MONTHLY REPORT 1

20 August to 19 September 2002

By GGDMA Miners Environmental Officer

GENCAPD Project

PROGRESS MADE ON ACTIVITY PLAN [DRAFT]

A Draft Activity Plan was presented for comment to the Executive Secretary, GGDMA. Mr Shields agreed with my suggestion of focusing on three main land dredge mining areas

Focus areas suggested by GGDMA:

1. Mahdia area
2. North West District
3. Puruni River area

These remain to be confirmed however, as Mr Shields preferred to consult with GGMC regarding their Tailings Management project schedule: "…we need to know where GGMC are going, so that we can focus on the follow up."

In addition to emphasizing the need for the Miners' Environmental Officer (MEO) to conduct follow up work in areas that the GGMC have commenced tailings management work, Mr Shields noted that it was still important for the MEO to work alongside the GGMC Mines Engineers for two reasons:

1. To assist in skills and technical transfer to GGMC engineering and geotechnical staff
2. To be aware of the modifications being recommended in the back dam, so that follow-up work remains consistent with GGMC stipulations.

Mr Shields also recommended that the MEO provide feedback where necessary to the GGDMA and to the GGMC, through the Commissioner on areas that require attention with respect to the technical and advisory abilities of GGMC staff.

Mr Shields also pointed out that the GGMC are after all the regulatory body and as such they should be doing the initial tailings management work. The GGDMA through the MEO will ensure miners are willing, able and environmentally aware through follow-up programs.

I have also sent the draft plan to the Managers of both Environmental Division and Mines Division. As I explained to Mr Shields, if we are to link in with the existing tailings management program of GGMC, then it is important that the two divisions have the opportunity to critically examine my proposals. My objective in this case is to be able to modify my work plan in the light of GGMC's proposed activities in the same area.

FIELD TRIPS: OBSERVATIONS & COMMENTS

General

- Tailings management is extremely site specific.
- Without mineral exploration data to draw upon, or without the ability to conduct exploration, the ability of miners to conduct adequate mine planning and tailings management is greatly hindered.
- Without earthmoving equipment, adequate tailings dams (the sort mentioned in the proposed regulation for OSH in Mining) can not be constructed. Hand made dams, or dams mad from the distribution of tailings from the sluice box and/or suction dredge are wholly unreliable, due to the nature of the material they are using: sand.
- Most land suction dredge pits seem to be operating basically on the basis of how the owner seems to best fit.
- Little regard is paid to systematic planning of pit expansion, face advance or height of face or tailings discharge.
- None of the operators had an environmental management plan in mind much less in place.
- All owners with environmental permits were not adhering to these permits.
- Many contractors rather than claim owners are working the pits.
- Debushing took place at most pits, i.e. by manually feeling trees with axe and/or chainsaw, followed by burning, however, no stripping of topsoil for reclamation was evident in any of the pits (Upper Mazaruni and Arakaka, NWD).
- Topsoil is not removed and stored for reclamation.
- There are no decommissioning plans in place.

Upper Mazaruni River [Imbaimadai / Wariquima-Jawalla / Kamarang]
24-30 August 2002

- Most land dredges and all river missile dredges were operating illegally within the 66 feet buffer zone from low water mark going inland (***Plates 1, 2, 3 & 4***).
- Many land dredge operations, through working within the buffer zone (or thereabouts) had open breaches to the Mazaruni River, which caused both productivity***** and environmental issues: work pits were rendered unworkable when river waters flooded in to them on occasion and highly turbid waters (a mixture of loose soil from unstable work pits and 'sling' water [tailings] from sluice boxes) were draining directly back out to the river, once the high waters had receded and water was flowing out of the pits through the breaches (***Plates 1 & 2***). [*******Water management on-site in the work pits is crucial to productivity and therefore, operations too close to the river run the permanent risk of bank breaches and reduced productivity*.]
- Small ravines in proximity to land dredge operations were invariably receiving direct tailings discharge.

- Where ravines were dammed, according to advice provided by GGMC engineer, the following observations were made:
    - These should only ever be considered short-term remedial solutions.
    - The tailings held back inside these ravines, will at some point in the future make their way into the main river channel, as the micro-catchment, which drains into these ravines, continues to be active well after the 'decommissioning' of the mine.
    - The hydraulic profile of the ravine micro-catchment is dramatically altered, leaving unanswered questions as to how localized floodwaters will flow back to the river, now that their normal path, the old ravine drainage line, is completely full up with tonnes of tailings.
    - Most dams were constructed very poorly from sand bags and organic material (small tree trunks, sticks and leaves), and were no longer considered capable of retaining tailings (***Plates 5, 6 & 7***).
    - Tree death in upstanding forests takes up to 6 months. This slow death is due to tailings covering the forest floor stopping normal humus decay. Since tropical forest soils are generally nutrient poor, the humus layer plays a vital role in providing organic nutrients to the forest trees and shrubs. Once covered over by tailings the bacterial and fungal decay processes, which make these nutrients available in the humus layer, are seriously restricted (***Plate 8***).
- Recycling water in a closed circuit system has a problem within the existing capabilities of Guyanese operators: the make-up water suction pipe would stir up the settled waters in the end pond, making the water unsuitable for the mark hole.
- Miners are generally very open to awareness-raising workshops, environmental education and technical assistance in tailings management.
- Land dredge operations on Amerindian concessions, pose additional social issues, with many non-mining personnel present on-site (***Plate 9***).
- The floating river dredges (cutter suction type) have a lower environmental impact in terms of overall river turbidity than the land dredge operations (***Plates 10 & 11***). "Most rivers and streams flood on a regular basis. What makes suction dredging unique is that it takes place in a very dynamic environment....a natural stream or river. Natural variations in stream conditions, such as continual downstream movement of material through erosion and flooding, cause the effects of small scale suction dredging to be very local and short term. Suction dredging simply mimics natural erosion on a very small scale. Areas that have been subjected to years of suction dredging show little sign of the activity. During floods, impacts similar to those caused by suction dredges occur on a vastly wider scale. It is now believed that the regular movement of sediment in a stream is vital to its health, much as forest fires have come to be seen as a vital part of the life-cycle of a forest. The life in and around a stream or river not only is not hurt by irregular turbidity and rechannelization effects, it has evolved to need these events to occur periodically for the environment to remain healthy. A major threat to the health of many streams is now seen to be the construction of dams. Many of these dams were originally built to help control flooding. Now it is seen that this has actually led to damage to the ecosystems of these streams. This new research sheds new light on

suction dredging, and reveals that the movement of sediments in a stream not only does no harm, but is beneficial to the stream." [***Source***: http://www.akmining.com/mining.htm]

Arakaka Creek back dam, Port Kaituma, North-West District
6-11 September 2002

- The entire Arakaka river flat is a completely altered environment:
  - The creek no longer flows along its original channel
  - All old pits are inter-connected and the creek flows freely through them, thereby preventing any colloidal settlement (***Plate 12***)
  - All sluice boxes dump directly into the flow of the creek (***Plate 13***)
- There are too many dredges operating in a confined area. Estimates of 40-50 dredges have been made for Arakaka back dam. This in itself creates issues:
  - For Miner A to block off an old pit and backfill, with the environmental objective of creating a settlement pond away from the forces of the creek's incessant flow, means an infringement upon the next claim of Miner B.
- Some dredge operators lower down the creek flat have attempted to redirect the river by isolating it from the rest of the operations and the old pits (***Plate 14***).
- Despite backfilling of old pits, without serious forethought and earthmoving equipment, the creek will continue to snake its way through all the old operations, keeping fine material in suspension.
- Damming of the existing creek flow has the danger of backing water up and flooding neighbouring claim owners topside.
- Upstream of the top-most dredge, Arakaka Creek has a turbidity reading of **10** NTU (***Plate 15***). Downstream of the first dredge the reading is **150** NTU. By the time Arakaka Creek flows into the Barima River, it has a reading of **4000** NTU!

10-mile back dam, Port Kaituma-Barima Rd: 7 September 2002

This was an unplanned visit to a back dam, one hour's walk from the Port Kaituma-Barima Road, in order to view hand dug shafts following secondary gold enrichment through quartz veins in a dark red/purple saprolytic parent material. See ***Plates 16, 17 & 18***.

FIELD TRIP ITINERARY

See separate document: Consultant's diaries on each field trip

1. Upper Mazaruni River [Imbaimadai / Wariquima-Jawalla / Kamarang]: *24-30 August*
2. North West District [10 mile, Arakaka & Big Creek]: *6-11 September*

WORKSHOPS FACILITATED

TITLE: Tailings Management
PLACE: Pampers shop, Arakaka Creek back dam, NWD
DATE: Monday, 9 September
TIME: 7:00 – 9:00 pm
ATTENDEES: Miners from Arakaka back dams
NUMBER: 40 MINERS

WORKSHOP OUTLINE:

20 min	Icebreaker	[**C. Curnow, MEO, GGDMA]**
5 min	Introduction and Welcome	[R.Glasgow, GGMC]
20 min	Ecological Overview & Dredging Impacts	[**C. Curnow**]
20 min	What is Tailings Management	[**C. Curnow**]
20 min	Why Tailings Management	[R. Glasgow]
20 min	Experiences so far in how to manage tailings	[P. Hutson, GGMC]
20 min	Water Quality measurements	[K.Husbands, GGMC]
5 min	Short 'Wake-Up' activity	[**C. Curnow**]
20 min	Chainsaw Safety & Maintenance	[W. Jarvis, GFC]

COMMENTS:
There were a number of questions at the end of the workshop relating to the miners' need for governmental assistance to implement the modifications that we were asking of them. They all agreed too that these sorts of things take time. Many miners however, still had problems with understanding the difference of impact between course and fine tailings. They tend to think that the fine slurry can go into the creek as long as they retain the course material. The awareness-raising discussions that I held went some way to change these erroneous perceptions.

MEETINGS HELD

21 August: Introductions with **Mr Benn** (GGMC Commissioner)
2 September: Introductions with **Mr Shields** (Executive Secretary, GGDMA)
12 September: Discussions with Mr Shields regarding the Draft Activity Plan. Some consensus was reached for the direction of future work

NETWORKING

16 September: Discussions with Mr Ney do Prado Dieguez (Brazilian Ambassador to Guyana) regarding possible technical assistance (formal and/or informal) from Brazilian experts familiar with conditions similar to those found in the Guyana back dam.

I am continuing with ongoing discussions with former colleagues working in the mining sector in Australia, regarding options for tailings management.

LITEARTURE REVIEW

- Report on the Technological & Operational Aspects of Dredge & Small-scale Open Pit Gold & Diamond Mining in the Co-Operative Republic of Guyana, Dept of Mines, Westeren Australia, Mine Engineering Division (Dec, 1990)
- Environmental Regulations made under Mining Act, 1989
- Angola River Dredging EIS by Earth Systems
- Mahdia Tailings Management Draft Report by Peter Hutson
- Occupational Safety & Health in Mining: Proposed Regulation for Guyana
- Various internet
- Yukon Environmental Assessment
- Tailings Management Project, Internal file, GGMC
- Potaro River Orientation Survey: A Preliminary Study of Suspended Solids & Mercury in the Mahdia Mining Drainage Basin (Sept, 2001), by GGMC and Natural Resources Canada and Fisheries & Oceans Canada.

PLATES

Photography by Chris Curnow [GGDMA MEO]
Camera: SONY digital camera with [DSC-S75]

Plate 1: Most land dredge operations are mining right on the river bank. The regulation 66 feet buffer zone is ignored resulting in breaches to the open river channel (In some cases, these breaches are facilitated by river dredges making further in roads onto land claims). In this case (**Tyron Powers** claim) new and old work pits have been flooded by the rising waters of the Mazaruni River, allowing for the escape of fine tailings directly to the river. Old pits, even if they are being used for backfilling are not isolated from the river, and as such there is little or no settlement of fine material priorto discharge back to the river. **Wilton Tafares** (General Manager) discusses tailings management with GGMC staff.

Plate 2: Flooded work pits (old and new) within the 66 feet river bank buffer zone. Turbid water, being a mixture of both tailings discharge and loose soil from the actual work pits, escapes easily and directly, once the high water levels subside. In this case (**Buddy Henry** and **Philbert Moore** claims, Upper mazaruni, upstream from Imbaimadai) work had to cease, and after river levels subsided, the remaining turbid water that could not drain back to the river channel, had to be pumped. In the absence of suitable old pits and tailings retention and settlement ponds, this turbid pit water is pumped and ejected directly into the river.

Plate 3: River dredge clearly operating illegally inside the river bank and within the 66 feet prescribed buffer zone. Tailings are dumped on the land side of the breach, however, with the bank fully breached this highly turbid zone is free to mix with the passing waters of the Mazaruni River. In this case (**Mark's** claim, upstream from Imbaimadai) two missile dredges are blatantly contaminating the Upper Mazaruni River.

Plate 4: As in *Plate 3*, missile dredge inside a large and penetrating breach into the river bank, with turbid waters escaping freely to the Upper Mazaruni River (**Mark's** claim).

Plate 5: Ravine dam holding back tailings from old suction dredge pit just behind river bank on the Upper Mazaruni, upstream from Imbaimadai. Discharge pipes and some bags were removed in the attempt to allow backed up water to escape to river. As a result this dam's structural integrity has been compromised. Overall these ravine dams, as a means to managing tailings (i.e. preventing tailings entering river through provision of adequate storage and settlement time), are short-term remedial solutions. (**Tyron Powers** claim)

Plate 6: Ravine dam (**Tyron Powers** claim, Upper Mazaruni, upstream from Imbaimadai) completely filled beyond useable and safe capacity. Natural drainage from the riverine ecosystem's natural micro-catchment is from right to left in the photograph. With the natural hydraulic profile of the ravine now changed, it is only a matter of time before the medium to course tailings is released into the river channel. The fine material has already all escaped to the river, because since there is no freeboard holding a minimum retention volume of water, there is no room for adequate settlement of the fine colloidal material.

Plate 7: Effect of damming of ravines. Tailings completely fill what was once a narrow deep natural drainage channel. In this case (**Tyron Powers** claim, Upper Mazaruni, upstream from Imbaimadai) the natural baseline water flow, flowing toward the viewer, is continually carrying fine material to the ravine dams constructed (*Plate 6*), and which, being now filled to beyond capacity, permit the constant discharge of tailings into the river. What are the other effects of this change in hydraulic profile?

Plate 8: Once the forest floor's humus layer is covered over with tailings, tree death takes up to six months (pers.comm. Amerindian dredge owner, Wariquima). Analogous to partial suffocation, without a source of nutrients the trees, despite continued solar energy, die a slow death. Vital bacterial and fungal decay processes in the humus layer, which liberate essential nutrients for uptake by the shallow rooted plants, are stopped once air and light are restricted by the covering layer of tailings (**Tyron Powers** claim, Upper Mazaruni River, upstream from Imbaimadai).

Plate 9: Four dredges operating in the same large work pit (**Wariquima Amerindian concession**, Upper Mazaruni, Jawalla). Note the presence of children in the active work pit. All tailings generated flow into large back swamp immediately behind river bank, some 900 metres from this pit.

Plate 10: Cutter suction floating river dredge: Brazilian built, owned and operated (13 kms downstream from Kamarang, Upper Mazaruni River). Low colloidal content in river bed material means that tailings turbidity discharge is significantly less than that from land dredges. The main environmental impact noted here is the creation of artificial sand/gravel bars mid-stream, increasing navigational risk to boat operators. (See Page 3 for comments regarding river suction dredging and the natural flood dynamics of river hydraulics)

Plate 11: Cutter suction floating river dredge (Brazilian operation, 13 kms downstream from Kamarang, Upper Mazaruni River) with tailings discharge directly into midstream channel.

Plate 12: Arakaka Creek back dam, NWD. Arakaka Creek flows through old pits. There is no isolation of tailings for retention and settlement purposes. All colloidal material remains in suspension through a combination of movement and dilution effects created by river flows mixing with tailings waters. Photo taken mid-way along Arakaka Creek flats.

Plate 13: Arakaka Creek back dam, NWD. Sluice box discharges directly into creek flows. The creek has been diverted continuously and no longer flows in its original channel. This is the fifth dredge operation from the top of the creek flat operations (**James Lowe** claim).

Plate 14: Arakaka Creek back dam, NWD. Attempts at using earthmoving equipment to isolate creek from active operations and to prevent the water from flowing through old pits, which are being used as tailings ponds. This is the work of only one operator (**Rodrigues** claim). These waters have drained through all the old pits of claims upstream and will continue to do so once this water leaves this claim heading downstream. Arakaka Creek starts off at 10 NTU upstream of the topmost dredge (see *Plate 15*). At the point just before it discharges to Barima River, the turbidity reading is 4000 NTU!

Plate 15: Arakaka Creek back dam, NWD. Arakaka Creek upstream from topmost dredge with a low turbidity reading of 10 NTU.

Plate 16: 10 Mile Back dam, Port Kaituma-Barima Rd. Open hand-dug shaft, mining secondary gold enrichment through quartz veins in saprolytic parent material (**John & Clarence Rodrigues** claim). Saprolyte carried to the surface, crushed and washed through the sluice.

Plate 17: 10 Mile Back dam, Port Kaituma-Barima Rd. Open hand-dug shaft, mining secondary gold enrichment through quartz veins in saprolytic parent material (**John & Clarence Rodrigues** claim).

Plate 18: 10 Mile Back dam, Port Kaituma-Barima Rd. Open hand-dug shaft, mining secondary gold enrichment through quartz veins in saprolytic parent material (**John & Clarence Rodrigues** claim).