MINISTRY OF NATURAL RESOURCES
CO-OPERATIVE REPUBLIC OF GUYANA

POLICY BRIEF #7

Environmental management in bauxite mining districts: a course of action

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A. SCOPE

This policy brief is the last in a series of seven that forms a policy framework for the management and utilization of Guyana's bauxite resources within the guidelines of the country's Green State Development Strategy (GSDS). The brief responds to one of the stated terms of reference guiding this project:

- Strategies for the environmental management, the geohazard management, and the after-use in active mining and mined-out areas.

Recommendations are guided by the policy positions outlined in the National Mineral Sector Policy Framework and Actions (NMSPFA), produced for the Ministry of National Resources (MNR) in 2018, which, in turn, harmonizes with the Green State Development Strategy.

B. BACKGROUND: IMPACTS OF BAUXITE MINING

(i) General

Guyana has been mining bauxite for over one hundred years. There are two distinct types of bauxite deposits in Guyana (Brief # 3): the high-iron plateau-type and the low-iron coastal bauxites, capped by sediments and occurring as residual pockets on the plateaus, on their flanks, or in proximal channels. Bauxite mining in Guyana has exploited the latter type.

Accompanying the industry's substantial economic and social contribution to Guyana's development are its widespread and complex historic and on-going environmental impacts. These impacts include diminished air quality, hydrologic disruption, chemical contamination of land and water, erosion, ground instability, and non-closure of mined-

out properties. Environmental impacts extend beyond the limits of mining properties into the adjacent and more distant land zones, biosphere and communities.

The negative environmental effects of bauxite mining are related to the nature of bauxite deposits, local climatic conditions, the associated mining methods, the historical lack of environment awareness and regulatory control, and the current inadequate regulatory engagement and enforcement.

The deposits occur at depths ranging from the surface to over 30 metres and are best suited to open-pit mining. This mining method typically utilizes and impacts large amounts of land resources. The required land-clearing and overburden removal disrupt the ecology, biodiversity and surface water patterns locally (within the mine footprint) and regionally. The high annual rainfall and shallow water table lead to the disruption of hydrologic regimes and necessitate measures to collect and dispose of large volumes of water during mining.

In addition to the extraction of ore, the processing of ore is another major source of environmental concerns. Raw bauxite in Guyana is crushed, washed, dried, and calcined. Processing requires mechanized operations that produce dust, noise and chemical pollution, as well as tailings.

There is only limited mine reclamation, closure, or post-closure monitoring at the historical bauxite mines in Linden or Kwakwani. Bosai Minerals Guyana) has not implemented reclamation or closure activity at the recently mined-out Dakoura deposit within the Dakoura Creek Watershed. There is however water quality monitoring on Dakoura Creek, Kara Kara Creek and the Demerara River as part of the Environmental Management Plan (EMP).

The need for land and resources drives encroachment and brings the associated communities within the boundaries of the abandoned or mined-out mining properties. This encroachment compounds the problem and brings new challenges and more immediacy to the responses.

The historical non-closure of the bauxite mines has produced several crises that must be addressed but also offers opportunities for more progressive and informed responses to the mined-out spaces now than previously.

(ii) Legacy issues: mined-out areas

One hundred years of bauxite mining, without mine closures or reclamation programmes, produced thousands of hectares of degraded mined-out properties. These properties are associated with the historical mines and deposits in Ituni, Kwakwani, Akyma, Three Friends, Dorabecee, Montgomery, Kara Kara, Coomacka, Lucky Spot, Christianburg and Dakoura Creek.

These locations are characterized by:

- Large, deep ponds/lakes of water from rainfall, springs and mine-run off
- Overburden and waste piles
- Steep and unstable landforms (leading to frequent landslides)
- Silted creek, drainage areas and depositional basins, some with quicksand conditions
- Extensive sheet and gully erosion and re-deposition
- Large deforested areas
- Uncontrolled access to properties that enables unlawful waste dumping, excavation of construction and other materials.

Over the years, natural revegetation/reforestation has returned to sections of the mined-out lands. The reforestation has attracted various species birds and other fauna including fox, deer, and rodents. Ecosystems are being partially restored by natural processes.

(iii) Legacy Issues: Impact on neighbouring communities

Hydrologic impacts beyond the boundaries of the mines or mining properties include siltation of creeks and rivers, siltation of wetlands, and disruption of aquatic habitats[1] Historical Mining Communities evolved adjacent to mining operations or processing plants. These communities often are located on the river banks between the mining operations and the rivers. The rivers were the only means of transportation during the initial exploitation of the deposits.

The drainage regimes generally included creeks that collect surface run-off or capture spring- flow and terminate in rivers. Some creeks also capture decant and overflow from tailings ponds and surface run off.

Often, during period of heavy rainfall or overflow from processing facilities result in increased turbid flow in creeks and flooding of adjacent communities. There has been frequent flooding of Noitgedacht, Kara Kara, and Rainbow City in Linden due to overflow from the tailings ponds associated with the processing plant at Linden.

In 2008, heavy discharge from Bosai's Dakoura Creek mines resulted in increased sedimentation and turbidity, necessitating the temporary closure of the Wisrock Water Treatment Plant (with its intake on Dakoura Creek).

In 2012, a landslide, from overburden piles at the mined-out Kara Kara mines (produced by an earth tremor centered in the Caribbean) temporarily blocked flow in Kara Kara Creek.[2] Continued siltation from the waste piles at the Kara Kara mine has silted-up the Kara Kara Creek basin and associated wetlands, and impacted the Demerara River channel at the creek mouth. This phenomenon is repeated through the various (Demerara) sub-basins within the disturbed and mined-out lands.

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[2] https://www.kaieteurnewsonline.com/2011/06/26/kara-kara-one-of-the-obscure-places/

Similarly, deposition of sediments from the old Coomacka mines has created a beach and narrowed the Demerara River Channel. It is estimated that corrective-action would cost in excess of G$100m[3].

Continued erosion of overburden piles and deposition have altered the flow of Dakoura Creek and impacted the aquatic habitats. This has also produced flooding of extensive areas upstream of the mines.

(iv) Encroachment of mining properties

There has been extensive and continuing encroachment into the mined-out areas around Linden by squatters and housing developers. Affected areas include the Christianburg mine, Block 22 mine, Dakoura Creek mine. Most of these unregulated settlements are on unstable slopes with continuing erosion. In the historic Christianburg mining area smaller mine pits are filled with vegetation and inhabited by large reptiles and alligators. Extensive squatting contributes to land degradation, erosion and contamination of water bodies. Harmful impacts on human health are highly likely.

A number of these are completely surrounded by squatters limiting access for any other use such as fish farming, environmental studies or recreation. The water bodies are now being contaminated by household and septic tank discharges.

Currently, the National Industrial and Commercial Investments Limited (NICIL), which is not an operator, owns and controls considerable amounts of mining and non-mining tracks of land in and around Linden, Kwakwani and Ituni. There is very limited monitoring of these properties. And better land management is required.

C. EXISTING ENVIRONMENTAL LAWS AND INSTITUTIONS

Guyana's mining and environmental regulations dictate that Social and Environmental Impact Assessments (SEIAs) be prepared and approved, prior to the initiation of mining. An Environmental Mining Plan (EMP) is also mandated and must address the impacts predicted through the entire life-cycle of the specific mine, including closure and post-closure. These laws emerged however after 1996.

The Guyana Environmental Protection Agency (EPA) and the Guyana Geology and Mines Commission (GGMC), through a 1997 memorandum of understanding, have joint responsibility for the environmental oversight of mining and specifically the implementation of the specific EMPs.

While robust environmental laws are in place, we find little evidence of any sustained and systematic management of the environmental problems confronting the bauxite mining districts. Furthermore, legacy issues from historic mining have received insignificant remedial actions.

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[3] http://guyanachronicle.com/2018/05/30/helps-on-the-way

D. PROPOSED POLICY FRAMEWORK

Of necessity, a policy framework for the environmental management within the bauxite mining belt of Guyana must address four challenges:

i. The impacts of current and projected bauxite mining activity.

ii. The impacts of current and projected mining of other minerals and materials, such as sands and clays.

iii. The legacy impacts of past mining activity (inclusive of issues related to the presence of mined-out areas and geohazards).

iv. The impacts of current and projected non-mining economic activities, such as logging and recreational activities.

These challenges encompass large temporal (historic, present, and future) and spatial extents (within and external to mining areas) as well as a wide range of effects (such as on air, surface and underground water, and ecosystems). In response, a comprehensive and integrated policy and management framework is therefore required. This brief accordingly recommends the design and implementation of the following:

1) A Cumulative Environmental Effects Assessment (CEEA)[4]. This response relates to the first, second and fourth challenges just above.

2) Related plans for the rehabilitation and after use of mined-out areas (relating to the third challenge above).

These responses fully conform with and are guided by the GSDS, the National Mineral Sector Policy Framework and Actions (2019 – 2029), (NMSPFA), Guyana Mining Act 1979, the Environmental Protection Act (1996), the Towards Sustainable Mining Initiative and the recently established Sustainable Bauxite Mining Guidelines (2018) (Brief #6). **A multi-stakeholder approach with community involvement is essential to the success of these plans.**

WHAT IS A CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT?

Regional cumulative environmental impacts can be defined as effects on the environment which are caused by the combined results of past, current and future activities. The concept of cumulative effects is based on the fact that single small activities at different locations, when aggregated together across a large area, such as a watershed, may be different in nature or extent from the effects of the individual activities.

The environmental management plan that derives from such an assessment is therefore regional in application and takes account of all impacting activities in a collective manner.

[4] Also referred to as a Cumulative Impact Assessment (CIA).

Plan #1: A Cumulative Environmental Effects Assessment (CEEA) for the bauxite mining districts

In areas of multiple existing or proposed operations, the understanding of the combined effects of activities on the environment is vital to delivering well-planned, well-managed and sustainable development. The impact of bauxite mining in Guyana extends across extensive territory affecting several communities and several ecosystems, habitats, watersheds, and groundwater systems. Other mining activity (such as mining for sands and clays) and non-mining activity (such as logging) can complicate and extend this environmental footprint. Accordingly, what is required is a regional integrated approach, one that meshes and goes beyond assessments based on single projects or localized areas.
CEEA or CIA is an approach introduced and recommended to the GGMC and EPA by the CIDA-funded Guyana Environmental Capacity Development Project (GENCAPD) in 2004. Plans were drafted for Mahdia and for sand and loam mining along the Linden-Soesdyke Highway.5 This brief recommends a similar approach for the bauxite mining districts (Table 1).

Table 1: Steps in a CIA (CEEA)

Assessment Framework

Basic EIA Steps	Tasks to complete for a CEEA
1. Scoping	• Identify regional issues of concern. • Select appropriate regional VECs. • Identify spatial and temporal boundaries. • Identify other actions that may affect the same VECs. • Identify potential impacts due to actions and possible effects.
2. Analysis of Effects	• Complete the collection of regional baseline data. • Assess effects of proposed action on selected VECs. • Assess effects of all selected actions on selected VECs.
3. Identification of Mitigation	• Recommend mitigation measures.
4. Evaluation of Significance	• Evaluate the significance of residual effects. • Compare results against thresholds or land use objectives and trends.
5. Follow-up	• Recommend regional monitoring and effect management.

Source: GGMC report. (VECs = Valued Ecosystem Components)

[5] For further details, see Strategic Goal #4 in the NMSPFA (pg 57).

Plan #2: Management of legacy issues

Special actions are here proposed to address legacy issues, inclusive of mined-out areas and other disfigured landscapes.

Current uses of mined-out areas in Guyana

- Urban waste dumping.
- Illegal waste dumping.
- Extraction of silica sand & overburden for construction materials .
- Entertainment , hiking swimming, and boating.
- Mine reclamation pilot.

There are number of current and proposed uses of the mined-out spaces. These include official dump sites in the Kara Kara and Dakoura mines by individuals and the Linden municipality. The mines are also used for illegal dumping. While there is concern about contamination of both creeks, there has been no targeted water quality monitoring. The Dakoura Creek Watershed Management Plan identified urban waste dumping as a potential threat to the sustainability of Dakoura Creek as a primary water source. Current uses also include extraction of silica sand and overburden[6] for construction and road building. Some mined-out areas are currently used for recreation and entertainment including hiking, and swimming and boating in the creeks and lakes. Proposed uses of the mined-out spaces also include up-scale housing development, solar farms, industrial development[7] and an engineered landfill.

Globally, the trend towards sustainability and sustainable bauxite mining has resulted in increased management, rehabilitation and re-use of mined-out bauxite properties (Table 2).

Table 2: Use of mined-out bauxite mines - globally

Country	Mine/Location	Proposed Mine use/Restoration Goals
Jamaica	Manchester, St Elizabeth	Agricultural purposes; Housing Developments[8]
Australia	Jarrahdale Mines	Reforestation, re-establishing stable biological systems[9]
Brazil	Mineração Rio do Norte	Reforestation[10]

A plan for Guyana should address:

[6] http://guyanachronicle.com/2019/03/26/lindeners-mull-exploitation-of-bauxite-overburden

[7] Kaiteur News https://www.kaieteurnewsonline.com/2019/05/17/overseas-based-linden-company-bullish-on-development-condemns-nicils-pussyfooting-on-lease-issue/ 17 May 2019

[8] http://www.jbi.org.jm/pages/uses_of_mined-out_lands

[9] http://www.fao.org/3/y2795e/y2795e03.htm#TopOfPage

[10]

Strategies	Actions and outputs
Assessment	▪ Inventories of properties - location, ownership, size - characterization (physical, hydrological, environmental, stability, hazards, closure status, economic value) - importance to local community
Usage and reclamation	▪ land use plan ▪ rehabilitation plan ▪ release and transfer strategy of lands from the mining/holding companies to community control

It is critical that after-use plans be formulated for areas where mining is currently active. Such land use projections could guide how mining presently proceeds, such as decisions on overburden storage and refilling of old pits.

Plan #3: Geohazard mapping and mitigation

Geohazards are geological processes that pose a threat to people and/or their property and activities. Examples include landslides, earthquakes, tsunamis, volcanoes, swelling and collapsing soils, floods, erosion, sinkholes, and severe weather phenomena.

Geohazards can be purely geologic in origin or have a significant geologic component (e.g., landslides, earthquakes, tsunamis, and volcanoes) or can be man-induced hazards with geological causes (dams that fail due to erosion, abandoned mines that collapse, and ground that subsides because of excessive pumping of water from aquifers).

The main hazards in the bauxite mining belt are mining-induced and include river and gully erosion, landslides, flooding, and river siltation. The main objective of geohazard mapping and mitigation is to:

- Determine the locations, probability of occurrence, and the magnitude of the geohazard events, with information displayed on geohazard maps;

- Based on the geohazard maps, prioritize areas for mitigation and preventive measures, such as reforestation and grading of slopes, and revetment of river banks.

The local Civil Defence Commission and the University of Guyana have accumulated experience with such work.

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