A RAPID ASSESSMENT OF THE EXISTING SYSTEM OF REGULATION AND CONTROL OF RIVERS IN GUYANA

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BACKGROUND

Under its 'Shared Resources, Joint Solutions' (SRJS) program, the World Wildlife Fund (WWF) seeks to address terrestrial and marine issues that significantly affect ecosystem-based International Public Goods (IPGs) in the Guianas. Focusing on three IPGs: climate resilience, water, and food security, the programme aims to ensure sustainably managed landscapes that provide the most essential ecosystem services on which local communities and the broader economy depend. To achieve this objective, the programme takes a holistic approach that encompasses:

- Building strong partnerships that can lobby for improved environmental governance and compliance
- Improving the capacity of civil society groups and organizations to advocate for their interests, and
- Improving the enabling environment by strengthening targeted policies and practices.

In Guyana, the WWF is partnering with Policy Forum Guyana (PFG) to implement some of these activities, with an emphasis on freshwater. Guyana is ranked second in the World Bank's country rankings of freshwater availability per capita (World Bank, 2018). However, threats to this resource are increasing and there is growing recognition of the need to develop mechanisms to strengthen, support and improve freshwater resource management and governance. In this context, it is critical to document the threats, identify the sources of these threats as well as the agencies that exercise authority and influence and can act to curb these threats.

Consequently, PFG initiated a rapid assessment of the existing system of regulation and control of freshwater resources and the major threats faced, with a focus on rivers of the Rupununi. Southern Guyana within which the Rupununi region lies, has been identified as a priority landscape for this project. This biodiversity-rich area has come under increasing pressure from mining, road and agribusiness developments, which are having an impact on the natural capital including freshwater resources. These threats are likely to increase as the region becomes more accessible, with attendant negative consequences for biodiversity and indigenous peoples who rely heavily on this resource.

This report details the rapid assessment and proposes recommendations that can form the basis for further discussion and inform the decision-making process.

INTRODUCTION

Water forms an integral part of Guyana's identify, with the word "Guyana" being derived from an unknown Indigenous language thought to mean "Land of Many Waters." The importance of water to Guyana's identify is also symbolized in the National Anthem, National Flag and Coat of Arms.

In recognition of the threats to Guyana's many rivers and the need for a concerted civil society effort to have these remedied, Policy Forum Guyana launched its "River Campaign." The river campaign seeks:

1) To raise awareness at the national level of the urgency of reducing pollution of freshwater sources and the urgency of self-regulation of the human species which involves adapting human activities to the limits of nature's capacity
2) Protection of Guyana's waterways: This requires
    i) Restoration of authority over rivers to communities and
    ii) Revitalized and integrated management and control of rivers
3) A ban on river mining

As part of its campaign, Policy Forum Guyana is undertaking a Rapid Assessment of the existing system of regulation and control of rivers in Guyana, with particular reference to the roles and responsibilities of relevant Government Agencies. The Rapid Assessment will serve as the basis for further consultation with the concerned agencies in a cooperative effort to identify ways to enhance river protection.

METHODOLOGY

Data Collection

Data collection comprised two main activities: (1) A review of existing literature in the form of legislation (Acts of Parliament and subsidiary legislation) and relevant reports/studies and (2) Interviews with key governmental organizations.

Both activities primarily sought to:

i) Identify the Agencies vested with some form of legal or administrative responsibility for rivers in Guyana;

ii) Provide a view of the Agency's perception of the effectiveness of present arrangements with respect to management arrangements for rivers in Guyana, with emphasis on:
   - Those areas where arrangements are inadequate;
   - Why those aspects which work well are effective;
   - Where inadequacies exist, whether they relate to legal, administrative or resource (human, financial, etc.) factors;
   - Specific inadequacies which may affect the protection of rivers against mining and agro-industrial threats.

iii) Identify whether rivers in heavily mined areas benefit from any special forms of protection.

iv) Identify whether efficient river management could be achieved by vesting authority/responsibility at sub-national levels (local and regional): -
   - Particularly, what would the advantages/disadvantages of vesting powers in elected Indigenous leaders to enforce the regulatory control over rivers affecting community life?

v) Proposals which Agencies may have regarding the creation of river protection measures to mitigate the effects of mining.

Data Analysis

The two primary data collection activities were merged to produce Agency-level qualitative analyses of legislative frameworks and perceptions. The combined outputs of this process were used to make recommendations on potential remedies or interventions to alleviate inadequacies in river management, both in the short-term and long-term. All analyses and recommendations are presented in this report. Due to requests for confidentiality, statements emerging from in-person interviews were not attributed directly to respondents. A list of respondents will be provided in a separate document to Policy Forum Guyana for validation and record-keeping purposes.

RESULTS

Literature Review

The sustainable management of Guyana's natural resources, including water, is encapsulated in Guyana's Constitution. Section 36 ('The environment') states: "In the interests of the present and future generations, the State will protect and make rational use of its land, mineral and water resources, as well as its fauna and flora, and will take all appropriate measures to conserve and improve the environment."(Constitution, 1980) The State is vested with the ultimate Authority to manage and protect Guyana's water resources.

The State's roles and obligations with respect to water resources being established by numerous Acts of Parliament and subsidiary legislation. In this study, the following Acts and subsidiary legislation have been identified, as setting-out the rules and framework for the management of Guyana's water resources:

1) Water and Sewerage Act (2002)*
2) Maritime Zones Act (2010)*
3) Drainage and Irrigation Act (1998)
4) East Demerara Water Conservancy Act (1998)
5) Creeks Act (1998)
6) Mahaica-Mahaicony-Abary Agricultural Development Authority Act (1998)
7) Guyana Lands and Surveys Commission Act (1999)*
8) Environmental Protection Act (1996)*
    - *Environmental Protection (Water Quality) Regulations 2000*
    - *Environmental Protection (Hazardous Wastes) Regulations 2000*
9) Mining Act (1989) and Guyana Geology and Mines Commission Act (1979)*
    - *Mining Environmental Regulations (Amendment) (2005)*
10) Forests Act (2009) and Guyana Forestry Commission Act (2007)*
    - *Forest Regulations 2018*
11) Protected Areas Act (2011)*

* *Acts which may be applicable to river pollution are described below:*

Water and Sewerage Act (2002)
A system for the management of water resources is established by the *Water and Sewerage Act*. Ownership and use of all water resources in Guyana are assigned to the State; Section 18 (1): "The ownership of all water resources and the rights to use, abstract, manage and control the flow of water are vested in the State…"

The Act is divided into 14 major sections

- National Water Council
- Hydrometeorological Department
- Ownership and use of water
- Licenses
- Drought orders
- Public Supplier
- Certain powers of public supplier
- Sewerage
- Connection and Disconnection
- Offences
- Acquisition of lands
- Creation of Guyana Water Inc.
- Regulations
- Miscellaneous

The Act allows for the establishment of a National Water Council (NWC) to advise the "Minister" on developing, implementing and amending the "National Water Policy (NWP)." Also, the Council may provide advice to Government Agencies on the integration of national water policy objectives/mandates into their work programmes and policies. The Council has an analytical function, providing the Minister with information on threats to water resources and potential solutions/alternatives. Currently, the Minister of Agriculture is responsible for administering the Act. The functions of the Council are not limited to internal (closed-door) settings, they may also provide information to the public on the national water policy and the protection and appropriate/sustainable use of water resources (including surface water systems). The Minister directly appoints the members of the Council after consulting with "consumers" of water resources.

For the purposes of the Act, "water resources" include all water which originates from runoff or rainfall from the land (within the Geographical boundary of Guyana). This limits the application of the definition of 'water resources' to watersheds or parts of watersheds which are found within Guyana. A 'watershed approach' to the management of water in Guyana must, therefore, be interpreted within the limits of that Geographic context.

The Act does not speak to who should convene the NWC nor does it specify who should/can sit on the NWC nor how many members it should have. It mandates the Minister and Council to consult with relevant government agencies prior to creating the NWP.

Hydrometeorological Department

The Act assigns numerous functions to Hydrometeorological Department (HD), including establishing national monitoring systems for the quality and quantity of surface and groundwater; weather forecasting; collection and storage of data on weather, climate, hydrology and oceanography; establishing licensing systems for activities related to the diversion or abstraction of water (surface and ground); note the impact of water use on its quantity and quality; provide technical advice to the Minister; provide weather and climate data to other agencies; establish an early warning system; research and; **"to ensure that existing sources of groundwater and surface water are conserved or sustainably used."** The HD may establish MoUs with other agencies to discharge its functions. HD's database must include (among other things) a "register of water use authorizations." The HD must advise the Minister on "any risk posed by the quality of any water to life, health or property."

Licenses

In executing its functions, the HD may issue licenses for the use of water resources (ground and surface water). If an application for extraction of water "may significantly" affect the environment, the application must obtain authorization from the Environmental Protection Agency first.

Drought Orders

The Minister of Agriculture, upon the advice of the HD, may issue an order aimed at controlling the amount of water being utilized, if **supplies** are threatened or seriously diminished. This order is only effective for three months (maximum) and can be extended for an additional three months by the Minister.

Regulations

The Act enables the Minister to create regulations, inter alia, requiring monitoring of the use of water from a water resource, and setting out the rules for monitoring (e.g. guidelines, procedures, standards).

Maritime Zones Act (2010)
The Maritime Zones Act repeals and replaces the *Maritime Boundaries Act (1977).* The boundaries of water bodies found in Guyana are delimited by the Act. These include the high seas, internal waters, the sea, territorial sea, contiguous zone, continental shelf and exclusive economic zone. The Act is therefore not limited to marine waters. Guyana's rivers and creeks are assigned to "internal waters." Part III (Internal Waters) limits internal waters to:

a) "the areas of the sea that are on the landward side of the baselines which form the inner limits of the territorial sea; and
b) all rivers, bays, historic bays, ports, harbours and waters lying landward of the baselines."

Part XIII of the Act empowers the Minister with responsibility for the Act (currently the Minister of Public Infrastructure) to establish regulations for the protection and preservation of the marine environment, in consultation with the Minister with responsibility for environment (currently the Minister with policy oversight of the Ministry of the Presidency). This is an acknowledgement of the need for inter-ministry collaboration to address environmental problems associated with the marine environment. These regulations may seek to prevent, reduce and control pollution of the marine environment from land-based sources such as rivers, estuaries, pipelines and outfall structures. This indicates that the Act explicitly acknowledges the relationship between inland (fresh) waters and marine waters, with the former potentially affecting the quality of the latter. It does not appear that these regulations were established.

The Maritime Administration Department administers the *Maritime Zones Act*, as well as the *River Navigation Act* (2012).

Guyana Lands and Surveys Commission Act (1999)
The *Guyana Lands and Surveys Commission Act* establishes the Guyana Lands and Surveys Commission (GLSC), a body tasked with acting as a "guardian over all public lands, river and creeks of Guyana." Section

4(1)(r) of the Act outlines the functions of the GLSC, including the preparation land use plans for any part of Guyana (except for municipalities). Apart from its role in land use planning, other functions which the GLSC may exercise during its guardianship of rivers in Guyana are not specified by the Act. However, planning would form a critical component of the management of any resource, especially water. There currently exists a National Land Use Plan (2013) which was established by the GLSC (GLSC, 2013). The US Army Corp of Engineers conducted a Water Resources Assessment of Guyana in 1998 (USACE, 1998). This assessment showed that fresh surface water in Guyana was perennially plentiful in enormous quantities (Map 1).

The Ministry of the Presidency has oversight of the affairs of GLSC.

Map 1: **Surface Water Resources of Guyana** (USACE, 1998)

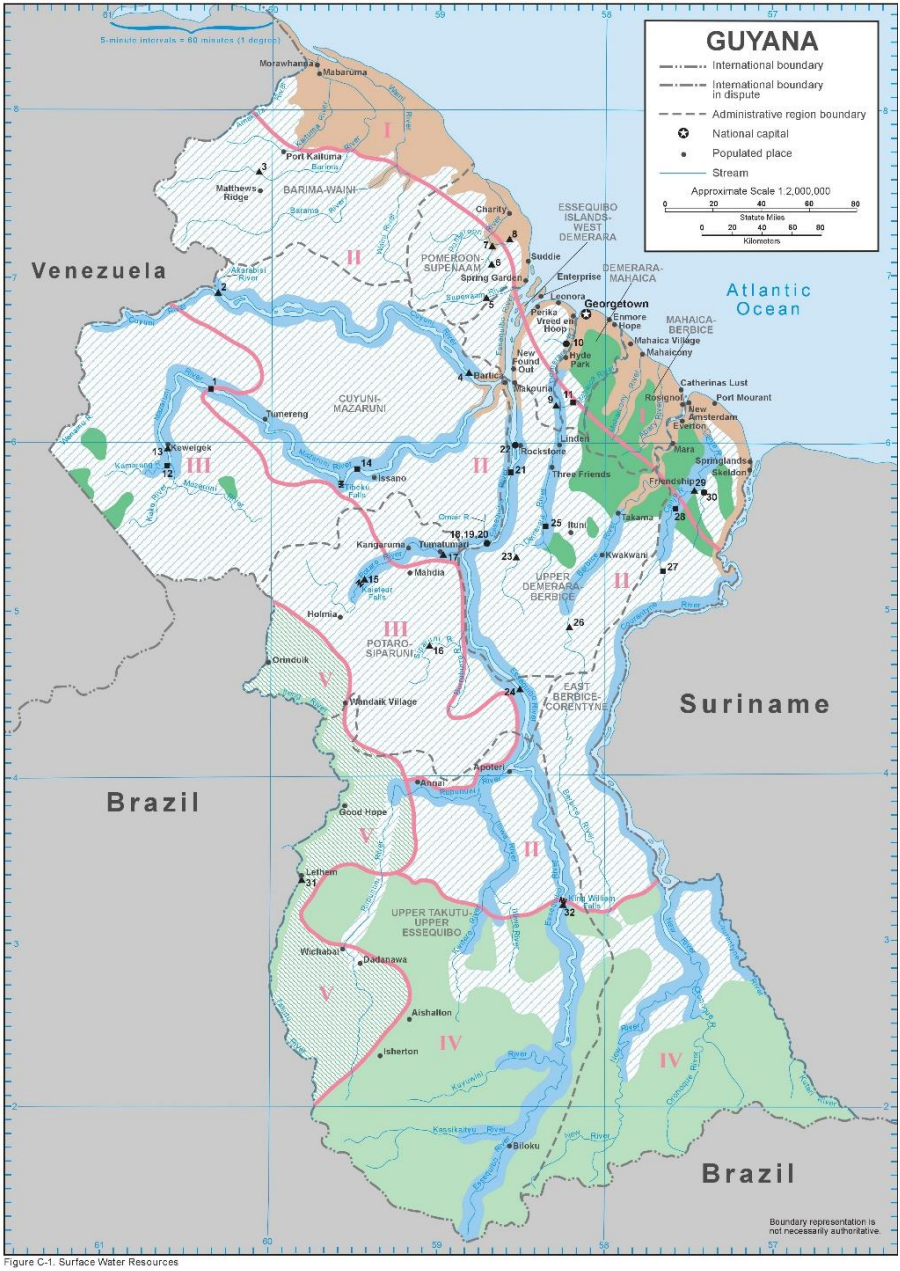

Figure C-1. Surface Water Resources

Environmental Protection Act (1996)

In addition to the *Water and Sewerage Act (2002),* responsibility for the protection of Guyana's water resources is enshrined in the *Environmental Protection Act (1996)*. The *Environmental Protection Act* (EPA) gives the Environmental Protection Agency (referred to hereafter as the 'Agency') the authority to manage the natural environment and resources by controlling and limiting the anthropogenic activities which occur. The environment is defined as "all land, area beneath the land surface, atmosphere, climate, **all water**, surface water, groundwater, sea, seabed, marine and coastal areas and natural resources, or any combination or part thereof;" while natural resources are defined as "…the living plants, animals and organisms, ecosystems, forests, waterways, soils and other biological factors within the natural environment and the geologic formations, mineral deposits, renewable and non-renewable assets and the habitat of the living plants, animals and organisms…" The Agency is intended to be consultative, involving public concerns in their planning.

The Act mandates the submission of an Environmental Impact Assessment for various types of activities. The Agency has jurisdiction over the review and acceptance of EIAs in keeping with the content requirements set out in the Act. All EIAs must assess the impact (positive and negative) of projects on the natural environment (including water), inter alia. EIAs must be done prior to the commencement of a project. Additionally, the Act prohibits other public authorities from issuing developmental consent (approval to begin a project) if the project which requires environmental authorization from the Agency and has not been granted the same.

Part V of the Act specifies conditions for the prevention and control of pollution. This Part prevents persons from undertaking any pollution-causing activity unless the best possible effort is made to mitigate adverse effects on the environment. Additionally, the discharge of contaminants into the environment is limited by the standards set by the Agency through their regulations or permits. Remedies are prescribed for breaches of this Part, including the restoration of the natural environment to baseline or pre-discharge conditions.

Part VII of the Act allows duly authorized representatives of the Agency to enter premises and take samples of the "air, water or land…" if they deem this necessary for investigative purposes. Part X authorizes the respective Minister (the specific Minister is not disclosed) to create regulations to give effect to provisions of the Act. This may include the

setting of permissible level of contaminants within any water body. With respect to rivers, there are two primary regulations of interest: *Environmental Protection (Water Quality) Regulations 2000* and *Environmental Protection (Hazardous Wastes Management) Regulations 2000*.

Regulation 5 (3) of the *Environmental Protection (Water Quality) Regulations 2000* prohibits: the discharge (irrespective of volume) of effluent (in toxic amounts) including those which can bioaccumulate in organisms in the receiving waters; discharges which can impair (substantially) navigation and anchorage of vessels and; any discharge which may have a negative impact on human health and the environment, as determined by the Agency. The Water Quality Regulations do not define the word "effluent" despite its prominence in the Regulations. Effluents are, however, popularly known to refer to the fluids (liquids and gases) which are considered "wastes" from any process/activity. Notwithstanding the aforementioned, persons involved in the discharge of effluents can do so legally, providing that they have obtained an environmental authorization from the Agency. The regulation permits the Agency to set parameter limits of effluents which may be discharged into water. However, these limits are not specified within the regulation document. Verification from the Agency suggests that international standards are used to guide the Agency. Local water quality standards do not exist. The Agency suggests that these can be created by adapting foreign standards to Guyana's context. Breaches of any parameter limits may carry fines and/or imprisonment.

Regulation 10 of the *Environmental Protection (Water Quality) Regulations (2000)* allows the Agency to waive the applicability of any parameter limit to any environmental authorization. It also mandates the Agency to establish and maintain a Register of water effluents, where each effluent is named and information in relation to quantities, conditions and concentrations are recorded. These must be gazetted. Such a Register does not seem to exist. The Third Schedule of the Regulation lists substances for which limits must be set and methods of analysis of effluents.

The *Environmental Protection (Hazardous Wastes Management) Regulations 2000* defines "hazardous waste" as "a waste or combination of wastes which, because of its quantity, concentration or physical, chemical or infectious characteristics, may pose a substantial hazard to human health and belong to any category contained in Schedule I unless

they do not contain any of characteristics contained in Schedule II and includes waste that is-

(i) hazardous industrial waste;

(ii) acute hazardous waste chemical;

(iii) hazardous waste chemical;

(iv) severely toxic waste;

(v) flammable waste;

(vi) corrosive waste;

(vii) reactive waste;

(viii) radioactive waste;

(ix) clinical waste; or

(x) leachate toxic waste, or polychlorinated biphenyl waste,

and includes a mixture of acute hazardous waste chemical, hazardous waste chemical, pathological waste, radioactive waste or severely toxic wastes and any other waste or hazardous material…"

The First Schedule of the Regulation expands on this definition by listing chemicals/compounds considered to be "hazardous wastes" which must be controlled. Mercury compounds and inorganic cyanides are included in this list, both of which are used in various forms of gold mining in Guyana. The Agency may grant an environmental authorization to a person who "is in operation of a facility that generates, treats, stores, disposes or transports hazardous waste." However, this is only to be done after public comments are deliberated upon. The public must be given notice of the operation and its intention to obtain environmental authorization, through a daily newspaper, with at least 60 days within which to make objections to the Agency. Penalties for not obtaining an environmental authorization when one is required include fines ranging from $70,000 to $300,000 and or imprisonment for up to three months. The relevant Minister may designate specific areas as hazardous waste disposal sites. Similar to the *Environmental Protection (Water Quality) Regulations 2000*, the Agency shall maintain a Register of hazardous wastes. The regulations exempt many operations from requiring authorization. This is specified in

Regulation 36. In some cases, the amount of waste generated is a determining factor, while in others, the type of activity is the determinant. This includes "oil, gas, mining and mineral processing wastes…" Mining tailings would, therefore, be exempt from this Regulation.

Forests Act (2009) and the Guyana Forestry Commission Act (2007)
The *Forests Act* defines a forest as follows:

a) *"…an ecosystem dominated by woody plants, consisting of –*
   i) *Closed forest formations, where trees of various stories and undergrowth cover a high proportion of the ground; or*
   ii) *Open forest with a continuous vegetation cover in which tree crown cover exceeds 10 per cent;*
   And
b) *includes –*
   i) *mangrove forests and any wetlands or open lands within a forest which form an integral part of the ecosystem;*
   ii) *forest produce in the ecosystem; and*
   iii) *biological, soil, and* ***water resources of the ecosystem****;"*

Water is clearly an inextricable part of the forest ecosystem. The *Guyana Forestry Commission Act* establishes the Guyana Forestry Commission (GFC), which is tasked with administering the *Forests Act*. However, neither of these Acts describe the Commission's role with respect to managing water resources within forest ecosystems in Guyana. The *Forest Regulations of 2018* briefly mentions rivers and creeks. Here, concessionaires are prohibited from hindering the navigation of creeks or rivers used by their concession. Additionally, the Regulations allow the GFC to assign portions of rivers and creeks which are used jointly by concessionaires, to each party for development and maintenance.

Codes of Practice (CoP) for Forest Operators (2018)

The CoP considers the effects of road building on water quality. It is mentioned that sediments from road building activities can have adversely impacted water quality, the local environment and aquatic life. Road planning is recommended to minimize impacts on the environment. Watercourses and buffer zones are required to be demarcated and excluded from harvesting. Creek beds should not be filled during the construction

of roads and bridges and waste should not enter the creek. Earthworks must be carried out to prevent soil erosion and buffers should be retained to the edge of the crossing. Minimum sizes of buffer strips are outlined, based on stream width. Workshop facilities should be at least 100m away from any watercourse or water body.

Mining Act (1989) and the Guyana Geology and Mines Commission Act (1979)

The *Mining Act* is the principal Act which governs the mining sector in Guyana. It vests all minerals in Guyana with the State and authorizes the Guyana Geology and Mines Commission to administer the Act. Rules are established for the granting of licenses to mine on private lands and on State and Government lands. The *Mining Act*, like the *GLSC Act*, defines "land" to include "land beneath the water and the river-bed or sea-bed, and the subsoil of such land and river-bed or the sea-bed." This allows for the allocation of licenses within rivers, usually in the form of "claim" licenses.

The Mining Environmental (Amendment) Regulations (2005) sets out rules to govern the management of the environment during mining operations. It establishes measures for pollution control, including the storage and disposal of waste (or effluent) and handling of toxic substances (e.g. Cyanide and Mercury). The Regulations also mandate the establishment of a Code of Practice for Environmental Mining. These are currently in draft form but cover the following areas as specified by the Regulations:

a) Tailings management
b) Use of small dams
c) Sand and Loam Mining
d) Waste Management
e) Quarrying
f) Mine Reclamation
g) Mine Effluents
h) Mercury
i) Environmental Effects Monitoring Programme
j) Cyanide
k) Contingency and response plans

The GGMC has the most direct role of any State entity in managing the activities within the mining sector.

Protected Areas Act (2011)
Section 3 of the Act lists its objectives, one of which is to "provide for the conservation of biological diversity, natural landscapes, seascapes and wetlands…" Water resources (rivers and creeks) are afforded special protection within declared Protected Areas, similar to other natural resources. The Protected Areas Commission administers the Act.

Table 1: Interview responses (paraphrased) of governmental organisations

Organisation	Perceptions					
	Authority over rivers in Guyana?	**Is the present arrangement effective in protecting rivers?**	**Are there inadequacies in the system?**	**Are those inadequacies related to legal, admin or resource factors?**	**Can more efficient river management be achieved by vesting powers at local and regional, rather than national levels?**	**Any other proposals/suggestions towards creating river protection measures to mitigate the effects of mining?**
Hydrometeorological Department	Yes. Through the *Water and Sewerage Act (2002).*	No	Yes	-Limited human resources: with weather stations across the country and sub-offices in 6 regions, personnel demand is high but limited. Financial resources for hiring staff is restricted; more funding is allocated to capital and operations (approximately 75-80%). Limited human resource capacity has partly led the HD to prioritize weather forecasting over other mandates as set out by the *Water and Sewerage Act (2002)*. Additionally, HD has been unable to attract highly skilled personnel due to largely unattractive remuneration packages. The HD is bound by Public Service thresholds in this regard.	Yes. - Decentralisation is ultimately preferred. However, HD currently lacks the internal capacity to implement such a model.	- The watershed approach needed to manage water resources in Guyana as opposed to industry/Ministry-driven approach. - Buffer zones along rivers should be observed and enforced. Monitoring stations (for both quantity and quality) needed on all rivers.

				- HD currently is limited to monitoring water quantity throughout Guyana but not quality. A laboratory facility is awaiting commissioning. This facility should allow HD to perform qualitative analyses of water samples. - National Water Policy is not in effect. The NWP may, inter alia, set procedures to ensure that water resources are sustainably utilized, that the environment is adequately safeguarded, and that surface water is conserved and protected. The NWP may also provide for cooperation with other institutions to protect the environment and control pollution, setting the foundation for integrated water resources management. -National Water Council is also not in effect and therefore cannot advise the Minister on implementing or developing the NWP. Council may have last been active in 2006-2008. - Legal ambiguities: The Act is not always clear on who the subject Minister is e.g. prior to		

				2015, Minister of Housing and Water had authority over most of HD's operations while the Minister of Agriculture was largely restricted to agriculture-related issues. - Regulations are not enacted. Regulations may allow the Minister to set parameters for the "proper use and conservation of water, including the prevention of waste, contamination or pollution of water." - HD currently does not play a role in determining the usage of rivers, apart from abstraction for domestic purposes; does not determine whether river mining occurs or not. - A National Hydrographic Committee was established in 2018 to "coordinate the sustainable management of Guyana's sea and river resources." (DPI, 2018) This committee was established to avoid duplication within the sector. It is unclear what work this committee has done to date.		

Guyana Lands and Surveys Commission	Yes. Broadly mentioned in *GLSC* and *State Lands Acts*.	No	Yes	- Data deficiencies: GLSC needs more data to gain a better understanding of what land is out there. Hydrographic surveys and maps are needed to better understand water resources, especially in mining areas. These were not done in the past. - Financial limitations: Hydrographic surveys are expensive but GLSC now working to have these done. GLSC is acquiring a boat for the first time. - Need for collaboration with other Agencies: National Hydrographic Committee needs to meet since this body is intended to provide a collaborative platform for Agencies involved in water resource use. - Possible overlaps with the *GLSC Act*, *Amerindian Act* and *MMA-Agricultural Development Authority Act*, with respect to land allocation and granting thereof.	Yes. However, such a move cannot be made until governance structures are set up and are transparent enough to withstand scrutiny e.g. land approval processes seem to be subject to political influence at Regional level.	- Political input needed to solve fundamental problems of the GLSC and other Agencies

				- Maps need to be digitized: GLSC only recently started digitizing maps. Digitized maps are easier to disseminate to the public. - GLSC was not adhering to its mandate previously, therefore many of its functions were not observed. - Not enough high skilled staff at the GLSC. Most staff are technicians, but some training is underway to improve the Commission's capacity.		
Guyana Forestry Commission	No	No response	Yes	- GFC's mandate with respect to rivers is not clearly defined by the Act and Regulations. The Forest Regulations (2018) sets parameters for the free navigation of rivers within concessions. The Code of Practice (CoP) for Forest Operations does, however, pontify the need for the protection of rivers and creeks during the construction of roads and bridges. GFC monitors concessions to ensure buffer zones are adhered to by concessionaires, *inter alia*.	Yes. - The GFC has sought to get communities involved in monitoring forest operations, by hiring forest officers from local communities (especially Amerindian communities). - GFC has also tried to decentralise its operations by establishing monitoring stations	No

				- The mandate for waste generated belongs to EPA. EPA has guidelines which forest operators (including sawmillers) must follow. - Forestry officers are limited in authority: Officers of the GFC are not authorized to remove miners from concessions. This power lies with the GGMC. Mining is not monitored by the GFC. - Limited capacity to monitor rivers: While the GFC monitors waterways for blockages by felling activity, it does not monitor water quality or quantity. Staff are not trained to do these. Responsibility may lie with EPA since Forest Operators are required to have Environmental Authorization. Pollution monitoring is limited by the GFC to solid waste around camps. - Overlaps of mining concessions and forest concessions: There are numerous instances where mining concessions are allocated on forest concessions. This type of duplication	across the country (30 in total at currently). The presence of GFC Monitoring Stations across the country allows communities to report breaches or suspected breaches to the GFC relatively easily.	

				sometimes creates conflict between forest operators and miners, who share access roads and rivers. There have also been instances of miners dredging the buffer zones within forest concessions.		
Guyana Geology and Mines Commission	Yes	No	Yes	- Limited enforcement of laws and regulations: there are many instances of miners breaching laws and regulations with respect to mining. The GGMC has to some extent been ineffective in addressing known breaches. It is unclear exactly why officers of the Commission have been largely ineffective in addressing river pollution, but popular opinion attributes this to corruption. Also, dangers associated with the environment in which mines officers operate may also serve to inhibit active enforcement of the *Mining Act* and its *Regulations*. Understaffing remains an issue for the Commission, with a handful of mines officers expected to monitor an industry which has issued thousands of mining claims.	Yes. This has already been implemented to some extent through *Community Mines Rangers*. These individuals relay information to the GGMC. However, strong distrust of the GGMC exists among some communities. This prevents cooperation. The GGMC has mines stations in all mining districts. These serve as the first point of contact for miners and the Commission.	- Watershed approach to river management needed. - GGMC needs to be strengthened as an institution for it to actively respond to widespread pollution. - Restriction of some types of mining equipment e.g. cutter head suction dredges. - Regaining of trust between GGMC and communities. - Ban of mining on critical portions of rivers/streams e.g. areas upstream of communities, headwaters etc.

				- Type of equipment used contributes to the severity of the damage: The cutter head suction dredge, which is popularly used in river dredging operations, causes extensive damage to riverbeds. This is exacerbated by the illegal dredging of riverbanks which some miners engage in. - Issuance of contiguous claims: Often, river claims (which are usually 1 mile long), are issued continuously. This allows a single river dredging operation to run for many miles on end. The impact is severe on the river's ecosystem. In many cases, sections of a river are mined repeatedly, compounding the already harmful activity. - Miniscule fines: Penalties for breaches of the various rules and regulations governing the industry do not adequately disincentivise breaches. There is a need for penalties to be much more severe. - Prioritisation of issue of non-compliance: Given the		

				magnitude of breaches which may be taking place in the industry, it is necessary for the GGMC to prioritise this issue and make a concerted effort to address it. It is not apparent whether this approach has been employed to date. - Difficulties in prosecution: The Commission does not have a history of actively prosecuting defaulters. This may be attributed to difficulties in gathering sufficient evidence required for prosecution.		
Compliance Department (MNR)	Yes. The Compliance Department is intended to be the enforcement arm of the Ministry of Natural Resources.	No response	Yes	- Compliance department lacks its own legislation. Corp of Wardens is empowered by the *Police Act* (1998). Wardens receive police-grade training to carry out their duties. Specific legislation would allow the department to prosecute offenders who breach natural resources legislation. Joint patrols are usually conducted with other Agencies. Currently, prosecution lies with the respective Agency involved. - There are human resource constraints. Department has approximately 40 officers.	No. Community involvement will not entail empowerment through the *Police Act*. Rather, communities can be involved in the work of the Department through cooperation and information sharing. There is potential for communities to be involved in water quality monitoring. - The department is currently headquartered in	- The Compliance Department can serve as a coordinating body for complaints and responses within the Natural Resources sector. Clear guidelines need to be set up on how the public can report matters to the department. - More baseline data needs to be collected on water quality.

				- Department still under establishment: Officially established in 2015, the department is still developing. Currently, it is entirely dependent on financial subventions, lacking the ability to generate its own funds, unlike other regulators. The department has not started monitoring waterways yet.	Georgetown but is looking to expand, with offices across the country.	
Maritime Administration Department	Yes. *Maritime Zones Act* delimits internal waters.	No response	No response	- MARAD does not do enforcement; the Coast Guard does. With respect to river pollution, MARAD is concerned with marine pollution. MARAD administers the MARPOL Convention which seeks to prevent pollution of the marine environment by ships from operational or accidental causes. - MARAD licenses boat operators including those in the interior but does not get involved in river pollution issues e.g. navigational blockages as a result of sandbanks formed from river dredging.		- Responsibility for river management should be consolidated into one organisation
Environmental Protection Agency	Yes. *Environmental*	No	Yes	- Limited capacity: The Agency, while given the large	Yes, but Act does not allow for this	-Steps have been taken to restore the Agency's

	Protection Act mandates the Agency to take steps to prevent and control pollution.			mandate for water resources protection by the Act, lack the capacity to enforce the Act. This is primarily related to limited human capacity. - Limited equipment: The Agency does not have enough vehicles. Also, it does not have a functioning lab and has a few portable pieces of equipment for field monitoring. - Other agencies that aren't able to upkeep their mandate: The Hydromet Department has a very large mandate for managing water resources as well. However, it is unable to fulfil its mandate, therefore, even more, the responsibility lies with the EPA. GGMC is another such Agency with a similar mandate. Wastewater management is primarily being dealt with by GWI. - Financial limitations: The Agency's subvention from the Central Government is not enough to allow the Agency to fulfil its many mandates. The Agency is being encouraged to find ways of generating more	currently. However, partnerships can be established with communities for groundwork/policing. This can enable the EPA to respond to issues faster than normal.	mandate for environmental management with respect to mining (possible rescinding of MoU with GGMC which delegated some of EPA's responsibilities for mining to the GGMC). - Communities can be allowed to monitor/observe operations by inserting their role in Environmental Authorisations. - Small and medium scale mining operations should obtain Environmental Authorisation from the EPA. - EPA can collaborate with other Agencies - EPA needs resources to assert its authority More policing needs to be done to detect illegal operations.

				revenue, especially from its permits. - Other governmental agencies/departments do not always acknowledge the Agency: The EPA has first developer's consent through the Act. However, there are often instances where this is not acknowledged by other authorities and permission for development is given without the Agency's first approval.		- Current staff need to have their capacity built while new, technically trained staff, need to be hired.
Protected Areas Commission	Yes. The PAC is specifically interested in rivers which are in Protected Areas.	No	Yes	- Difficulties in determining mandates: multiple Agencies seem to have responsibility for rivers. This makes it difficult to understood who can address what issues. - Mining in PAs still an issue: Active mining is still happening in PAs. In 2017, as many as 12 active mining sites were recorded within PAs. - PAC seeking to establish resource use agreements with villages on access and extraction from rivers within PAs. - PAC has limited powers to stop illicit activities. Rangers	Yes. - PA Rangers are usually employed from nearby villages. - Villages play an important role in reporting illicit activities to the PAC	- It needs to be clarified, who is responsible for inland fisheries. - One body or agency should be tasked with coordinating river management

				do not have the authority to make arrests or take aggressive action. Issues of illicit activities are usually reported to the relevant authorities (Police, GGMC, GFC, etc.). Corps of wardens will eventually play an enforcement role. - The legislation is unclear on rights to access: It is unclear whether PAC can stop access to PAs through rivers. PAC interprets this in the negative (does not stop access).		

DISCUSSION

This Rapid Assessment included a review of 11 pieces of primary legislation and interviews of 8 governmental organisations. It sought to establish the legal framework for water management in Guyana, with specific emphasis on rivers. Governmental organisations empowered by law to manage rivers and prevent/control their pollution were identified. The specific roles these organisations are expected to play by law were identified and examined. Interviews sought to gather information on the organisations' perceptions of their roles and their efforts to meet (if any at all) their mandates with respect to river management.

With respect to water management, while many Acts are assigned some amount of responsibility for rivers in different forms, the *Water and Sewerage Act (2002)* is the most precise in doing so. The Act gives the Hydrometeorological Department (of the Ministry of Agriculture) the overall mandate for managing ground and surface water (rivers and creeks) resources in Guyana. However, interview results suggest that only a very small aspect of HD's large mandate is observed. The HD is cognizant of this shortcoming and attributes it to a severe lack of resources to carry out its functions, in keeping with its mandates.

It seems as though some portions of the HD's mandate are assigned to other governmental organisations, which share similar responsibilities, e.g. the EPA is tasked through its Act, with responsibility for monitoring (both quantity and quality) and preventing/controlling river pollution, hence the Agency makes efforts to carry out this mandate from time to time. However, the EPA is also severely under-resourced and prevented from carrying out its mandate fully. Interestingly, the EPA's activities seem to revolve around the activities of holders of Environmental Authorisation, who would have paid fees to obtain the Agency's approval of their operations. Given the financial situation of the EPA, it is not surprising that work would revolve around permit-holders. However, it must be noted that the EPA also responds to complaints that are made by the public. These may not necessarily be related to a permit-holder. What is lacking, is consistent monitoring of rivers, outside of developmental activities.

Additionally, the EPA may lack the legislative framework to hold defaulters accountable, outside of permitted conditions. For example, there are no authorized water quality standards for surface water. While the EPA may attempt to use international standards, unless these are tailored to suit local conditions in Guyana, they may not be applicable or relevant, especially in the courts. This lack of standards makes it difficult to assess the 'health' of rivers. The GGMC Regulations do not help this situation since water quality standards are also not defined. Limits are set for turbidity, but these are niche, insofar as they are applicable to tailings and the discharge of tailings. Other water quality parameters are not prescribed.

Considering that river pollution is primarily due to mining activities (ASGM in particular), the GGMC has the clearest mandate with respect to managing/controlling river pollution. The GGMC is cognizant of this but it is unclear why more potent actions have not been taken or have not been effective over the years. It is probable that the GGMC has prioritized other aspects of its mandate, at the expense of preventing environmental pollution. Considering the status quo, it may be helpful for the EPA to get involved in monitoring and managing pollution caused by ASMG. However, given the EPA's resource constraints, it is unlikely that this would be attainable without significant increases in the Agency's funding. By proving Environmental Authorisation to small-scale miners, the EPA may be able to generate some of the revenue needed for managing the sector.

RECOMMENDATIONS

Long-term remedies

1) It does not seem that conflicting mandates are the primary reason for the governmental organization not carrying-out their functions with respect to river management. Rather, it is the lack of resources (both financial and human) that prevents potent steps from being taken. While collaborative efforts can be implemented to improve coordination among Agencies (e.g. Integrated Water Resources Management), there is a need for pollution prevention to be made a priority by each Agency (especially the GGMC) and receive sufficient resources. A comprehensive assessment of the resource requirements needed for agencies to adequately address river pollution should be conducted. This information can inform a larger strategic plan which may seek to ensure that budgetary allocations are appropriately assigned and that agencies are properly resourced to address the issue.
2) A committee with oversight of water resources management in Guyana should be established. This idea was already incorporated into the *Water and Sewerage Act* through the National Water Council. This Council should be reconvened and made to serve its intended purpose. The Act does not specify who should sit on the Council, but efforts should be made to include civil society and private sector organisations, in addition to the representative of the relevant governmental organisations. While the recently established National Hydrographic Committee may seek to serve this purpose, unlike the National Water Council, it is not supported legislatively.
3) To aid in efforts to monitor and assess the health of rivers, it is critical for Guyana to have its own legally binding water quality standards. These standards can form the baseline from which changes to rivers are monitored and would enable communities to be more involved in the monitoring of rivers which they depend on. While this exercise would be extensive, it is necessary that it starts as soon as possible since anthropogenic influences on the environment may skew baselines overtime.
4) Communities should have the legislative authority to enforce environmental laws. The legal framework for this does not

currently exist but should be established through amendments of current legislations. Communities ultimately are best positioned to respond quickly to illicit activities and would require few resources to do so. Additionally, this would allow communities to exercise greater stewardship over their natural environment and the activities taking place it.

Short-term remedies

1) Given the acknowledgement by governmental organisations of their mandates with respect to river management, strict enforcement (of relevant laws and regulations) measurements should be taken. A lack of resources can be mitigated through interagency collaborations, aimed at sharing and optimizing resource use. The Compliance Department of the Ministry of Natural Resources could serve as the coordinator of collaborative efforts. Also, the involvement of the department's Wardens will allow for stricter action to be taken (such as arrests).
2) Communities need to be more involved in river management. This cannot currently take the form of enforcement activities since the laws do not allow for this. However, communities can and have played a major role in the past in monitoring activities taking place close to their communities. An information-sharing mechanism should be established between governmental organisations and communities, especially those in mining areas.
3) Considering the harmful impacts of river mining and the lack of enforcement by relevant government agencies, a moratorium should be instituted on the activity. This will serve to prevent (to some extent) the continued decline of the health of Guyana's rivers until systems are put in place by governmental agencies to adequately uphold their mandate and ensure the protection of rivers. This moratorium can be national or restricted to critical portions of rivers e.g. headwaters and areas upstream of communities.

A FOCUS ON THE RUPUNUNI

Area of interest

Region Nine (Upper Takutu/Upper Essequibo) often referred to simply as the Rupununi, is the largest administrative region of Guyana. Comprising an extensive savannah, approximately 1 million hectares in size, and approximately 5.4 million hectares of forests, the Region is divided in two by the Kanuku Mountains. Just over 24 000 persons scattered across 60 villages inhabit the Region, with indigenous peoples comprising approximately 90% of the population. Of these, the Macushi occupy the northern savannahs with the Wapishana and Wai-Wai based in the south. The rest of the population is made up of inhabitants from Guyana's coastlands and are concentrated mainly in the town of Lethem.

Among the last great wilderness areas on earth, the Rupununi is one of Guyana's most unique and diverse ecosystems. It is home to more than 5,400 known species, including 70% of all vertebrates recorded in Guyana (WWF, 2016). Many species which are globally endangered, inclusive of iconic Amazonian species such as the jaguar (*Panthera onca*), giant river otter (*Pteronura brasiliensis*), harpy eagle (*Harpia harpyja*), Brazilian tapir (*Tapirus terrestris*), giant anteater (*Myrmecophaga tridactyla*) and giant armadillo (*Priodontes maximus*), make the Rupununi their home. This species richness can be attributed to the diverse habitats found in the Rupununi as well as the interface between the Amazon Basin and the Guiana Shield ecoregions that occurs here.

Major rivers in this Region are the Rupununi, Rewa, Kwitaro, Kuyuwini, Essequibo, Ireng, and Takutu rivers. During the rainy season, many of these rivers including the Rupununi River and its tributaries overflow their banks, forming vast wetlands, particularly in the North Rupununi. These wetlands are a critical food source, spawning ground, nursery and migratory path for the region's fishes. The world's largest scaled freshwater fish, the Arapaima (*Arapaima sp*.), is found in the Essequibo river system because it was able to cross from the Amazon basin via the flooded North Rupununi wetlands. These wetlands underpin a food chain that is a vital source of life for the Rupununi's wildlife and indigenous peoples.

Apart from being key to sustaining food sources on which they depend, many indigenous peoples utilize the waterways for various purposes including bathing, washing, source of water for household use including drinking, source of water for their animals such as cattle and source of irrigation. The rich biodiversity and unique culture also sustain a growing nature-based tourism industry with activities on offer include birdwatching, wildlife viewing, catch and release sport fishing, and adventure trips.

In recent years, road, mining, agriculture and other developments have increased in the Rupununi. Consequently, the landscape, though still largely pristine, has been undergoing changes with more likely to come with attendant consequences for the myriad ecosystems including freshwater resources, and the people of the Region who depend on them.

THREATS

Two main activities have been identified as presenting the greatest threat to freshwater resources. These are:

- Gold mining
- Commercial agriculture

Mining and commercial agriculture developments have increased in the region over the past decade with mining activities concentrated in the Marudi Mountains in the South Rupununi and commercial agriculture primarily focused on the North Rupununi. These two activities impact on the surrounding ecosystems in a number of ways with varying consequences for the environment and people who rely on natural resources, including freshwater.

Threats to freshwater resources in the South Rupununi

The Marudi area was first opened for mining in the 1970s. Romanex Guyana Exploration Limited, a Canadian company, holds a mining licence to operate a large-scale mine and has done some amount of small scale, highly mechanized mining. The company is undertaking an Environment and Social Impact Assessment (ESIA) required before it can begin full-fledged operations.

Over the past decade, small and medium-scale miners, including Brazilians, have also been attracted to the site and occupied land awarded to Romanex, mining illegally there. The number of small-scale miners at Marudi fluctuate with some estimates indicating over 300 miners. However, the Ministry of Natural Resources recently indicated that of 70 operators who were active when a mediation agreement was signed in 2016, just 39 remain (Stabroek News, 2018). The Ministry is working with miners to regularize gold mining in the area and in January announced that several blocks of mining lands contiguous to the Romanex concession have been identified for those miners.

Impacts linked to gold-mining are already evident in the area. The expansion in mining over the past decade has resulted in deforestation, destruction of creeks and other water sources as well as pollution of

watercourses with mercury and tailings sediment (WWF, 2016; SRDC, 2017). Downstream habitats and freshwater resources have also been impacted while social impacts in surrounding communities have been reported. In relation to freshwater resources, in particular, major impacts include:

Destruction of watercourses - watercourses at the Marudi Mountains such as Toucan and Panche creeks have been destroyed while others such as Locust creek have been severely damaged (SRDC, 2017).

Mercury contamination – The GHRA (2016) reported that copious amounts of mercury were being utilized at mining sites in Marudi. A Biodiversity Assessment Survey by the WWF found high concentrations of mercury in the Marudi Creek and Kuyuwini River. It was surmised that the mercury levels in the Marudi Creek were likely due to the mining activities occurring in the upper reaches of the creek. According to the WWF (2016), gold mining is undoubtedly causing as yet unmeasured mercury contamination of food fishes and of the local populations of indigenous people who frequently consume fish.

Turbidity – erosion and sedimentation which result from mining activities increase turbidity, and this has been observed in several major watercourses. The WWF (2016) reported that gold mining has caused visible alteration in water quality, especially turbidity at the Kuyuwini River area, including Marudi Creek. The headwaters of the Rewa and Kwitaro rivers are located in the Marudi Mountains and there have been reports of increased turbidity and sedimentation in those waters as well, likely as a result of gold mining in the Marudi Mountains area.

Pressure on wildlife – wild meat and fish are used to supplement food stocks in mining camps. It has been reported that there has been a move from fishing for subsistence to fishing as an economic activity, with persons capturing large quantities of fish for sale to miners who present a ready market. According to the WWF (2016), in the South Rupununi, some species such as Arowana have been severely over-fished and other species identified as scarce or overharvested.

Threats to freshwater resources in the North Rupununi

Most of the land in the Rupununi savannah is classed as poor or non-agricultural land with the addition of lime, fertilizer and organic matter required for the land to become economically productive (GLSC, 2013).

Nonetheless, there is increasing interest in large-scale farming in the Rupununi, particularly in the northern savannahs. One venture, Santa Fe Farms - the largest commercial farm in the Region to date - has been undertaking large-scale cultivation of various crops for approximately eight years and is moving into livestock rearing. Under its' Memorandum of Understanding with the government, the Barbadian company can have access to 100,000 acres of land for Phase One of the project.

Another company, Johil Green Farms has applied for 5000 acres in the North Rupununi for the cultivation of rice, corn and soybean as well as the rearing of livestock. According to the project proposal, the farm will require freshwater from the nearby Takutu River and Lamparina Lake as well as creeks. Increased cultivation of various crops is also taking place at various ranches and initiatives are underway to encourage more private sector interest in interior farming. The government is moving to establish a 20,000-acre Research Station and model farm with funding from the Inter-American Development Bank at Pirara, North Rupununi. These farming ventures utilize and are expected to utilize, a significant amount of freshwater resources. The venture at Pirara is said to include the establishment of a 9000-acre reservoir. Main threats to freshwater resources include:

Excessive water abstraction – Given the prolonged nature of the dry season in the Rupununi, agricultural operations utilize rivers, creeks, artificially-created reservoirs and other sources of fresh water for their operations. Santa Fe Farms, for example, extracts water from the Ireng River while Johil Green Farms plans to extract water from the Takutu River, Lamparina Lake as well as creeks. Plans for the Pirara research station include the establishment of a 9000-acre reservoir that will harvest water from vast areas of the swamp (Stabroek News, 2017). This is already being done at, for example, the JR Ranch. It has also been reported that cultivators of crops like vegetables, cassava and peanuts are already taking seriously the potential for large scale mechanized farming on savannah lands utilizing water from swampy areas (ibid).

Water contamination – it has been noted that the soils in the Rupununi are nutrient-poor and require heavy, frequent inputs of fertilizers in order to achieve yield targets. According to the GLSC (2013), huge investments in lime, fertilizer, land preparation and management would be necessary for the development of large-scale mechanised agriculture. To illustrate, in 2016, it was reported that Santa Fe had invested $1.3 billion after six years

(Thomas, 2016). Further, it was also reported that the AR Irja 424 variety of rice being cultivated on the farm required greater fertiliser application which meant using three times the fertiliser regimen applied on the coastland as well as greater use of pesticides (Stabroek News, 2013). However, the company has said that agrochemicals are used only when necessary and measures are in place to limit their impact on the surrounding ecosystems. According to Santa Fe, water testing is done biannually and so far, no change in water quality has been detected. Nonetheless, there are no studies publicly available or being done that can independently verify the situation.

Other threats

Unregulated tourism – tourism is a growing industry in the Rupununi. However, there are reports of improper waste disposal at remote camping sites in the Rewa and Kwitaro rivers by tour operators.

Climate change – in the Rupununi, one of the greatest threats associated with climate change is the decrease in precipitation and an increase in temperature. The surface water systems e.g. rivers, creeks, wells, and groundwater recharge are particularly sensitive to drought.

Certain activities also have the potential to exacerbate the impacts of climate change. Excessive water abstraction from the Ireng River, for example, can reduce the flow of water downstream thus leading to a build-up of sediment in the river. Consequently, during the rainy seasons and high-intensity rainfall events, flow rates in the river are reduced which can lead to above-normal overtopping of the banks of the river. It has been posited that this occurred and contributed to the unprecedented 2017 Region Eight flood when several villages were inundated with several feet of water as the water in the Takutu and Ireng rivers overtopped their banks (Guyana Chronicle, 2017).

DISCUSSION

The Rupununi is in the midst of change. Factors such as its relative isolation, low human population densities, traditional lifestyles, minimal road infrastructure and connectivity, and few viable transportation options, particularly in the South Rupununi, has limited economic expansion and the environmental degradation that has accompanied such developments in other areas. With the exception of some areas, rivers and other watercourses remain relatively pristine, ecosystems are relatively intact and high levels of biodiversity still present in the Region.

Nonetheless, it is clear that the Rupununi and its freshwater resources is coming and will under increasing pressure. In the South Rupununi, the restarting of small and medium-scale gold mining at Marudi could see the recurrence of environmentally unsound practices unless adequate environmental regulations are in place and enforced. The destruction of watercourses means that the freshwater ecosystems and the life they support are destroyed as well. The use of mercury in mining also has deleterious consequence. Heavy metals like mercury do not degrade in the environment but are transferred from one environmental component to another, including soil and sediment, where they accumulate and can be ingested by aquatic biota. These metals then accumulate in humans as they consume aquatic species like fish. Mining can also have environmental consequences far beyond the mining sites.

Erosion and sedimentation resulting from mining activities increase turbidity which affects the temperature of the water, and in turn, the concentration of dissolved oxygen and the photosynthetic activity of algae and aquatic plants. Oxygen is essential to all fishes and aquatic animals and if the amount of oxygen declines to very low levels, then aquatic animals may migrate or die. Further, excessive amounts of suspended materials could clog fish gills; and, as they settle, could blanket the bottom of a water body, thereby smothering fish eggs and other aquatic organisms. Suspended solids in waterways can also alter flow rates of the watercourses as well as negatively impact fish that migrate to the upper reaches of rivers to spawn.

The move from traditional fishing to fishing as an economic activity could also mean the depletion of species which can impact indigenous peoples for whom freshwater fish is a fundamental food item. It has been noted

that 29% of Rupununi households are engaged in fishing for sale and several communities have reported the quality and quantity of fish have declined in recent years (CI, 2015). Overfishing can also limit the availability of fish for household use. Further, the method used to catch fish can negatively impact fish numbers as the use of seines, for example, can also snare fingerlings and spawning females, which contributes to the depletion of fish.

Such impacts can also affect activities that depend on freshwater resources such as tourism. Rupununi communities such as Rewa and Yupukari are engaged in eco-tourism ventures, with a major selling point being the pristineness of the environment and watercourses. If rivers become polluted or depleted of aquatic life, then the tourism product would be negatively affected.

In the North Rupununi, as previously described, the challenging regime of infertile soils and the cycle of excessive water and drought means that huge investments would have to be made for commercial farming to be successful. According to IFAD, of the 4 571 hectares of arable lands in the Rupununi, 67.5 per cent are under mixed forest cover with the remaining 32.5 per cent in pockets of the savannahs. Semi-arable land in the Rupununi amounts to 69 060 hectares. This is a poor agricultural land with fertilization possibilities (IFAD, 2016). The low soil fertility means that high amounts of fertilisers (and pesticides) would be required to sustain desired crop yield. However, water contaminated from pesticides and fertilizer run-off can infiltrate water sources jeopardizing the wetlands, other habitats, species and local livelihoods. While measures may be in place that can contain run-off during the dry season, it is not clear how effective this is during the rainy season when water levels can rise rapidly to great heights.

Agencies with oversight of/interest in rivers

National Level

Environmental Protection Agency

Ministry of Natural Resources – Guyana Geology and Mines Commission

Ministry of Agriculture – Fisheries Department

Local-level – South Rupununi

Village Councils

South Rupununi District Toshaos Council (SRDC)

South Central People's Development Association (SCPDA)

Local Level – North Rupununi

Village Councils

Kanuku Mountain Community Representative Group (KMCRG)

North Rupununi District Development Board (NRDDB)

Iwokrama International Centre (IIC)

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