C.E.T.S

CENTMAX ENGINEERING TECHNOLOGY SOLUTIONS

EXPLORATION GEOLOGICAL SERVICES

Our Partners and Clients

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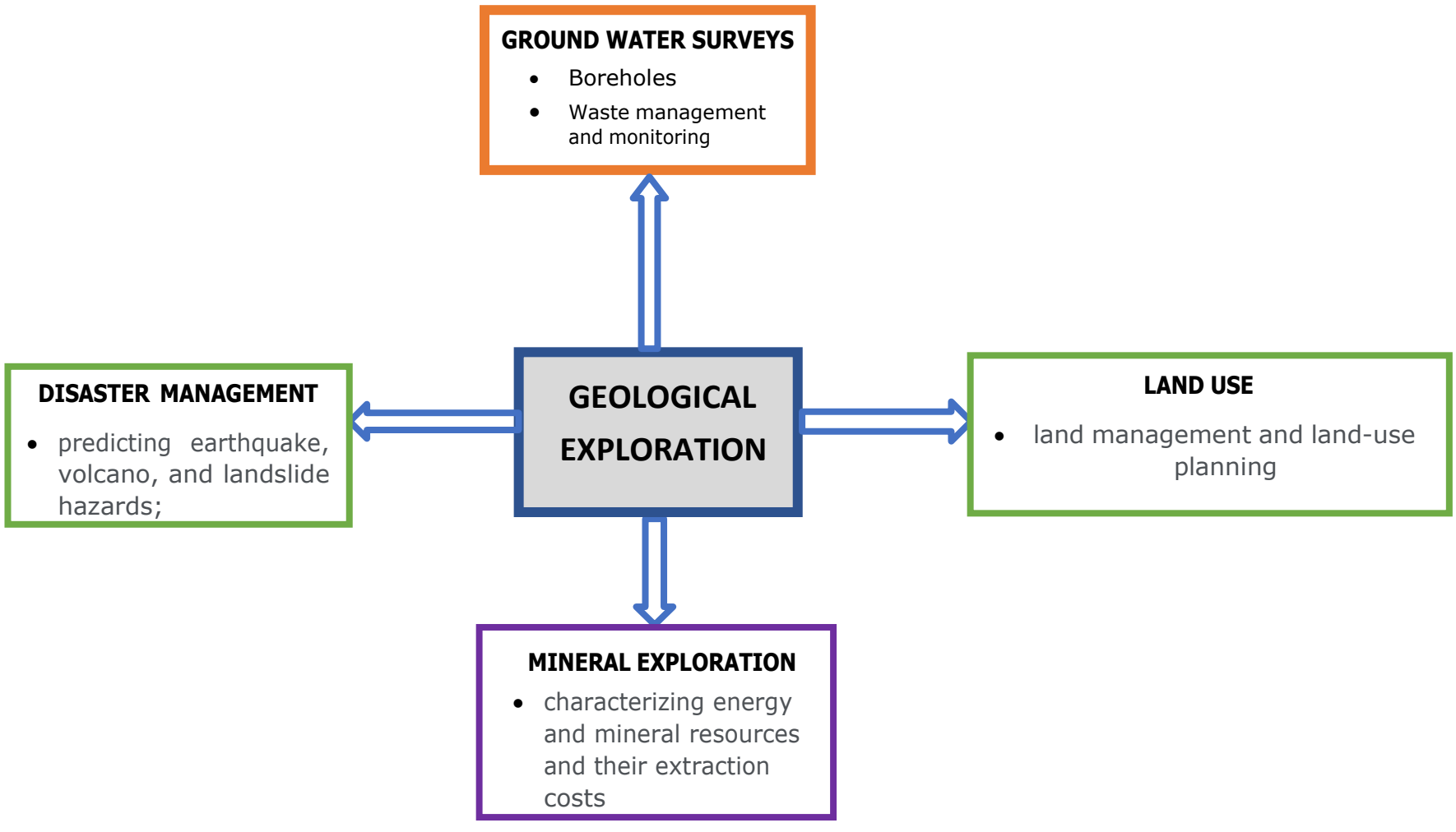
1.0 BACKGROUND

Over the past century, industries have developed rapidly, populations have grown dramatically, and standards of living have improved, resulting in an ever-growing demand for water, energy and mineral resources. Geologists have led the exploration for ground water, mineral resources, fossil fuels (oil, natural gas, etc.), for which applications have grown in recent years. This has played a major role in locating deposits of commercially valuable minerals. Geological exploration is the process of finding commercially viable mineral resource and the objective is to locate it in the shortest possible time and at the lowest possible cost. The important parts of a successful exploration are selection of right geological terrain, optimum level of funding and keeping pace with the state-of-the-art exploration technology. Adoption of right combination of techniques is warranted to conduct exploration in a cost-effective manner. The Quality Control/Quality Assurance validated exploration data are integrated to generate 3D models for better interpretation and predictive targeting.

APPLICATION OF GEOLOGIC EXPLORATION



The main benefits of adopting Geological survey include;

i) Mapping gathers structural information, including attitudes of veins and faults that can be used to predict the geology in the subsurface or laterally under the rocks, and improves the utility of geophysical data for refinement of subsurface targets.

ii) provides broad knowledge of the history of the site.

iii) provide knowledge on what remedies need to be put in place before actual mining can start and provide broad knowledge and guidance to miners

2.0 OUR APPROACH TO GEOLOGICAL SURVEYING

Exploration Program Planning and Design

Our geologists do ensure that the exploration program is based on a sound understanding of the regional-scale and property-scale geology, the target commodity, and the type and style of mineralization that is either known or being sought on the subject property. This understanding is then supported by relevant field data and should include a thorough review of available published, corporate, and private information. The geologist designs the exploration program and selects the exploration methods and tools that will credibly test the geological premises and interpretation.
In planning, implementing, and supervising exploration work, our Geologists ensure that exploration practices are based on criteriathat either are generally accepted in the industry, or can reasonably be justified on scientific grounds.
he periodically reviews the geological premises the exploration work is based on, and updates those premises as new field observations and data become available. All systematic and thorough review is based on all new information collected from the exploration program, describe and document the interpretation, and discuss any apparent inconsistencies in the data.

Previous Exploration Results

This is an initial step in designing an exploration program, we compile and review previous work that has been carried out on the property, geological mapping and sampling results, geophysical surveys, geochemical surveys, or drilling programs. Our geologists can use either public domain information (Mining Cadastre), including Directorate of geological survey and Mines programs and provincial assessment files and information in our internal database.
We validate the accuracy and verify the suitability of the information collected from previous work before using it.

Coordinate System

An exploration program needs a consistent spatial coordinate system from the outset, to locate all exploration information on a property.

Tenure and Access

our team confirm with the client that tenure and access rights to the subject property have been secured before beginning work. Access includes permissions from, and agreements with, indigenous and local communities, land owners, and surface rights holders. our team confirms the location of property boundaries, especially to properly locate significant exploration activities such as drilling.

Permits

Our team confirms with the client, that the project holds all necessary permits and permissions before beginning work. Many exploration activities that require the use of water from surface or groundwater sources or require extended stays on undevelopedlands require notification and permitting. Our team is fully aware of the permitting requirements to work in an area well before activities start. Obtaining permits often requires a component of community consultation, which should not be viewed as the only opportunity to meet with the affected communities and their members.

Corporate Social Responsibility

Corporate social responsibility is a business model by which companies make a concerted effort to operate in ways that enhance rather than degrade society and the environment.

This helps both improve various aspects of society as well as promote a positive brand image of companies.

Our geologist is often the first person on a project to meet members of the local community. Before the first visit to the exploration area, the approach to community consultation is considered and responsibility for each element of community relations is documented.

Figure 1 community Engagement

Records and Documentation

All geological, geophysical, and geochemical information is stored in a standard digital format in databases or files which can be distributed over network this makes it possible to compile and analyze data efficiently on computers. Data base is managed by personnel who ensure that files are managed and preserved for the long-term.

Geological Surveys

Our geological mapping programs focus on observing and recording information on major lithological units, alteration, structural features, and mineralization types present on or around an exploration property, along with the nature and location of major physiographical features. This information is typically compiled in a geological map, whose scale depends on the objectives defined at the design stage of the program. The information is collected andstored on paper and in digital format. At regional and local scales, maps show the location of major lithologies, structures, and alteration types, plus any potentially significant economic mineralization. Detailed geological maps typically display the lithology, alteration, and structural features of a small area such as an exploration trench or an individual outcrop. Samples collected during the course of a geological mapping program are used to:

- accurately determine lithology;
- determine the mineral or metal content of geological features of interest;
- determine the chemical composition of a given rock unit or alteration type.

Figure 2 Geologists conducting field work

Locations of all samples are noted on a geological map and also provided as a separate record or field note book. The sites of all field samples are clearly marked so the sample site can be re-visited when necessary.

The project retains a suite of hand samples that display representative characteristics of the host rocks, alteration styles, and mineralization types found on the property for reference and training. Preparation of this suite ensures that geological mapping information is collected in a consistent manner by our exploration team.

For all data collection, there is documentation related to equipment type and methodology; calibration methods, frequency, and dates. Records of relevant (digital) photos are maintained with the photos, including date, scale, and locations.

Figure 3 Geologists making and noting field observations

Our team is well versed with **GIS** technology, cartography, spatial analysis, web mapping which facilitates mineral exploration via gathering, storing, and providing access to large spatial datasets. With GIS, the team can collect information on the spatial location of various minerals and uses it to guide mining experts on where best to focus theirefforts. As a result, this can reduce costs and increase the efficacy of mining operations.

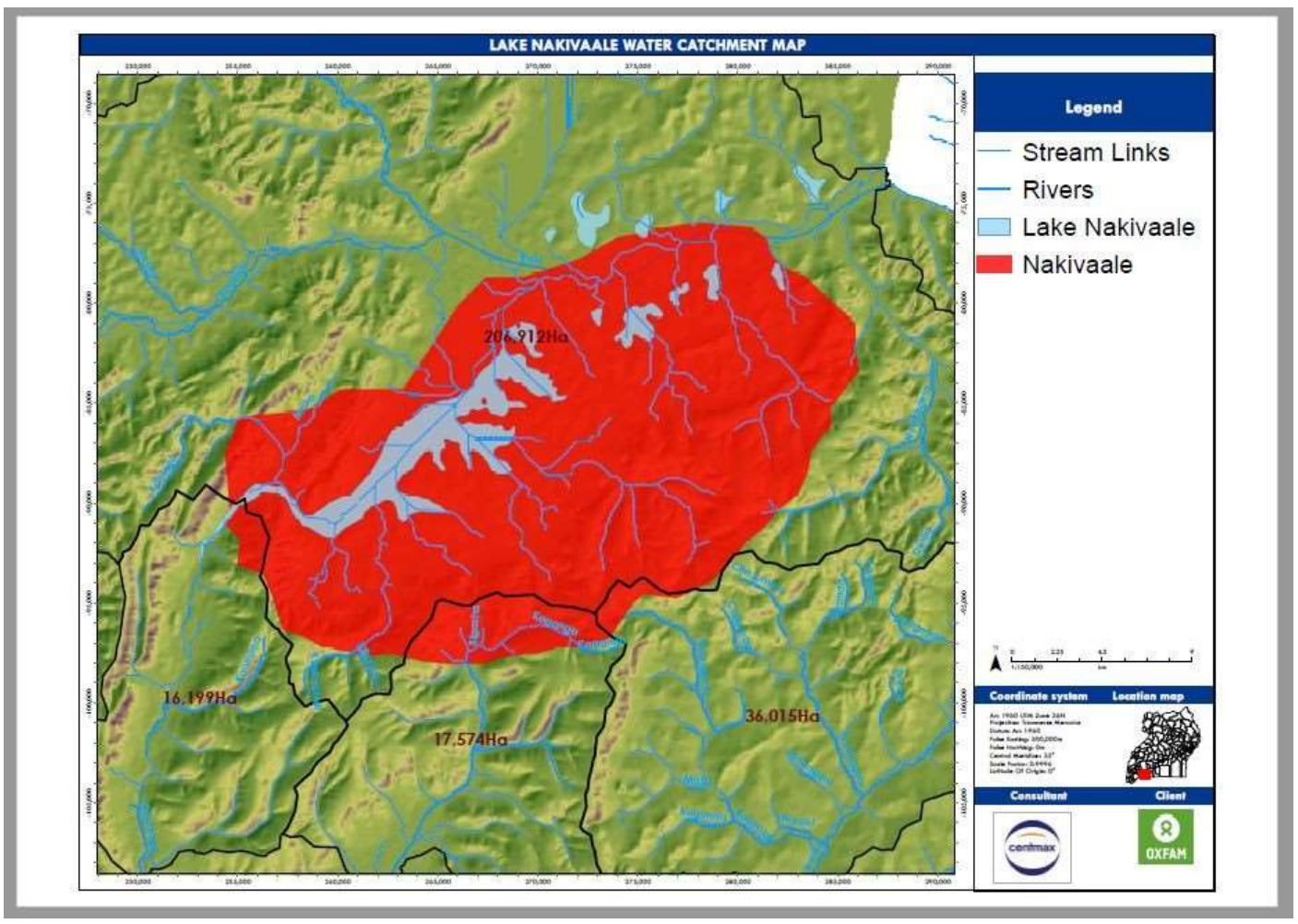


Figure 4 Base map for field exploration in Isingiro district

EXPRESSION OF INTEREST FOR:

GEOTECHNICAL AND HYDROGEOLOGICAL SURVEYS FOR MINES, INDUSTRIAL PLANTS AND FACILITIES

1.0 SCOPE OF WORK

1.1Project objectives

To investigate the risk of Soil Contamination around the site i.e. whether there is exposure to heavy metals, industrial waste or any hazardous substances

To assess the Water level of the site while considering risks such as surface run-off, flooding or other hydrologic hazards

To assess the Geotechnical properties of the subsoil for construction

To assess water quality, availability and its suitability for use

1.2 Technical Summary of Project

The geotechnical and hydrogeological survey activities are summarized as follows:

A field Reconnaissance survey shall be carried out to determine the nature of any outcrop/exposed rocks and topography around the site of investigation. These studies shall include; topography mapping, surface hydrological mapping, soil profile mapping among others.

Topographic map shall be used to assess the elevation and geotechnical hazards such as flooding, foundation crack and settlement, erosion etc.

Soil and water sampling shall be conducted to assess the level of contamination for heavy metals, industrial waste or any hazardous substances

Shallow angering of soils from 1 to 2m depth at every 50 meter intervals shall be done to obtain samples for laboratory tests on soil engineering properties. Augers will also investigate the depth of shallow water tables.

Geophysical surveys shall be conducted to investigate the thickness and extent of the overburden/subsoil. Electrical Resistivity Sounding shall assist to determine the nature of any fractures and faults both on the overburden and Bedrock.

Coring shall be necessary in some locations to assess the type of rock and geological structures. The cored sites shall coincide with sites that shall be excavated during Civil Works

Laboratory analysis of Cored samples ie both rocks and soils to determine the geotechnical and engineering properties.

Geotechnical Lab results for soils and rocks shall be used to assess the nature of subsoil, groundwater properties, load bearing capacity and foundation design

2.0 GEOTECHNICAL INVSESTIGATIONS

The following studies shall be carried out on the site:

Field Reconnaissance

Geophysical surveys

Surface Hydrological mapping

Soil Tests

Drilling and Coring

Laboratory Analysis of Rock and Soil Samples

2.1 Field Reconnaissance

This will be done so as to get acclimatized with the field in order to plan for the location of Geophysical *Vertical Electrical Surveys (VES)* profiles. Consultations with the local authority will be essential to minimize any possible resistance towards the Surveyors from locals.

The field reconnaissance will involve:

Assessing Site Accessibility by both equipment and manpower

Meeting Administrators and Local Leadership to ensure harmonious work environment.

Conducting a Topographic Survey to assess the elevation and any shallow geo-hazard risks

Field Geological mapping to determine the type of bedrock and any geological structures

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2.2 Topographic Survey

Terrain points for generation of contours that indicate the elevation profile/Altitude of the project area will be taken using GPS. The points will be taken at 50m intervals in line with site layout. Additional points will be taken to show *break-lines* or sudden changes in terrain. GPS points shall be taken along any Drains, Earth Ditches, Streams and Canals. These GPS points will be measured by taking the centerline and top edges. The GPS points taken will be used to generate a Digital Terrain Model (DTM) which will be used to generate cross sections. This data shall be used to assess any future shallow geo-hazards such as flooding, foundation settlement, and erosion.

2.2 Geological and Geophysical Mapping

The Consultant shall conduct Geological and Geophysical mapping to assess the type of bed-rock, over-burden the nature of fractures and faults. A Geological Map of the project area helps the Consultant to determine number of drill holes to be drilled or cored while the Topographic map shall be used to assess the elevation and any shallow geo-hazard risks. Drill holes will indicate whether the medium is soil or rock.

Geophysical Electrical Resistivity surveys shall be conducted using *Terameter* to investigate the thickness and extent of the overburden and the depth of water table. Electrical Resistivity Sounding shall assist to determine the nature of any fractures and faults both on the overburden and Bedrock. Up to 4 Electrical Resistivity Surveys shall be conducted in line with

the plot layout.

2.3 Drilling and Coring

Borehole logging and Coring shall be necessary in specific locations identified by the Resistivity surveys to assess the type of rock and geological structures. The core depth shall be between 4m to 6m depending on the proximity to basement rocks within the area. The cored sites shall coincide with sites that shall be excavated during Civil Works for positioning the *piles/ concrete pillars* for the Foundation. Water samples shall be obtained to assess ion content and chemical reactivity especially with cement/ grout mixtures.

The data shall be used to determine bedrock depth, degree of compaction, load bearing capacity of the subsoil, stratigraphy, porosity, aquifer/water table depth among others

The following key outputs shall be determined from the survey:-

Lithological log to assess type of rock

Fracture/fault network distribution

Subsoil thickness

Electrical Resistivity Sounding profile to assess rock continuity

Aquifer/Groundwater depth

Soil profile characterization

Load Bearing Capacity of Rocks

Mechanical Strength parameters

The data shall be used to assess foundation design risks such as; liquefaction, foundation settlement, erosion, seismicity, flooding/surface runoff among others.

2.4 Soil Tests

The consultant shall conduct Pitting and Boring at every 50-meter intervals to assess topology, surface water rise/runoff, piezometric parameters and liquefaction risks among others. The following field tests shall be conducted:

Soil profile characterization

Determination of groundwater presence and its level

Other Laboratory measurements on the sampled soils shall include:

Chemical Reactivity Tests (Content of Soluble Sulphate)

Particle Size Classification (ASTM-D422-2014)

Unified soil classification (ASTM-D2487-00)

Dry Density

Logging of the sampled points to assess soil types, moisture content, degree of compaction among others

Atterberg limit to determine the plasticity index and moisture content of the soils (ASTM-D4318-2014)

Direct Shear Testing to evaluate shear resistance of soils (ASTM-D3080-2011)

Consolidation Test (ASTM-D4767-2011)

Table-1 Bills of Quantities for Geotechnical Work

SN	ACTIVITY	SUB-ACTIVITY
1	Soil analysis for **10 samples**	Pitting manual labor
		Engineering Lab tests for 10 soil samples
		Contaminant assessment for 10 soil samples
		Cartographic print outs for soil maps- 1:50,000 scale
2	Professional fees	Geologist
		Geotechnical Engineer
		Report compilation
3	Equipment mobilization and demobilization	Drilling and Coring equipment
		Terameter for Geophysical Survey hire
		Vehicle hire and Fuel
		Sampling bags and bottles-
4	Drilling and Core Logging for **4 Stations** at 4 to 6m depth	Core drilling of 4 drill holes
		Borehole Logging and report compilation
		Sample cutting and storage
5	Lab Analysis of **4 core Samples**	Tests such as; degree of compaction, load bearing capacity, shear strength, porosity

3.0 WATER QUALITY AND HYDROGEOLOGICAL INVESTIGATION

Surface water samples shall be obtained to assess ion content and chemical reactivity especially with cement/ grout mixtures. Shallow auguring of soils from 1 to 2m depth at every 50-meter interval shall be done to investigate the depth of shallow water tables.

Geophysical Electrical Resistivity surveys shall be conducted using *Terameter* to investigate the aquifer thickness and aerial extent. Geophysical *Vertical Electrical Sounding* (VES) profiles shall measure up to 20 meters below the subsurface.

Areas with high potential for constructing a production well for supplying the Data Centre shall be recommended for future planning.

Table-2 Bills of Quantities for Water Quality and Hydrogeological Investigation

		Geophysical Surveys-Electrical Resistivity
2	Lab Analysis of 10 water samples	AAS analysis 10 water samples
3	TOTAL	

4.0 Equipment for Field and Office

2 Leica TCR407power Total Stations with accessories

2 Field Tablets and Notebooks

4WD Vehicle

Field Augers

Geological Hammers

Terametre SAS Resistivity Meter 300

1 Handheld GPS (Garmin Montana 300)

1 RTK GPS, x900+

CAD software installed on high capacity –32 GB RAM workstation i.e

AutoCAD 2021,

AutoCAD Civil3D,

ArchiCAD 2022,

ArcGIS 8.0

Microsoft Project Management

Table 1 List of our equipment

Equipment	Make and year	Condition	Ownership	Use
Hilux	Pick up double cabin, 1994	Good	Hired	Transport
Resistivity equipment	ABEM SAS 1000 terameter, 2003	Good	Hired	Siting
Resistivity equipment	ABEM SAS 300C terameter, 2000	Good	Hired	Siting
2 GPS	Garmin GPS Etrix 2010 & Oregon 300, 2010	Good	Owned	Location
3 EC meters	Eijekelkamp, 1999	Good	Owned	Water quality
3 pH meters	Eijekelkamp, 1999	Good	Owned	Water quality
2 Water level meters/dippers / solinst	1 of 50m and 1 of 100m	Good	Hired	Water depths
2 Laptop Computer	Toshiba and a dell		Owned	Field data collection andReporting
1 Generator	Hale Pumps Hot 4200GE-D W/ Lombardini Motor 1 Ph 17937LR	Good	Hired	Test pumping

Software

Software name	Ownership	Application
Microsoft office (word, Excel, Access)	Owned	Reporting, data, analysis, presentation of geophysical data
RESSOUND	Owned	Sounding interpretation
Aquitesolv & Aquitest	Owned	Pumping test data interpretation
Surfer version 8.0 Arc GIS 10.5	Owned Owned	Presentation of data on Maps Interpretations and analyses

3.0 OUR TEAM OF EXPERTS

No	Technical staff	Qualifications	Years of experience	Position in the company
1	Ecau James	M.Sc. Petroleum Engineering and Production, BSc. Geological Resources Management	9	Senior Geologist
2	Mulinde Rodrick	BSc. Geology, physics	6	Geologist
3	Angeyango Conslate	MSc Environmental Engineering PDG in Project planningand Management BSc. In Water ResourcesEngineering	6	Environmental Engineer
4	Angumenawe Nichodemus	Diploma Workplace Safety and Health, Diploma Environmental Science, Occupationalhealth and safety.	7	Health and safety Engineer

4.0 OUR TEAM ON SITE

	
Exploration for base metals Arua region	Exploration for Bentonite Ihimbo district
	
Exploration for Gold Mityana area	Exploration For Rare earth elements Bugiri district

Drilling at Tororo Cement Factory

Taking the level of water table for a drilling site at Tororo Cement Factory

Materials samples extracted for further laboratory testing and analysis

A multi-disciplinary and multi-cultural team is a good blending for a successful site, 2018

SELECTED MINING PROJECTS

S/N	Projects	Client(s)
1	**Jan, 2018 –to-date** ▪ Field geological mapping of Marble and Granite Quarries ▪ Geological Sample analysis and interpretation, ▪ Reserve estimation of Marble & Granite quarry for dimension stones	Mechanized Agro (U) Ltd, P.O. Box 16616, Kampala (Project Areas include: Kotido, Mubende and Mukono)
2	**Nov to 2019 Dec,2021** ▪ Field Geological Mapping ▪ Supervision of Core drilling (up to 250m Depth), ▪ Core Sampling and Logging of Ultramafic rock formation, ▪ Quarry Reserve estimation	Pearl Mining (U) Ltd P.O. Box 2903, Kampala; project areas are in the Rift Valley, Mubende and Mukono)
3	**September, 2019 to July,2020** ▪ Geotechnical design of oil waste dump sites ▪ Well designs for ground water wells ▪ Ground Resistivity Measurements for oil waste dump sites ▪ Environmental Impact Assessment ▪ Soil Classification and Compaction studies ▪ Borehole data acquisition and interpretation ▪ Borehole drilling Supervision	**CNOOC Uganda Ltd** (Project was at King Fisher - Block 3 Area, Albertine Graben)
4	**August 2019 to June, 2021** ▪ Geotechnical and Environmental Impact Assessment for an Iron Ore Processing Plant ▪ Use of Gold Scanner *(Vector Trek- long Range Scanner*) for mapping precious metals ▪ Soil and Stream Sediment Geochemical exploration ▪ Ground water Investigation and Hydrogeological investigations ▪ Geophysical mapping GIS and Remote Sensing Mapping	**Banta Investments Uganda Ltd** **P.O Box 7459, Kampala** **(**Projects in Gold exploration and Mine development in Ibanda, Mubende, Muko-Tororo, Grounwater projects across Uganda)
5	**March, 2018 to date** ▪ Geological mapping and sampling for Limestone ▪ Lab and Core Analysis supervision Drill-hole supervision	Bamburi Minerals Co. (U) Ltd, P.O. Box 5136, Kampala, Projects were in Kasese, Kotido and Tororo
6.	**March 2018 to September 2019** Review of Energy and Mineral Development Sector Development plan for the key government institutions in Uganda	**GIZ Funded Project-for** ADROIT CONSULT INTERNATIONAL