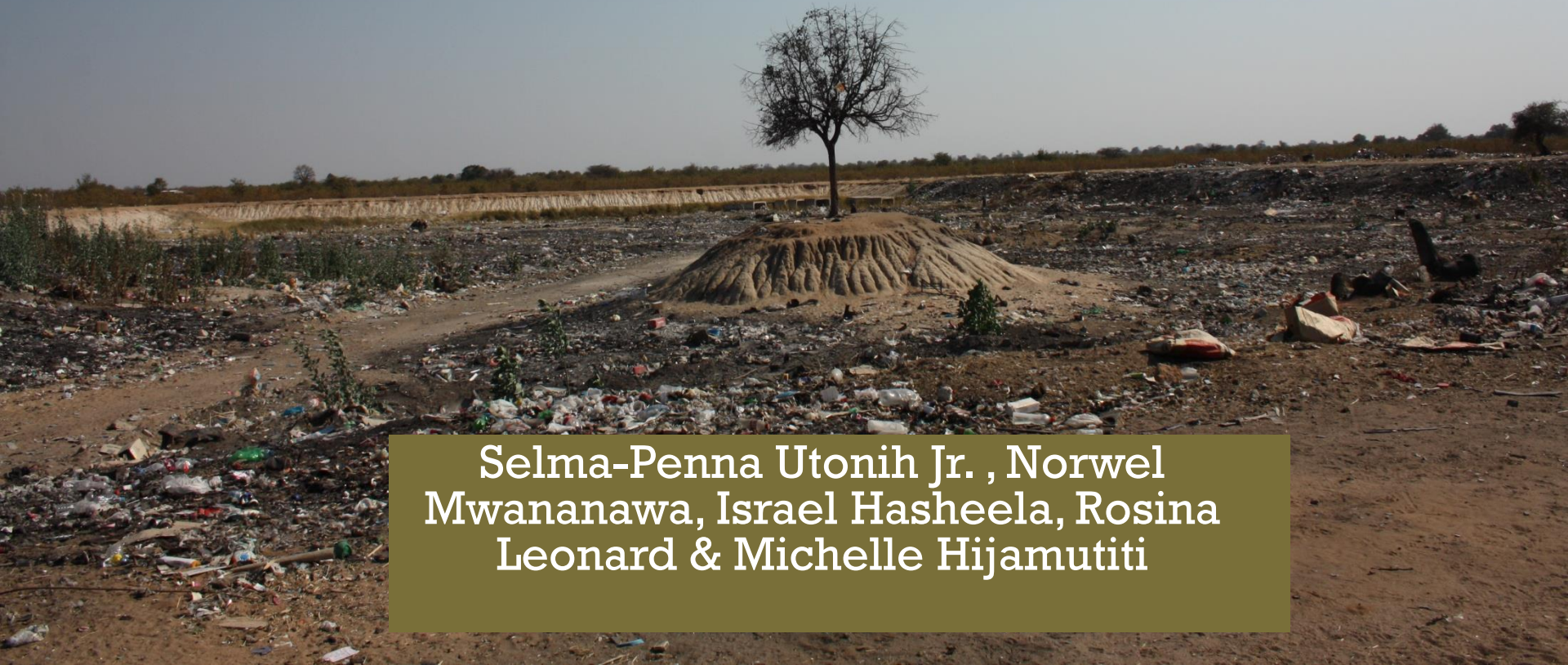


Geological Contribution to Urban Land-Use; Environmental Assessment of Municipal Waste Disposal Facilities in Outapi, Oshikuku, Okahao, Ruacana and Opuwo

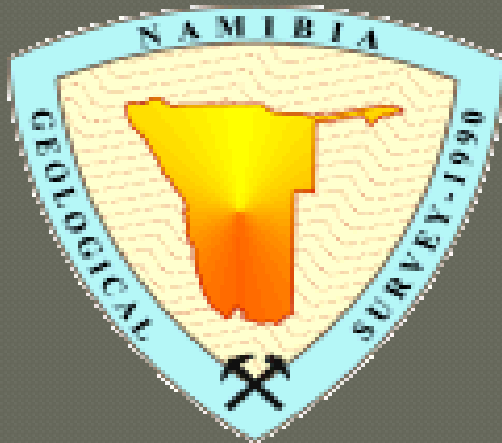


Selma-Penna Utonih Jr. , Norwel
Mwananawa, Israel Hasheela, Rosina
Leonard & Michelle Hijamutiti

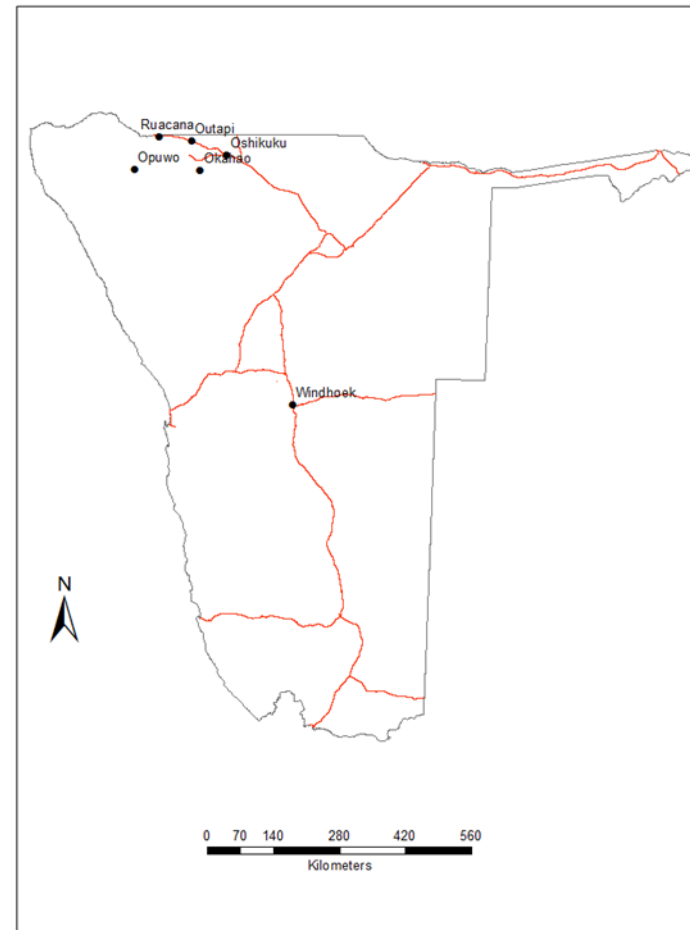
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 - Solid waste treatment
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Introduction



MINISTRY OF MINES AND ENERGY



Introduction cont..



**OSHIKUKU VILLAGE
COUNCIL OFFICE**
WAS OFFICIALLY INAUGURATED
BY
HON. JOHN PANDENI
MINISTER OF REGIONAL AND
LOCAL GOVERNMENT, HOUSING
AND RURAL DEVELOPMENT
ON
15 FEBRUARY 2007

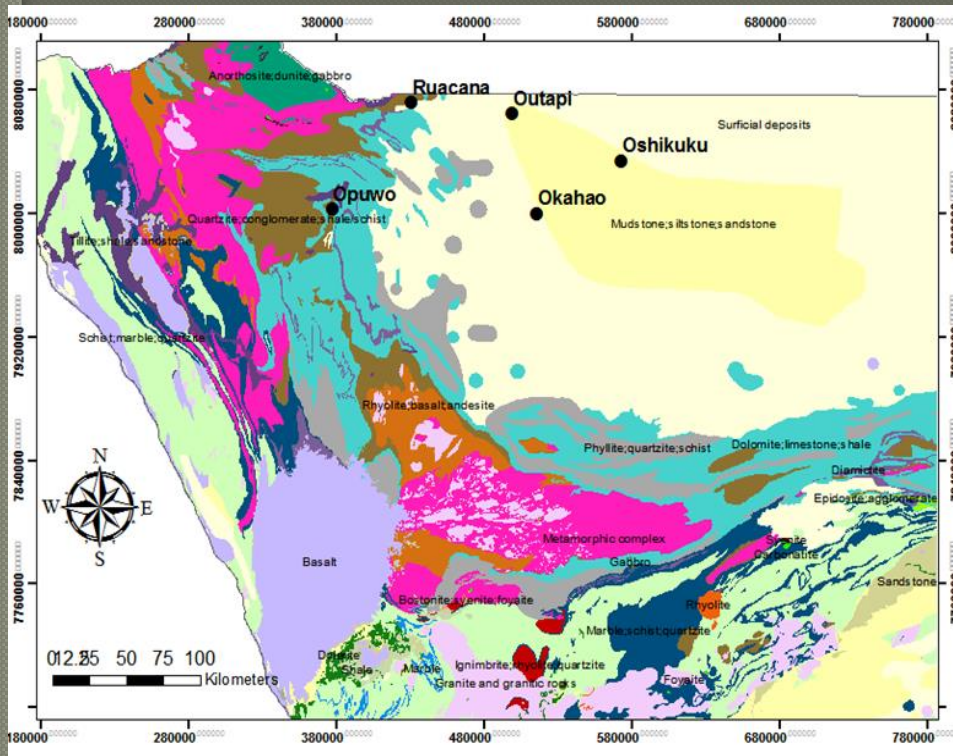


Objectives

- Familiarization with principles of waste management in the towns of Opuwo, Ruacana, Okahao, Outapi and Oshikuku.
- Contributing to land use planning ;waste disposed does not pose a threat to the environment and groundwater resources
- Identify areas of improvement in terms of waste management in the above mentioned towns.

Local Geology

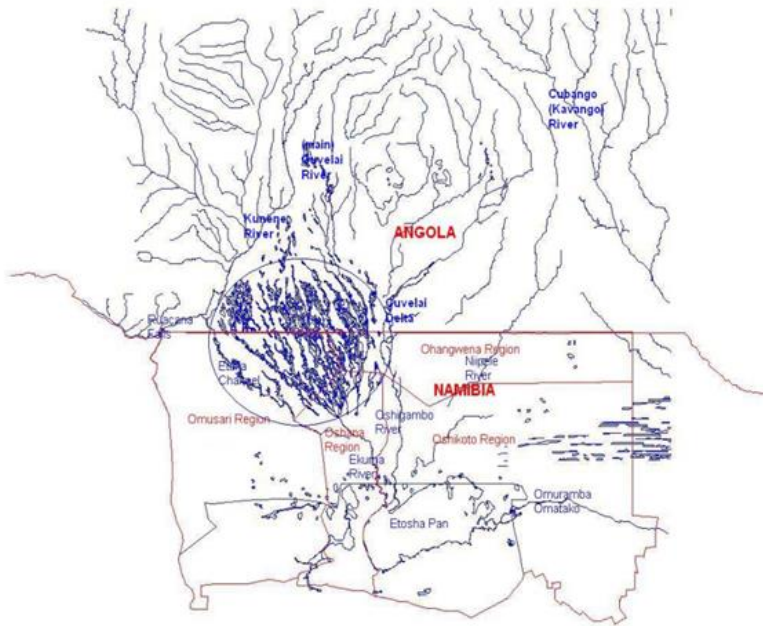
- Fransfontein Granitic Suite and - Granite and Gnessitic Basement
- Sedimentary Rocks of Damaran Sequence (Nosib, Otavi and Mulden Group)- Carbonatitic rocks and sandstones
- Karoo Sequence (Basalt, sandstone and shale)
- Kalahari Sequence (semi to unconsolidated sediments of cretaceous to recent)



Hydrogeology

Name of aquifers and aquitards, Hydrogeological character	Maximum thickness [m]	Lithology	Recharge	Formation, Subgroup, Group	Groundwater quality and vulnerability
Unconfined Kalahari Aquifers (mainly porous, locally fractured)	Thin	Sand	direct infiltration of rainwater	Recent	Fresh, brackish during dry season, extremely vulnerable to pollution
	150	Calcrete, limestone; sand layers		Andoni (Elosha Limestone Member)	Fresh, locally high nitrate concentration, vulnerable to pollution
	50	Silt, clayey sand; calcrete layers		Andoni	Fresh to brackish
	70	Sand, calcrete			Brackish to saline, local fresh water lenses
Confined Kalahari Aquifers (porous to fractured)	100	Sand, gravel,	Recharged by the Oshanas	Olukonda	Fresh, Group B
	60	Sand, sandstone			Fresh to saline
	180	Sand, calcareous			
	50	Sandstone, conglomerate		Beiseb	
	100	Sandstone		Ombalantu	
Karoo Sequence Aquitard KSA	200			Undifferentiated	
	100			Kalkrand	
	140	Sandstone		Etjo	
	220			Prince Albert	
	160	Tillite		Dwyka	
Mulden Group Aquitard, MGA	4200	Sandstone, quartzite, limestone, dolomite		Owambo, Kombat, Tshudi	
Otavi Dolomite Aquifer, ODA (fractured, partly karstic, partly confined)	4000	Dolomite, limestone	recharged in the fractured dolomites	Taureb Subgroup	Fresh Vulnerable on exposed surfaces
	2000			Abenab Subgroup	
Nosib Group Aquitard	1200	n/a		Varianto, Nabis	
Basement Aquiclude,	n/a	n/a		Fransfontein Granitic Suite, Khoabendus Gr.	

Hydrology



- Namibian part of the Basin is characterized by the “Oshanas”
- “Oshanas” are shallow, often vegetated, poorly defined but are interconnected flood channels and pans through which surface water flows slowly or may form pools depending on the intensity of the flood.



**WASTE WATER
TREATMENT IN
OBSERVED NORTHERN
TOWNS**

Sewage Water Treatment

Secondary Facultative ponds

Primary Facultative ponds

Anaerobic ponds



Sewage Water Treatment cont.

Maturation Pond



Oshikuku

HOSPITAL POND



TOWN COUNCIL POND



Okahao



- The maturation pond is heavily covered by plants and overflowing.



Ruacana and Opuwo



Damaged Membrane and no Effluent
flow between ponds
Maturation ponds used as drinking
water for livestock
No Fencing in opuwo



Recommendations

- Removal of vegetation within the pond in order to optimize the pond performance.
- Installing monitoring boreholes to determine if contaminants are seeping.
- Monitoring the quality of the final pond water on a regular basis, potential contamination source since pond is not lined.
- Closing down the hospital ponds and link its sewer system to the new ponds
- Additional ponds to accommodate overflowing effluents
- Storm water diversion channels to direct water away sewer system.
- Provide other water sources for livestock as pond water quality may change.
- Regular maintenance of the ponds

**SOLID WASTE
TREATMENT IN
OBSERVED NORTHERN
TOWNS**

Landfill Characteristics



- Burrow pit
- Landfills not lined, no leachate collectors or groundwater monitoring installations
- Most are close/on the edge of “Oshanas”
- Basic infrastructure
- Low volume of waste



Environmental hazards



Environmental Hazards

A photograph of a dry, dusty landscape with a dog standing in the center. The ground is covered in dirt and scattered trash. In the background, there are dry hills and a clear blue sky. A green speech bubble is overlaid on the image, containing the text "I REALLY SHOULDN'T BE HERE".

I REALLY SHOULDN'T BE HERE

Environmental Hazards



Mitigation measures



Mitigation measures



Mitigation measures



Recommendations

- Proper fencing to prevent waste from blowing outside the landfill contaminating surrounding areas.
- Security guard to guard and monitor the landfill and its fencing and also direct people on proper disposal methods on the site
- Waste segregation for proper disposing of vast amounts of waste produced in an environmentally friendly conscious manner. Different components of waste have very different properties and grouping them by type allows for proper processing or storage.
- Regular clean-ups of surrounding areas to prevent possible contamination and pollution

Recommendations cont..

- Implementation of composite liners, leachate collection and removal systems and groundwater monitoring systems
- Waste Audits
- Regular monitoring of dumpsite in order to ensure that any environmental impacts are identified and rectified
- Protective gear

CONCLUSIONS

Conclusions

- The wastes at towns differ in size and in the potential to threaten the environment.
- The weaknesses that were identified regarding waste management at the surveyed towns can be used as an opportunity for improvement at those towns as well as other towns in Namibia.
- This study concluded that from the towns that were surveyed all managed their waste to some degree but the different faults in their waste management methods needs to be addressed.



THANK YOU!

