objectives...……..1

3.0 Support…….…...…….…….1

4.0 Activities……...……...…….…….2

5.0 Observations……..3
- 5.1 Tailings Management……3
  - 5.1.1 "Closed-Circuit" Water System Adjacent to a Mined-out Area..3
  - 5.1.2 "Closed-Circuit" Water Recycle System in a New Mine Area.…4
- 5.2 Creeks and Diversion Channels…….7
- 5.3 Mechanization……7
- 5.4 Health and Safety.....7

6.0 Conclusion..……8

7.0 Recommendations.....9

APPENDICES

Appendix A Expenditure
Appendix B Photographs

1. INTRODUCTION

The field trip to the North-West Mining Districts was completed during the period 07 July to 21 July 2003. Accompanying me was Mr. Kerion Husbands, Environmental Technician – GGMC. During the trip visits were made to seven (7) mining locations where a total of thirty-two (32) land dredging (jetting) operations and four (4) operations involving crushing/milling of hard rock were investigated.

The operation of two (2) vertical shaft/adit mining systems: one at 10 Miles where a series of unsupported shafts (to a maximum depth of ninety-eight (98)) ft. were dug; and the other at Eyelash with a fully timber supported, artificially ventilated and lighted tunnel and adit system operating at depth of sixty-six (66) ft. were of interest.

Discussions with mine operators revealed that miners were aware and have latched unto the "closed-circuit" recycled water system utilized in land dredging operations but there was need for refining the technique and to minimize the effect of turbidity on our waterways due to inefficient handling of tailings discharges. Efforts were made to sensitize miners of the critical importance of understanding and applying the correct methodology for the construction of diversion channels and the changing of mining culture to that of impounding all tailings discharges, from the inception of mining activities.

2. OBJECTIVES

To make an assessment of the impact made on environmental awareness (by efforts of the previous Miners' Environmental Officer (M.E.O.) and GGMC's Officers) on the culture, systems and techniques employed by miners.

To continue the environmental awareness and sensitization programme, with emphasis on the minimization of turbid discharges to our waterways and on the implementation of proper procedures for the handling of mercury.

To be engaged in the process of problem identification and provision of viable solutions for any operation having a negative impact on the environment, whether it is turbidity or mercury related and to stress the additional need for a safe and healthy work environment.

Where feasible, to hold evening group discussion sessions with miners with the intention of enforcing on-spot (in-mine) decisions.

3. SUPPORT

G.G.M.C.'s Environmental Technician, Mr. Kerion Husbands, who had worked along with the previous M.E.O., accompanied me throughout the trip. His knowledge and understanding of the interior, the mining districts and the culture of the gold mining industry was of great benefit. His specific input of securing water samples, completing turbidity readings and mercury retort demonstrations was highly appreciated.

With the consent of Mines Officer, Eclipse Falls Top Mines Statio n (Mr. Linton Butters) we were given exclusive use of GGMC's vehicle for transportation to mining locations from the afternoon of July 07 to July 10. The vehicle left Arakaka on the morning of July 11 for the Eclipse Falls Top Mines Station. The skill and cooperation of driver Mr. O. Sydney was appreciated.

The general support, understanding and cooperation given by the miners in fulfilling our tasks were commendable. But special mention has to be made of Mr.Francis Holder (Claim Holder at "Eyelash"), Mr. J. Phillips (Claim Holder at "Arakaka"), Mr.Lloyd Cameron (Owner/Operator at "14 Miles"), Mr. Brian Joseph (General Manager of Claude Adams Operation at "Five Star") and Mr. Fredrick Obermuller (Claim Holder at "Papaya").

4. **ACTIVITIES**

Discussions were held with mine operators to investigate the impact of efforts (made by the previous M.E.O. and GGMC's personnel) on the mining culture and systems employed as it relates to the environment. Of specific interest was the identification of systems, which were readily adaptable, and investigation of those that were successfully implemented.

Problem identification and on-spot discussions of remedial methods were a standard for the trip. Apart from these discussions, one (1) evening group discussion session was held at Arakaka.

Water samples were taken at various points of waterways surrounding land-dredging (jetting) operations and at discharge end of mercury plates used for amalgamation of fine gold from crushing processing operations.

Opinions were sought on the practicality of establishing "Self-Monitoring Groups" (compromising miners and possibly other key area personnel) with the intention of encouraging and enforcing environmental friendly mining activities in accordance with expectations and regulations.

AREAS VISITED

Monday, July 07, 2003	-	10 Miles
Tuesday, July 08, 2003	-	Eyelash
Wednesday, July 09 to Friday, July 11, 2003	-	Arakaka, Purple Heart
Saturday, July 12 to Sunday, July 13, 2003	-	13 Miles and 14 Miles
Wednesday, July 16 to Friday, July 18, 2003	-	Five Star
Saturday, July 19 to Sunday, July 20, 2003	-	Papaya

5. OBSERVATIONS

5.1 TAILINGS MANAGEMENT

There is a great degree of understanding and appreciation of the "Closed-circuit" water recycle system of land dredging mining operation within this mining district. Various pit configurations were observed but invariable the water from the mining operations was not totally enclosed. What were often achieved were systems where water from land dredging operations was discharged to some creek or swampy area after some degree of settlement of tailings discharge. Most often, the miners explained that excess rainwater makes it difficult to perfect the system during the rain season since their operations are concentrated in the valleys or rainfall catchment areas. The general consensus is that the reduction in water available for dredging operations, during the dry seasons, makes it imperative to attain some form of "closed-circuit" operation.

Two designs of "closed-circuit" operations are detailed below:

5.1.1 "Closed-Circuit" Water System Adjacent to Mined-out Area

A visit to Kenneth Joaquin's operation at Arakaka proved that it is possible to have an efficient "closed-circuit" operation adjacent to a mined-out area. (See following photograph).

Tailings are discharged from the sluice-box (at the extreme right). The sluice-box is positioned such that the tailings are dumped on the slope of the catchment pond. The coarser, heavier particle sizes are segregated and trapped on the slope allowing a reduced quantity of solids directly to the settling pond. The discharge flows left to the feed pump for the water jets (centre of photograph) with sufficient time and under a body of water that reduces the turbulent effects of the flow thereby achieving adequate settlement.

The internal "silt control dam" (at the left of photograph) could be sequentially raised to retain the settlement conditions at the feed water pump and to separate and prevent unwanted silt and water flowing to the mine pit (at the extreme left of photograph).

Please note that the mine was not operational at the time that the photograph was taken hence the body of water (at the extreme left of the photograph) located in the working pit, would have had to be dewatered before jetting commenced.

Variations of this design are practical and could easily be established where local topography or the depth of overburden allows adequate accumulation of feed water.

Figure1. "Closed-Circuit" Water System Established by Kenneth Joaquin at Arakaka

5.1.2. "Close-Circuit" Water System at a New Mine Area

Discussions with Mr. Mark Thomas (General Manager of Milton Seenarne's operations, on Peter Jeffery's claim at "14 Miles") confirmed that it is practical to establish robust and innovative tailings impoundment systems for small gold mining operations.

Prerequisite to better positioning and implementation of a "closed-circuit" water recycle system at a new mining location is that geological data be acquired for ore body definition and optimum placement of borrow pits.

For effective functioning of any settling pond, an adequate body (depth) of water must be retained and the residence time (within the pond) should allow for efficient settlement of suspended solid materials to take place prior to discharge. The sizing of the ponds is not much dependent on production rate and life of mine but rather on the relative thickness of the ore seam, the planned dimensions of the first mining pits and the parameters required to enhance settlement.

The spillway (between interconnecting settling ponds) should be sized and designed to control the depth of water required for effective settlement and to allow for additional flow due to rainfall.

Layout of a "closed-circuit" recycle water system is depicted in the sketch that follows:

A preferred set of basic procedures for establishing this “closed-circuit” system is:

- Assay deposit (by trenching and panning material) to define ore body.
- Demarcate the ore body and placement of borrow pits on periphery of the defined ore body.
- excavate series of borrow pits to be used as tailings discharge settlement ponds, while systematically casting excavated material away from deposit.
- Strip and stockpile overburden from first mining pit.
- Mine first pit by jet-washing ore-bearing material with sluice-box positioned such that tailings are discharged into pond “A” of the series of settling ponds.
- Route the tailings discharge by sequential decanting tailings water through series of ponds to ensure settlement. The settled water is routed to the feed pump for the jets.
- Excavation from mine pit #1 would serve as initial catchment area for tailings from pit #2. The deposit could be systematically mined for sequential placement of tailings discharge and land reclamation.

One variation of this system would be the establishment of the required series of settling ponds, within the boundaries of the ore deposit, by digging and wasting overburden while stockpiling pay material. Tailings discharged from the mining pits would then be sequenced as above.

Even though there are some gains in the appreciation for the need of tailings management, the muddy water of the Barima River vividly indicates the need for improved tailings management and increased environmental awareness **by all.** A prevalent situation is where tailings are discharge into swampy area before running into nearby creeks without any particular settlement.

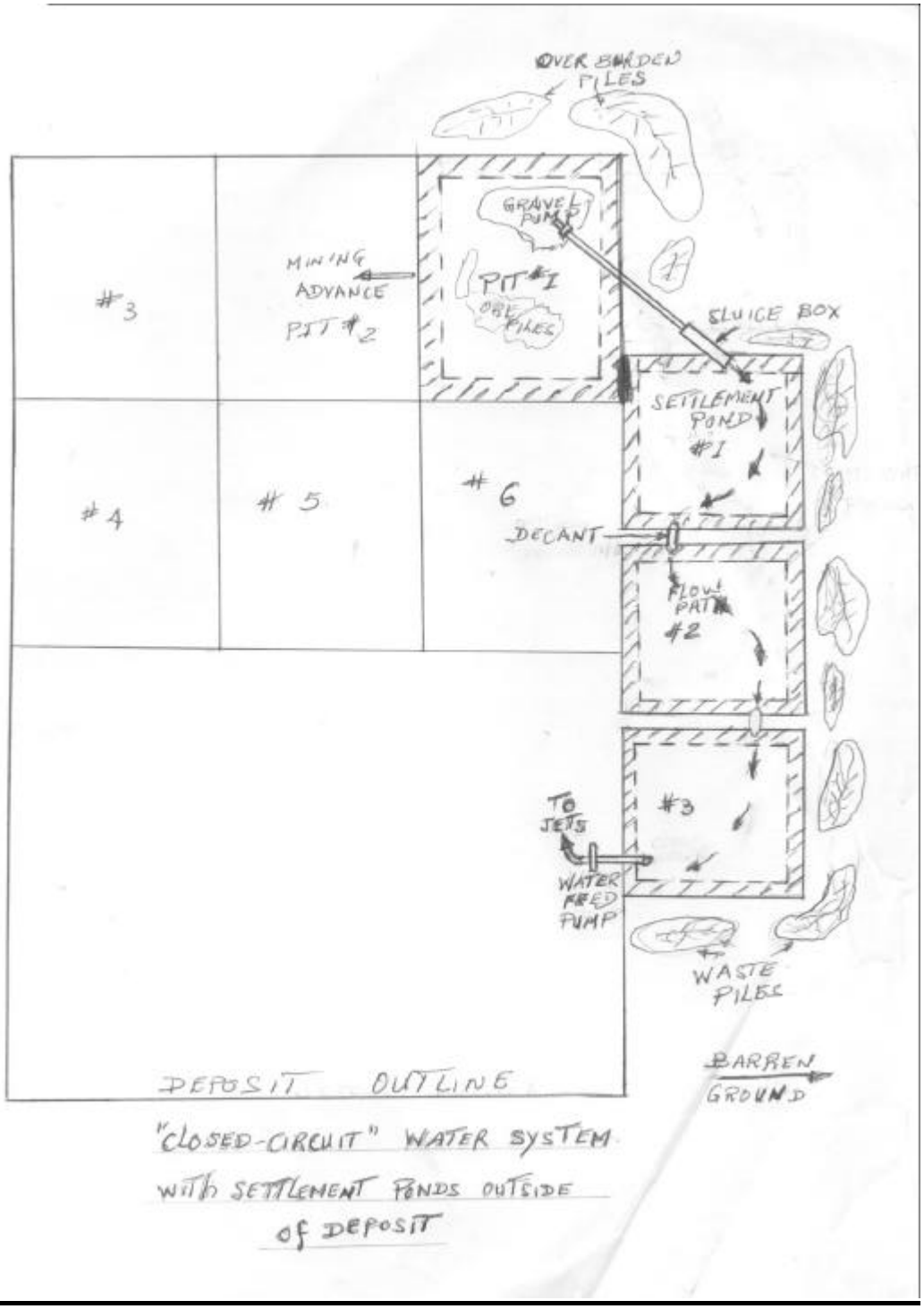

Figure2. A Practical Design of a “Closed-Circuit” Water System for a New Mining Location

5.2 CREEKS and DIVERSION CHANNELS

There is still the tendency by miners to route small creeks and streams (as a source of water for jet pumps) directly through their mining pits, which could lead to only one result, contamination of creek and recipient flow. Efforts were made to sensitize miners to the negative environmental impact of this practice and of the need to desist from this.

Where small creeks run through an identified deposit, the creek must be rerouted on the periphery of the deposit. This can be achieved by ditching "diversion channels" that closely mimic the original characteristics or flow parameters of the stream. That is, at the point of re-entry to the original creek, the width, depth and rate of flow of the diversion channel must be approximately the same as the original creek or stream.

5.3 MECHANIZATION

With progressive mechanization of the industry, particularly the advent of small backhoes and bulldozers, small mining operations are and will be required to be more systematic and efficient in their planning.

A critical observation was the rental of backhoes, for short periods of time, to various mine pits within some mining locations. Even though one cannot deny the benefits derived from the sharing of valuable resources, potential jeopardizes are:

- Poor utilization of equipment, as substantial time is spent walking backhoes from one location to another.
- High track maintenance costs.
- Damage and deterioration of access roads (especially during the rain season), unless separate paths are cut for heavy equipment.
- Potentially long delay periods when waiting on a backhoe to arrive to complete a critical activity.

The greatest benefit derived from mechanization is the scheduled stripping and placement of overburden by backhoes which would lead to a direct reduction of the volume of material required to be removed by jetting hence a proportional reduction in the volume of tailings generated.

5.4 SAFETY and HEALTH

Throughout the period of the field trip various health and safety issues came to fore:

On two occasions it was observed that miners were engaged in the detrimental practice of not debushing the working ground and worst still, of leaving undermined trees standing in the mining pit, with the intention of felling at a later time (more opportunely by jetting).

The safety of underground openings (vertical shafts and adits) must be addressed in relation to support, ventilation and establishment of emergency exit. Safety rails should be encouraged and flow of rainwater directed away from openings.

Miners are aware of the purpose of the mercury retort (even though there is need for this to be made available to them) but all should be knowledgeable of the methods of handling and storing mercury and of its possible detrimental effectives on the human system.

Having experienced and now recovering from the ravages of Malaria and Dengue Fever accompanied with the water borne disease of Typhoid, I am positioned to be even more critical of the maze of the visible water filled mined-out excavations. In closing a mining operation, areas of improvement to be addressed are:

A). Where plausible, holders and/or operators of mining claims should ensure that efforts are made to reduce the amount of stagnant water bodies by ditching to interconnect mined-out pits, thereby allowing for proper drainage.

B) With the introduction of small backhoes and bulldozers into small-scale mining Operations, some degree of land reclamation should be encouraged, not only in the form of sequential placement of tailings in mined out areas but also by the systematic replacement of the overburden covers.

6. CONCLUSION

Effective tailings impoundment for all land dredging operations can lead to a reduction in the level turbidity hence a reduction of the sediment load to our waterways. Two (2) designs of the tailings impoundment systems applicable to small-scale mining industry are:

- Impoundment designs which result in effecting a "closed-circuit" water system of operation; that is, jetting (for removal of overburden and/or "pay material") with subsequent routing of tailings discharge, in such a manner that water settled and returned to the raw water feed pump for the jets is of acceptable quality and quantity.

- Damming of tailings discharge, which allows fine solids and suspended material to be settled then water (of acceptable quality) decanted via spillways or overflow pipes into our waterways.

Most of the actual mining locations visited in the North-West mining district were basically flat lands, adaptable to the establishment of the "closed-circuit" water system of tailings effluent control.

"Closed-Circuit" water systems are more efficient during the drier season where there is a shortage of water or the water levels in the mining pits are lower. However, in the wet season where there is an excess of water due to runoff from rainfall, there is need to have systems (such *as rapid filtration medium placed in spillways*) to ensure water discharged from mining operations to the environment is of acceptable standards.

Routing streams and creeks through mining pits is detrimental to the environment hence not acceptable. Rather, effective use should be made of diversion channels, which

separate the waterways from the mining operations while retaining, as best as possible, the original flow parameters.

It is imperative that effective systems be in-place to control or confine all tailings discharges prior to the commencement of mining activities. The mining of swampy areas (where tailings are discharged in the direction of mining advance on the prospective mining ground to achieve some consolidation of the land) presents a problem in that often times the inlet and/or outlet of the water is not identified or defined, resulting in serious down stream pollution. The accumulative effect of this problem is evident at Arakaka.

The increased mechanization of the gold mining industry, specifically the introduction of small backhoes and bulldozers would bring positive benefits to the industry. Immediate impacts are: the stripping and stockpiling of overburden with backhoes which would lead to a direct reduction in the amount of material removed by jetting, hence a proportional reduction in the amount of tailings discharged; secondly, the ability of operations to be engaged in land reclamation activities would reduce the amount of stagnant water bodies left on mine closures.

There are indications of the need for engineering and technical support for operations approaching the medium size scale, specifically in relation to scheduling, slope stability in deep mines and safe construction and operation of underground opening.

Miners need to be more safety conscious, especially in regards to the potentially detrimental practice of leaving undermined trees standing in mining pits.

No systematic mining or tailings management activities can be achieved without prior debushing of work ground.

For the small scale gold and diamond industry, tailings management is integral to the mining activities hence is difficult to separate from other issues such as health, safety and mine planning.

It is practical to build small retaining dams by confining tailings discharged between two (2) vertical sheets of anchored silt-fence material. This is due to the acceptable consolidation of fill material, probably achieved by rapid drainage along with some displacement of fine silt and clay fraction of tailings discharge.

7. RECOMMENDATIONS

Recognition should be given to miners (as incentive) for innovative initiatives or for employing mining systems or techniques that make a positive impact on the industry, especially environmentally.

The continuing mechanization of the gold and diamond industry should be encouraged. This would allow for an increase in overburden removal by “dry stripping” methods hence a reduction in the tailings generated by mining operations.

There were some positive responses to the idea of establishing "**Self Monitoring Environment Groups**" by the miners but doubts about the composition of such groups exists. Anyhow, the idea is worth pursuing.

An identification tag (and probably an introductory letter) should be provided to the "Miners' Environmental Officer", if to function without an accompanying GGMC personnel.

Mr. Linton Butters, a senior Mines Officer posted at G.G.M.C.'s Eclipse Falls Top Mines Station, Port Kaituma has displayed great initiative and willingness by "hand writing" a set of rules (on the covers of the Miners' Production Books) that serves as a reminder to miners on how they are expected to operate. Further, he was observed explaining these rules to individuals when uplifting these production books. Suggestions were made for addition of critical environmental, health and safety issues to this list. Even more importantly, this list should be reviewed by relevant Department heads with intention of being officially adopted and published as part of the Miner's Production Book. This effort could be supported by orientation sessions for Claim Holder and owner/operators when uplifting relevant licenses.

Lloyd Stephen
Miners' Environmental Officer

APPENDIX A

EXPENDITURE

Overhead cost and cost of air flight to and from Port Kaituma not included.

Budgeted cost for trip	- G$437,570.00
Amount received for trip	- G$400,000.00
Actual cost	- G$297,345.00
Cash returned	- G$102,655.00

APPENDIX B

Photo 1 - System of Tailings Impoundment Employed by the Rodrigues at 10 Miles where Tailings Discharge is Routed Through Mined-Out Pit then Partially Settled Water Decanted to Nearby Stream.

Photo 2 - Damming of Arakaka Creek (by Older Method of Confining Tailings Discharged From Sluice Box Directly Between Two Rows of Supported and Plaited "Cocorite" Leaves) In-order to Reroute Creek Flow to Allow Mining of Current Creek Bed.

Photo 3 - A Typical Land Dredging Operation (by Brian Phillips at Arakaka) where both Overburden and Pay Material are Removed by Jetting and Routed Through Sluice Box.

Photo 4 - The Impact of Mechanization: The use of Cat. Backhoe (M. Seenarine's Operation at 14 Miles) to separate Overburden from Pay Material, Enabling Only Pay Material to be Removed by Jetting then Routing to Sluice Box.

Photo 5 - The Impact of Mechanization: The use of Cat. Backhoe (C. Adams' Operation at Five Star) Resulting in Clean and Stable Pit Walls, with Jetting of Pay Material Only.

Photo 6 - The Impact of Mechanization: The use of Cat. Backhoe (C. Adams' Operation at Five Star) Allows Good Pit Definition and (in Combination with a Power Saw) Effective and Safe Debushing.

Photo 7 - The Impact of Mechanization: The use of Small Cat. Bulldozer (C. Adams' Operation at Five Star) Enables Better and Safer Ground Preparation as well as some Land Reclamation.

Photo 8 - The Impact of Mechanization: The use of Small (Jaw) Crushers (J. Jairam's Operation at Purple Heart) Enables Processing of Previously Unmanageable Hard Rock Deposits.

Photo 9 - A Fully Supported, Artificially ventilated and lighted Vertical Timber Shaft and Adit System in Hard Rock Operation. (Edenilson Santos Pereira's Operations at Eyelash).

Photo 10 - Mercury being handled with bare hand (L Cameron's Operation at 14 Miles)