# AL-SHERMAN LTD

## P.O.BOX 87074
## MOMBASA

## PROPOSED SALT WORKS IN A SECTION OF LAND PARCEL L.R. No. 13536, MARERENI, KILIFI COUNTY

# ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT


Compiled by:-
**SIGTUNA CONSULTANCY LIMITED**
Registered and Licensed EIA/EA Firm of Experts Reg. No.9582
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2018

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## PROPOSED SALT WORKS IN A SECTION OF LAND PARCEL L.R. No. 13536, MARERENI, KILIFI COUNTY

# ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT

**Signed and submitted by the Proponent**

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**Mohamed Islam ALI**
Director
**AL- SHERMAN LTD**

## EXECUTIVE SUMMARY

This report presents findings of an Environmental Impact Assessment Study for a proposed salt works. The proposed salt works will be constructed by Al-Sherman Limited (who is the project proponent) on a section of Land Reference number 13536. This parcel of land is located in Kilifi County, Magarini Sub-County, Fundi Issa Location, Marereni Sub-Location, Adu Ward at Musumarini area. The Environmental Impact Assessment Study and report was prepared as provided for in Legal Notice No. 150 of 2016, section 58 (2) of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit Regulations), 2003. Other relevant legislations and policies reviewed included National Environment Policy, 2013, National Climate Change Framework Policy Sessional Paper No. 5 of 2016, The Constitution of Kenya, 2010, The Occupational Safety and Health Act, 2007, The Water Act 2016, Mining Act 2016, The Land Act 2012, The Public Health Act Cap 242, Work Injuries Benefits Act 2007, Building Operations and Works of Engineering Construction Rules, 1984, Noise and Excessive Vibration (Pollution Control) Regulations, 2009, Environmental Management and Coordination (Water Quality) Regulations, 2006, Environmental Management and Coordination (Waste Management) Regulations, 2006 and Environmental Management and Coordination (Air Quality) Regulations, 2014.

### The proposed project site

The proposed project site is land reference .number 13536, a section of this land has squatters, while another section of the same land has no squatters. The section of land reference .number 13536 where the proposed salt works is to be constructed is that part of the said land which has no squatters.

### Land documentation

The Project Proponent Al-Sherman Limited has land document for the proposed project site land reference .number 13536. The Land document for land reference .number 13536 is a grant number CR17511 of a term of 45 years from1/1/1986.

**Land use of the proposed project site as indicated in the land document**

One of the special conditions of the grant of land reference .number 13536 states that 'the land and the buildings shall be used for extraction of salt, shrimp and prawn farming and housing of essential staff.

**Condition of the section of LR No 13536 where the proposed project is to be constructed**

The section **of** land reference .number 13536 where the proposed project is to be constructed is open with no squatters. There has been previous attempt to establish a salt works at this portion of the land as evident from remnants of structures on site that include an old site camp with dilapidated buildings, three dilapidated pumps stations, disintegrating dykes and silted salt pans grown with vegetation.

**Objective of the proposed project**

The objective of the proposed project is to construct a salt works that will utilize seawater and solar radiation to produce salt using solar technology. The scope of the proposed salt works will be to construction of salt ponds (evaporator ponds, serving ponds and crystallizer ponds), pump stations, dykes, service facilities, and a camp with offices and associated support facilities.

**Environmental condition**

The proposed project site is rich in biodiversity including flora such as trees, shrubs, herbs, grasses and sedge and fauna such as reptiles and amphibians, invertebrate crustaceans, and avifauna. The proposed project site and its neighborhood are served by both surface and underground water resources. The surface water resources at the project area are mainly ephemeral streams while underground water resources are mainly wells. There are four ephemeral streams that drain from the upper part of Adu area down to the proposed project site and its neighborhood and into the creek. These ephemeral streams are Mbwageni Stream, Kwa Kubanda stream, Kwa Nzai stream and Magadi stream. The neighborhood of the proposed project site has numerous wells. The wells are mainly shallow in nature and are located at Kakomani, Kwa Mikadzo, Kwa Bikache, Kwa Bicharo, Kithungu, Muyu Wa Kae, Kwa Kaloki, and Kwa Pili. Three community beach access routes pass through a section of the proposed project site namely Msumarini-Kaswakini Beach Access Route, Solar Camp-Kaswakini Beach Access Route and Kadzuyuni-Mbwana-Saidi Beach Access Route.

**Potential positive impacts of the proposed salt works**

A summary of potential positive impacts likely be realized from the proposed salt works include: -

- ✓ Employment opportunities for the local community
- ✓ Support to existing local businesses
- ✓ On job training opportunities for local people
- ✓ Potential for local economic improvement
- ✓ Technology transfer
- ✓ Support for development of local community through company CSR programme
- ✓ Contributes to improved competition in the salt sub-sector
- ✓ Contribution to supporting the country to be is a net producer of salt
- ✓ Taxes to National government
- ✓ Taxes to Kilifi County Government
- ✓ Foreign exchange earnings from salt exports

**Potential negative impacts**

A summary of potential negative impacts likely be realized from the proposed salt works include**:-**

- ✓ Fear of displacement of squatters
- ✓ Labour influx from outside the local community
- ✓ Loss of local biodiversity
- ✓ Potential alteration of natural flow/stream channel of local ephemeral streams
- ✓ Potential blockage of community beach access road
- ✓ Change of local air quality
- ✓ Occupational injuries and accidents

**Proposed mitigation measures**

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| **Construction phase** | |
| Fear of displacement of squatters | - An appropriate platform to be provided which will bring together the local community together with their leadership and the project proponent to dialogue and address all fears and mistrust that could exist to clear it all prior to project implementation. The outcome of the dialogue to be documented in writing and be signed by both parties and appropriately witnessed for future reference.<br>- The project proponent to keep his word to the local community that the proposed project will only be undertaken in the open areas where there are no squatters and that no squatter will be removed from where they are currently.<br>- The proposed project to be strictly limited to the open areas as defined by the GPS coordinates in the provided drawing of the salt works ensuring that such areas do not have any squatters in them.<br>- No squatter should be displaced in the name of implementing the proposed project. |
| Labour influx | - First priority to be given to people from the local community when recruiting construction workers.<br>- Unskilled and semi-skilled labor to be strictly sourced from the local community<br>- Skilled labor to be sourced out of the local community when it has been ascertained that there is no person from the local community with such a skill. |
| Occupational injuries and accidents to construction workers | - All construction workers to be given appropriate personal protective equipment.<br>- All construction workers to first be trained on the appropriate use of the provided personal protective equipment. |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | - Project proponent to ensure each construction worker and visitors to the construction site also use the provided personal protective equipment.<br>- The project proponent to ensure that tools and equipment provided for use at the proposed construction site are well serviced and maintained.<br>- Project proponent to ensure that the construction site is free of hazards.<br>- The project proponent to ensure that among the construction workers are trained first aiders.<br>- Project proponent to ensure there is a fully equipped first aid station at the proposed project site.<br>- Project proponent to ensure appropriate measures are put in place to minimize fugitive dust by regularly flooding with water all dusty working areas especially during windy periods. |
| **Operational phase** | |
| Blockage of community beach access routes | - All the community beach access road that pass through sections of the proposed project site to be identified and appropriately documented.<br>- Design of the proposed salt works to factor in the access roads and ensure that they are not interfered with.<br>- In a case where an existing community beach access road has to be altered consultations with the local community together with the local leadership to be done first to obtain consensus prior to the change. |
| Restricted access to local fish landing sites | - The design of the salt works should ensure that access to local fish landing sites is not restricted.<br>- All the community beach access road that pass through sections of the proposed project site to be identified and appropriately documented. |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | - Design of the proposed salt works to factor in the access roads and ensure that they are not interfered with.<br>- In a case where an existing community beach access road has to be altered consultations with the local community together with the local leadership to be done first to obtain consensus prior to the change. |
| Blockage of local ephemeral streams | - The design of the salt works should ensure that no local ephemeral stream or any other surface water body flowing through sections of the proposed project site is blocked or its natural course altered.<br>- Project proponent to ensure that the proposed project to comply with all the provisions of the Water Act 2016 and its relevant subsidiary legislations. |
| Labour influx | - First priority to be given to people from the local community when recruiting workers for the operational phase.<br>- Unskilled and semi-skilled labor who will be hired during the operational phase of the proposed salt works to be strictly sourced from the local community<br>- During the operational phase of the proposed salt works, required skilled labor to be sourced out of the local community after exhausting those available in the local community. |
| Occupational injuries and accidents | - During operational phase all workers to be given appropriate personal protective equipment.<br>- Workers hired during the operational phase to first be trained on the appropriate use of the provided personal protective equipment.<br>- Project proponent to ensure all operational phase workers and visitors to the salt works also use the |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | provided personal protective equipment provided appropriately.<br>- The project proponent to ensure that tools and equipment provided for use during the operational phase of the salt works are well serviced and maintained.<br>- The project proponent to ensure that among the operational phase workers are trained first aiders.<br>- Project proponent to ensure there is a fully equipped first aid station at various sections of the proposed salt works. |
| **Potential negative environmental impacts** | **Proposed mitigation measures** |
| **Construction phase** | |
| Negative impacts on local flora | - Vegetation to only be cleared from the actual areas where the salt ponds will be constructed and associate support infrastructure.<br>- Large trees such the Baobab within the project area to be preserved.<br>- Management to plant more trees and other vegetation in open areas of the project site were project activities will not be constructed.<br>- Management to support tree planting in areas outside the proposed project site such as in schools, health centers, compounds of religious institutions to boost local green cover and carbon sink |
| Negative impacts on local fauna | - Ensuring there is no killing, trampling on, capturing and or removal of any fauna from the proposed project site during implementation.<br>- Minimize noise and vibration from equipment activity during construction phase that might course some fauna to migrate, hyparnate and or relocate. |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | - Maintain ecological sensitive vegetation that is essential for the sustenance of local fauna.<br>- Fauna feeding areas not with salt pan areas to be preserved by maintaining pockets of vegetation within the proposed project site in identified strategic areas. |
| Negative impacts on local hydrology | - There should be no blocking or diverting any of the ephemeral streams or any other surface water body passing through the proposed project site without the written permission of the Water Resources Authority.<br>- No encroachment to community water wells<br>- Proponent to ensure that proposed project activities do not compromise the existing community water wells quality |
| Negative impacts on local air quality | - Water sprinkling on dusty surfaces to be done to minimize fugitive dust<br>- Flooding with water opened areas for construction of salt pans to be done during dry spells and windy conditions to reduce clouds of dust.<br>- Ensure construction equipment are properly serviced and maintained to minimize noise and vibration |
| Negative impacts on local soils disturbance | - Minimize soil erosion by planting vegetation on all open areas of the proposed project site where salt pans will not be constructed |
| Noise and vibration from site equipment use | - Ensure construction equipment are properly serviced and maintained to minimize noise and vibration |
| Construction phase waste impacts | - Excavated soil to be used in construction of dykes<br>- Waste generated from equipment servicing and maintenance to be managed and disposed as per the |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.<br>- Provide waste receptacles for dropping of generated waste<br>- Where possible try to reduce potential waste generation, reused and or recycle generated waste. |
| **Operational phase** | |
| Bitten generation, handling and disposal impacts | - Generated bitten to be channeled into bitten ponds, ensure the bitten ponds are of adequate capacity to handle all the bitten to be generated in each salt harvesting season.<br>- Ensure the bitten ponds lined with appropriate clay soil and other impervious material to ensure no seepage of bitten into the soil.<br>- Allow the bitten in the bitten ponds to crystalize into low grade salt which can be harvested and sold as cattle salt |
| Generation of effluent from raw salt washing | - Provide for adequate capacity settling ponds for handling effluent from salt washing<br>- Effluent from salt washing to be channeled into settling ponds were sediments settle down and the resulting clear saturated brine recycled back to salt washing<br>- Scoop out settled sediments from the settling ponds and use them to fill low-lying areas with the salt works |
| Blockage of free flow of tides within the creek from constructed dykes | - The design of the salt works should as much as possible avoid construction of perimeter dykes that are parallel to the coastline<br>- Avoid construction of dykes at or close to the high water mark |
| Increased electricity demand and use | - Water pumps at the pump stations to be solar energy power as opposed to drawing energy from the |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | grid |
| Increase fresh water demand and use | - The proponent should not source freshwater to be used at the salt works from local community water wells. |
| Impacts of waste generated in the operational phase | - All solid waste to be generated to be handled and disposed as provide for in the Environmental Management and Coordination (Waste Management) Regulations 2006.<br>- Waste oil and any other liquid waste to be generated to be handled and disposed as provided for in the Environmental Management and Coordination (Water Quality) Regulations 2006. |

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# 1. BACKGROUND

## 1.1 Introduction

This report is an Environmental Impact Assessment Study for proposed construction of salt works to be developed by Al-Sherman Limited. The Environmental Impact Assessment Study and report was prepared as provided for in Legal Notice No. 150 of 2016, section 58 (2) of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit Regulations), 2003.

## 1.2 Definition of the proposed project

The proposed project will be to construct a salt works that utilizes solar technology to produce salt from seawater. The components of the salt works will include salt ponds (evaporator ponds, serving ponds and crystallizer ponds), electricity connection from the national grid, saltwater pumps, salt washing area raw (salt washery), site camp with offices and support facilities.

## 1.3 Location

The proposed project will be located in Kilifi County, Magarini Sub-County, Fundi Issa Location, Marereni Sub-Location, Adu Ward at Musumarini area on a section of land L.R.No. 13536 that is open without squatters, appendix 1 gives land documents. The area of land L.R.No. 13536 as indicated in the land document is 1,021.9 hectares. The proposed salt works will occupy approximately 753.8 hectares. Table 1 tabulates the coordinates that define the open section of L.R.No. 13536 L.R.No. 13536 as per the drawings provided by the project proponent while figure 1 is the map of Kilifi County showing location of Magarini Sub-County the where the proposed project will be located.

## 1.4 Land documents for the proposed project site

The land documents for the proposed project site land reference .number 13536 are in the name of the Project Proponent Al-Sherman Limited. The Land document for land reference .number 13536 is a grant number CR17511 of a term of 45 years from1/1/1986.

**Table 1: GPS Coordinates that define the area of the proposed salt works**

| Description | Coordinates |
|---|---|
| Old cut-line West on road crossing | Latitude: $02^0$47.440’S, Longitude: $40^0$09.140’E |
| Pump station No.3 | Latitude: $02^0$46.385’S, Longitude: $40^0$09.557’E |

| Description | Coordinates |
|---|---|
| North limit dyke junction pump No.3 | Latitude: $02^0$46.385'S, Longitude: $40^0$09.557'E |
| Pump station No.1 Sea intake | Latitude: $02^0$46.450'S, Longitude: $40^0$09.960'E |
| Junction EX-Dyke (Pump No. 3) | Latitude: $02^0$46.710'S, Longitude: $40^0$09.590'E |
| Junction EX-Dyke Near service area | Latitude: $02^0$47.200'S, Longitude: $40^0$09.600'E |
| End Offset dyke (line of crystallizers) | Latitude: $02^0$47.490'S, Longitude: $40^0$09.660'E |
| Line of crystallizer junction | Latitude: $02^0$47.490'S, Longitude: $40^0$09.550'E |
| Junction ''X'' | Latitude: $02^0$47.670'S, Longitude: $40^0$09.594'E |
| T-Junction Perimeter | Latitude: $02^0$47.839'S, Longitude: $40^0$09.598'E |
| S.E Corner on perimeter dyke | Latitude: $02^0$47.730'S, Longitude: $40^0$10.050'E |
| Junction at Mid Crystallizer | Latitude: $02^0$47.620'S, Longitude: $40^0$09.400'E |
| T-Junction Perimeter | Latitude: $02^0$47.840'S, Longitude: $40^0$09.410'E |
| N.E Corner Crystallizers | Latitude: $02^0$47.490'S, Longitude: $40^0$09.400'E |
| Site Office (Containers) | Latitude: $02^0$47.383'S, Longitude: $40^0$09.385'E |

Sources: Extracted from the drawings of the proposed salt works

### 1.5 Project Proponent

Al-Sherman Limited, a private company incorporated with limited liabilities in the Republic of Kenya is the project proponent. The company holds a certificate of incorporation number No. C 30942 date eighteenth day of December one thousand nine hundred and eighty five and personal identification number certificate P000632683Z dated 05/10/2017. Appendix 2 is copy of the certificate of incorporation and copy of personal identification number certificate

### 1.6 Project Objective and Scope

The objective of the proposed project is to construct a salt works that will utilize seawater and solar radiation to produce salt using solar technology. The scope of the proposed salt works will be to construction of salt ponds (evaporator ponds, serving ponds and crystallizer ponds), pump stations, dykes, service facilities, and a camp with offices and associated support facilities.

### 1.7 The proposed project site

The proposed project site is land reference .number 13536, a section of this land has squatters, while another section of the land has no squatters. The section of land reference .number 13536 where the proposed salt works is to be constructed is that part of the said land

which has no squatters. The section of land reference .number 13536 that has squatters is not part of the proposed project site.

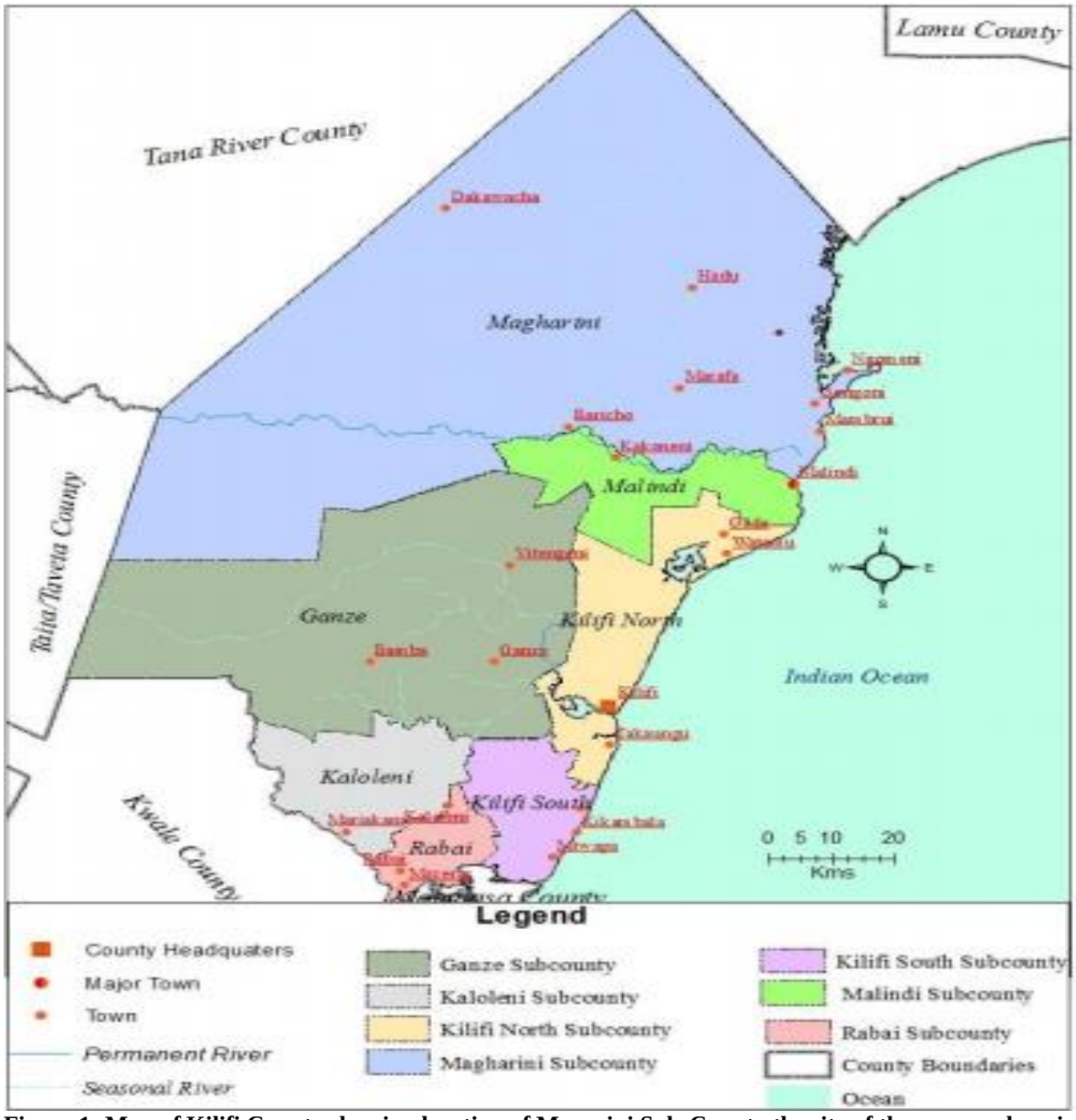


**Figure 1: Map of Kilifi County showing location of Magarini Sub-County the site of the proposed project**

### 1.7.1 Use of the proposed project site as per land documents

One of the special conditions of the grant of land reference .number 13536 states that 'the land and the buildings shall be used for extraction of salt, shrimp and prawn farming and housing of essential staff'. The proposed salt works thus fits within one of the required use of the land.

### 1.7.2 Existing structures at the proposed project site

There has been previous attempt to establish a salt works at the proposed project site. This is evident from remnants of structures currently at the proposed project site that include an old

site camp with dilapidated buildings, three dilapidated pumps stations, disintegrating dykes and silted salt pans grown with vegetation. The plates below capture some of the observations at the proposed project site.

**Plate 1: Remnants of pump station 3, 2 & 1 and one of the disintegrating dykes on site**

Other existing old structures at the proposed project site include site camp with remnants of buildings some only walls without roofs while others with frayed makuti roofs, large slat pans some with grown vegetation as captured in plates 2 and 3 below.

**Plate 2: Existing old silted salt pans some grown with vegetation**

**Plate 3: Remnants of the existing site camp buildings at the proposed project site**

### 1.7.3 The Magarini salt belt

The proposed salt works project site is located within the Magarini salt belt. Existing salt works within the salt belt are Krstalline Salt Limited who operates Krystalline Marereni Salt Works, Kurawa Industries Limited who operate Kurawa Salt Works at Kurawa. Other salt works within the salt belt include, Krystalline Salt Limited who operate Krystalline Gongoni salt works at Gongoni, Kensalt Limited who operate Kensalt salt works at Gongoni, Malindi Salt Packaging Industries Limited who operate Malindi salt works at Kambi ya Waya and Kemu Salt Packer Productions Limited who operate Kemu salt works at Kemu.

## 1.8 Terms of Reference

Terms of reference (ToR) for the EIA study were prepared and submitted to the National Environment Management Authority (NEMA) for approval. The ToR was approved by NEMA paving way the compilation of this environmental impact assessment study report. Appendix 3 is copy of the ToR approval letter from NEMA.

# 2. BACKGROUND TO ENVIRONMENTAL IMPACT ASSESSMENT

## 2.1 Definition of Environmental Impact Assessment

Broadly environmental impact assessment (EIA) refers to the need 'to identify and predict the impact on the environment and on man's health and wellbeing of legislative proposals, policies, programmes, projects and operational procedures, and to interpret and communicate information about the impacts'(Munn 1979). UNECE (1991) defines EIA as 'an assessment of the impacts of planned activity on the environment', IAIA (2009) on the other hand defines EIA as 'the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of proposed development proposals prior to major decision being taken and commitments made'. Glasson *et.al* (2012) defines EIA as 'a systematic process that examines the environmental consequences of development actions in advance'. EIA is thus a vital tool that aid formulation of development actions, decision making, an instrument for sustainable development and vehicle for stakeholder consultation and participation (Glasson *et.al* 2012).

## 2.2 The purposes of EIA

### 2.2.1 An aid to decision making

EIA is an aid to decision-making. For the decision maker, for example, a local authority, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The EIA can be considered by the decision-maker along with other documentation related to the planned activity. EIA is normally wider in scope and less quantitative than other techniques, such as cost-benefit analysis (CBA).It is not a substitute for decision making, but it does help to clarify some of the trade-offs associated with a proposed development action, which should lead to more informed and structured decision-making. The EIA process has a potential, not always taken up, to be a basis for negotiation between the developer, public interest groups and the planning regulator. This can lead to outcome that balances well the interests of the development action and the environment.

### 2.2.2 An aid to the formulation of development actions

Developers may see the EIA process as another set of hurdles to jump before they can proceed with their various activities; the process can be seen as yet another costly and time-consuming activity in the development consent process. However, EIA can be of great benefit to them, since it can provide a framework for considering location and design issues

and environmental issues in parallel. It can be an aid to the formulation of development actions, indicating areas where a project can be modified to minimize or eliminate all together its adverse impacts on the environment. The consideration of environmental impacts early in the planning life of a development can lead to more environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother development consent process, and sometimes to a worthwhile financial return on the extra expenditure incurred. O'Riordan (1990) links such concepts of negotiation and redesign to the important environmental themes of 'green consumerism' and 'green capitalism'. The growing demand by consumers to goods that do no environmental damage, plus a growing market for clean technologies, is generating a response from developers. EIA can be the signal to the developer of potential conflict; wise developers may use the process to negotiate 'environmental gain' solutions, which may eliminate or offset negative environmental impacts, reduce local opposition and avoid costly public inquiries. This can be seen in the wider and contemporary context of corporate social responsibility (CSR) being increasingly practiced by major businesses (Crane et al.2008)

### 2.2.3 A vehicle for stakeholder consultation and participation

Development actions may have wide-ranging impacts on the environment, affecting many different groups in society. There is increasing emphasis by government at many levels on the importance of consultation and participation by key stakeholders in the planning and development of projects. EIA can be a very useful vehicle for engaging with communities and stakeholders, helping those potentially affected by a proposed development to be much better informed and to be more fully involved in the planning and development process.

### 2.2.4 An instrument for sustainable

Existing environmentally harmful developments have to be managed as best as they can. In extreme cases, they may be closed down, but they can still leave residual environmental problems for decades to come. It would be much better to mitigate the harmful effects in advance, at the planning stage, or in some cases avoid the particular development together. This of course leads on to the fundamental role of EIA as an instrument for sustainable development-a role some writers have drawn attention to as one often more hidden than it should be when EIA effectiveness is being assessed (Jay et al.2007)

## 2.3 Origins and development of EIA

The first EIA legislation was formerly established in the United States of America in 1969 (NEPA 1970), in Europe the 1985 European Community directive on EIA (Directive 85/337) introduced broadly uniform requirements for EIA for all member states (CEC, 1985). In Australia, the Commonwealth EIA system was established in 1974 under the Environmental Protection (Impact of Proposal) Act (Wood 2003, Ellott and Thomas, 2009). The United Kingdom enacted a formal legislation on EIA in 1988 (Glasson *et.al* 2012). China formerly enacted its first EIA legislation in 1979 (Moorman and Ge 2007). In Africa and the Middle East, Israel and Algeria pioneered in enactment and implementation of EIA legislations in 1982, 2003 and 1983, 1990 respectively (Economic Commission for Africa, (2005) Almagi *et.al* (2007). In East Africa Uganda pioneered in enacting EIA legislation in 1998, Kenya EIA legislation was enacted in 2000, and implemented in 2003 (Morara *et.al* 2011).

## 2.4 Key elements in the EIA process

The environmental impact assessment process comprises of various interactive steps such as screening, scoping, consideration of alternatives, action design, preparation of the EIA report, reviewing or evaluating the report, decision making, and post decision activities such as monitoring and auditing (Glasson *et al.,* 1994; Wood, 1995). According to UNEP (2002) key elements in the EIA process are screening, scoping, impact analysis, mitigation, reporting, review, decision-making, follow up and public involvement. Figure 2 is the schematic presentation of general EIA process adopted from UNEP' environmental impact assessment training manual.

### 2.4.1 Screening

Screening determines whether or not a proposal requires an EIA and, if so, what level of analysis is necessary. This process brings clarity and certainty to the implementation of EIA, ensuring that it neither entails excessive review nor overlooks proposals that warrant examination.

### 2.4.2 Scoping

Scoping identifies the important issues in readiness for preparation of terms of reference; it is a critical, early step in the preparation of an EIA (UNEP. 2002). The scoping process identifies the issues that are likely to be of most importance during the EIA and eliminates those that are of little concern. In this way, EIA studies are focused on the significant effects and time and money are not wasted on unnecessary investigations (Glasson *et al.*, 2012).

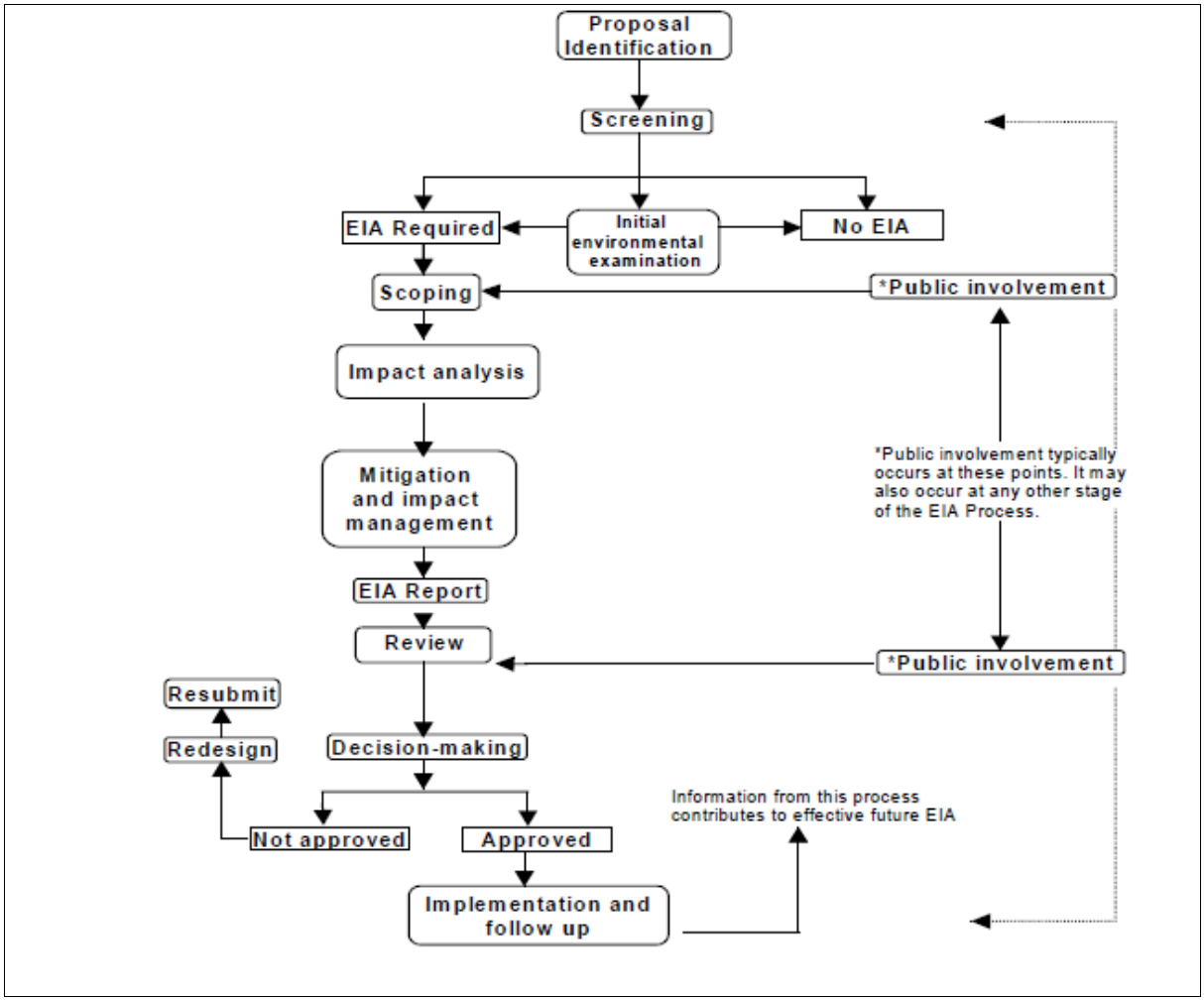


**Figure 2: Generalized EIA process flowchart. Adapted from UNEP 2002**

### 2.4.3 Impact analysis

Impact analysis is carried out in the detailed phase of the EIA; it involves identifying the impacts more specifically, predicting the characteristics of the main impacts and evaluating the significance of the residual impacts (UNEP, 2002).

### 2.4.4 Impact Mitigation

Mitigation is the stage of the EIA process when measures are identified to avoid, minimize or remedy impacts. These measures are implemented as part of the process of impact management, together with any necessary adjustments to respond to unforeseen impacts. Both elements are integral to ensuring that the EIA process leads to practical action to offset the adverse environmental impacts of proposed developments (UNEP, 2002). Mitigation recommends feasible and cost–effective measures to prevent or reduce significant negative impacts to acceptable levels.

### 2.4.5 Reporting

Reporting involves compiling all the information obtained into an EIA report which is a keystone document. It assembles the information that assists the proponent in managing the impacts of the proposal, the responsible authority in decision-making and condition setting; and the public in understanding the likely impacts of the proposal (UNEP, 2002).

### 2.4.6 Report review

The review stage of the EIA report is one of the main 'checks and balances' built into the EIA process to establish the quality of an EIA. It helps to ensure the information submitted is credible and sufficient for decision-making purposes (UNEP, 2002) by verifying the accuracy and comprehensiveness of the report (Glasson *et al.*, 2012). The decision-making element of the EIA process involves approving or rejecting the proposal and setting conditions. Decision making stage provides for incorporation of environmental considerations into proposed development (Glasson *et al.*, 2012). Once the proposed project is approved, implementation and follow up complete the EIA process (UNEP, 2002).

### 2.4.7 Monitoring and auditing

Monitoring, auditing and other tools are used to 'close the loop' of impact prediction and condition setting (Sadler, 1996). Monitoring and auditing is vital as it is used to identify the impacts that occur; to check that these are within the levels predicted and required by legislation; determine that mitigation measures are properly implemented and work effectively; ensure the environmental benefits expected are being achieved; and provide feedback to improve future applications of the EIA process (Arts, 1998).

# 3. APPROACH AND METHODOLOGY

## 3.1 Study team

The Environmental Impact Assessment Study was carried out by Sigtuna Consultancy Limited firm of experts. The composition of the experts was as follows:

- ✓ Philip Manyi Omenge, Team Leader, EIA/EA Lead Expert, Natural Resources Management/Ecology, Rural Development, Conflict Management and Gender Mainstreaming Specialist.
- ✓ James Morumbasi Mong'oni a registered EIA/EA Lead Expert, a Mechanical Engineer, a Safety Practitioner, Safety Trainer, and Inspector of pressure vessels and lifting equipment
- ✓ Hezekiah Adala, EIA/EA Lead Expert, Mechanical Engineer, Safety Advisor;
- ✓ Beatrice Minoo Nguti EIA/EA Associate Expert , Physical Geographer/ Socio-economic Expert
- ✓ Jonathana Katana Yeri, EIA/EA Associate Expert, Soil, Water and Environmental Engineer
- ✓ Polucon Services (Kenya Limited), sampling and laboratory analysis of quality of water sourced from local wells.

The study team was aided by the following local guides who had good knowledge of the project site and its neighbourhood.

- ✓ Anderson Chisiwa
- ✓ Garama Charo

Registration certificate and practicing license of the firm of experts is attached in appendix 4 while that of the individual experts is in appendix 5. The following approach and methodology was used by the team of experts in undertaking the Environmental Impact Assessment study for the proposed salt works

## 3.2 Approach

At the beginning of the assignment inception meetings were held between the Proponent and the Consulting Team Leader both in the office at the proposed project site. The meetings served as formal introduction for clarification of terms of reference for the study team, introduce them to the contact person and physically show the team the proposed project site.

## 3.3 Methodology

The following methodology was used in undertaking the Environmental Impact Assessment:

i) Scoping and development of Terms of Reference
ii) Desk review of relevant project documents including project design documents, relevant policy and legislative documents.
iii) Field visits for detailed documentation of site conditions and actual site assessment.
iv) Public participation
v) Reporting.

### 3.3.1Scoping

Scoping identified the important issues in readiness for preparation of terms of reference; it was a critical, early step in the preparation of an EIA study report. The scoping process identified the issues that are likely to be of most importance during the EIA and eliminated those that were of little concern.

### 3.3.2 Desk review

Desk top review included review of the following:

- **Policy documents**: National Environment Policy, 2013, Kenya National Youth Policy, Kenya Gender Policy, and KNBS Economic Survey Report 2017, National Climate Change Framework Policy Sessional Paper No. 5 of 2016 among others.
- **National legislations:** The Constitution of Kenya, 2010; the Mining Act of 2016; The Environmental Management and Coordination Act (EMCA),1999; The Environmental (Impact Assessment and Audit) Regulations, 2003; The Environmental Management and Coordination (Water Quality)Regulations, 2006; The Environmental Management and Coordination (Waste Management) Regulations, 2006; Environmental Management and Coordination (Air Quality) Regulations, 2014; The Public Health Act Cap 242; The Occupational Safety and Health Act 2007; The Physical Planning Act 1996, Cap. 286, The Water Act 2016; Climate Change Act, 2016 among others.

### 3.3.3 Field assessment

Field assessments included vegetation survey, terrestrial fauna survey, local hydrological survey and local soil observation and documentation. The vegetation survey employed the plot-less method to capture plant diversity in the various habitat types. The survey method involved random walks through the proposed project site and recording of the various vegetation species observed. Terrestrial survey targeted specific habitats within the proposed project site as was informed by local guides with prior knowledge of the targeted specific habitats. Herpetofauna (reptiles and amphibians) and invertebrates and other terrestrial fauna were observed and recorded. Local account was used to supplement information on existence

of species or taxa. Photographic recordings of some of the observed species were done. Hydrological survey targeted local water resource (ground and surface water bodies). This was aided by local guides with prior knowledge of the location of the local water resources. The names of the streams and wells were recorded and GPS coordinates of their physical location recorded, photographs of local water resources was also captured. Hydrological survey also involved taking water samples from selected wells for laboratory analysis to beach mark the water quality in the area. Local soils at the proposed project site were observed and documented by aid of the Explanatory Soil Map and Agro-Climatic Soil Map of Kenya.

### 3.3.4 Public participation

Public participation involved conducting three public meetings (barazas) in three different locations adjacent to the proposed project site as was suggested by the local leadership. Invitation letters were sent to local leaders informing them and inviting them to the meetings. The meetings were also publicized locally through the Chief- Mzee wa Mtaa- Nymba Kumi channel to ensure the information reached each housed within every Nyumba Kumi cluster. Local language Giriama was used in the meeting with a Kiswahili translation to ensure as many local people as possible actively participated in the meetings. To supplement the local meetings a detailed questionnaire survey was carried out, the questionnaire survey targeted various groups/ institutions including local leaders, civil society groups operating in the area, local learning institutions, local faith based institutions and local health institutions. Written submissions were also received from local community members as part of the public participation.

### 3.3.5 Reporting

All the information and data collected from scoping exercise, the desk top document review, field assessments and stakeholder consultation and participation was compiled into two reports namely:-

- ✓ Terms of Reference Report; and
- ✓ Environmental Impact assessment (EIA) Study Report.

Terms of Reference Report was submitted to NEMA as specified in Regulation 11 (1) and 11(2) of the Environmental (Impact Assessment and Audit) Regulations, 2003. The Environmental Impact assessment (EIA) Study Report was prepared as specified in Regulation 18 of the Environmental (Impact Assessment and Audit) Regulations, 2003 and

submitted to NEMA as specified in Regulation 19 of the Environmental (Impact Assessment and Audit) Regulations, 2003.

# 4. POLICY AND LEGAL FRAMEWORK

## 4.1 Relevant National Policies

### 4.1.1 National Environment Policy, 2013

The National Environment Policy document was prepared with the goal of bettering the quality of life for present and future generations through sustainable management and use of the environment and natural resources. The document underscores the importance and contribution of environment and natural resources to the local and national economy, people's livelihoods and the provision of environmental services such as watershed protection and carbon sequestration. It also reviews the status of environment in Kenya and highlights the key environmental issues and challenges. It identifies Kenya's critical ecosystems and natural resources and proposes measures to enhance conservation and management of ecosystems and sustainable use of natural resources. It addresses a wide range of issues relating to environmental quality and health. The areas covered include air quality, water and sanitation, waste management, radiation, toxic and hazardous substances, noise, HIV and AIDS and environmental diseases. It also outlines strategies and actions that will ensure effective implementation of the Policy and the Environmental Management and Coordination Act.

### 4.1.2 National Climate Change Framework Policy Sessional Paper No. 5 of 2016

This Policy was developed to facilitate a coordinated, coherent and effective response to the local, national and global challenges and opportunities presented by climate change. The policy adapts an overarching mainstreaming approach to ensure the integration of climate change considerations into development planning, budgeting and implementation in all sectors and at all levels of government. The Policy therefore aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting a low carbon development pathway. The response to climate change in Kenya must adhere to the constitutional governance framework and commitment to sustainable development, while addressing the goal of attaining low carbon climate resilient development. To attain the latter, the policy focuses on appropriate mechanisms to enhance climate resilience and adaptive capacity, and the transition to low carbon growth.

## 4.2 National legislations

### 4.2.1 The Constitution of Kenya, 2010

The Constitution of Kenya 2010 is the overarching legal framework for matters on environment. It recognizes the environment as part of the country's heritage, and which must be safeguarded for future generations. It provides for the right to a clean and healthy environment for every person in Article 42, obligating the state to enact legislation to protect that right as well as to establish systems of environmental impact assessment, environmental audit and monitoring of the environment in Article 69.

Article 69 imposes on the State, other obligations including, to:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Encourage public participation in the management, protection and conservation of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

Article 69 (2) similarly confers a conservation obligation on parties including the proponent of the proposed salt works. The proponent is thus obligated to cooperate with State organs and other persons to protect and conserve the environment.

### 4.2.2 The Environmental Management and Co-ordination Act, 1999

EMCA, 1999 provides a legal and institutional framework for the protection and conservation of the environment in line with Article 42 of the Constitution of Kenya, 2010. The ultimate objective is to provide a framework for integrating environmental considerations into the country's overall economic and social development. According to section 58 of the Act projects specified in the second schedule that are likely to have significant impact on the environment have to be subjected to an EIA study. Salt works are categorized as high risk projects in the second schedule of the act and hence must be subjected to environmental impact assessment study prior to implementation.

### 4.2.3 The Occupational Safety and Health Act, 2007

This Act came into force in 2007 and replacing The Factories and Other Places of Work Act, Cap 514. It makes provisions for the health, safety and welfare to be observed by employers

and persons employed in places of work. Part IV of the act covers health issues such as the state of cleanliness, refuse management, employee space requirement, ventilation and sanitary conveniences. Part V covers fire safety, operation and maintenance of machinery, fencing requirements, storage of dangerous substances, training and supervision of workers. Part VI deals with welfare issues; drinking water supply, washing facilities, sitting areas and first aid provision.

### 4.2.4 The Water Act 2016

This is an Act provides for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes. The Act aligns the water sector with the new Constitution's primary objective of devolution. The Act recognizes that water related functions are a shared responsibility between the national government and the County government. The Act provides that every person has the right to access water resources, whose administration is the function of the national government as stipulated in the Fourth Schedule to the Constitution. Section 63 thereof also provides that every person in Kenya has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution. The Water Resource Authority was established under this Act to protect, conserve, control and regulate use of water resources through the establishment of a national water resource strategy. The Water Act provides for the conservation and controlled use of water resources in Kenya. Under the Ministry of Water the Act prohibits pollution of water resources and controls the discharge of industrial and municipal effluents into the ocean and other water bodies. The act exempts license requirement for sea water abstraction for purposes of salt production.

### 4.2.5 Mining Act 2016

This is an act of Parliament to give effect to Articles 60, 62 (1)(f), 66 (2), 69 and 71 of the Constitution in so far as they apply to minerals; provide for prospecting, mining, processing, refining, treatment, transport and any dealings in minerals and for related purposes. The Mining Act, 2016 came into force on May, 2016 thereby repealing the previous Mining Act (Cap.306) which was enacted in 1940. Salt is categorised as a mineral under this Act.

In this Act, a holder of a mining license shall:-

- Conduct mining operations in compliance with the approved programme for mining operations;

- Comply with the terms and conditions of the approved environmental impact assessment license, social heritage assessment and environmental management plan relating to the operations to be carried out under the mining license;
- Demarcate and keep demarcated the mining area in the prescribed manner;
- Comply with the conditions of the license, any applicable mineral agreement and any directions issued by the Cabinet Secretary or an authorized officer in accordance with this Act;
- Submit to the Cabinet Secretary up to date quarterly returns of mine development and mineral production;
- Stack or dump any mineral or waste products in the manner provided for in the license or as otherwise prescribed, having regard to good mining industry practice;
- Carry out prospecting and mining activities in accordance with international best practice and the prescribed guidelines; and
- Sign a community development agreement with the community where mining operations are to be carried out in such a manner as shall be prescribed in Regulations.

The holder of a mining license under this Act shall keep at the registered office, a complete and accurate record of the mining operations in the prescribed form. Records shall include:-

- Copies of all maps, geological reports, sample analysis, aerial photographs, cores, logs and tests and other data obtained and compiled by the license holder;
- Financial statements and such other books of account as the Cabinet Secretary may prescribe; and
- Such other reports and information as may be prescribed or otherwise determined by the Cabinet Secretary.

The holder of a mining license under this Act shall give the Cabinet Secretary a notice of any intention to cease or suspend mining operations, or curtail production carried on pursuant to the mining license. The holder shall give notice of at least -

- Six months, for cessation of mining operation;
- Three months, for suspension of mining operation; or
- One month, for curtailment in production.

A notice given under section shall include a statement that sets out the technical and economic basis for the proposed cessation, suspension or curtailment of production. Under the Act, the Cabinet Secretary shall not grant a prospecting license, a retention license or a

mining license to an applicant; unless the applicant has submitted a site mitigation and rehabilitation or mine-closure plans for approval. Salt is categories as a mineral under the category of construction and industrial minerals in the first schedule of the act. The proposed salt works will comply fully with the provisions and requirements of the Mining Act, 2016.

### 4.2.6 The Lands Act 2012

The Land Act 2012 is "an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes". Part I of the act is preliminary provisions, part II of the act deals with management of public land, part III of the act deals with administration of public land (Leases, Licenses and Agreements), part IV of the act deals with community land, part V of the act deals with administration and management of private land, part VI of the act deals with general provisions of leases, part VII of the act deals with general provisions of charges, part VIII of the act deals with compulsory acquisition of interests in land, part IX of the act deals with settlement programmes, part X of the act deals with easements and analogous rights, part XI of the act deals with miscellaneous, the schedule lists repealed laws i.e. The Wayleaves Act, Cap. 292 and The Land Acquisition Act, Cap. 295. The proposed salt works will fully comply with the provisions and requirements of the Lands Act 2012.

### 4.2.7 The Public Health Act Cap 242

Key relevant provisions of this Act are:

- Section 10, 11, 12, and 13 for regulating the maintenance, repair and inspection of drains, latrines, cesspool or septic tanks
- Section 28, 29, and 30 which give requirements for the construction of drains in connection with buildings and
- Section 115 prohibiting nuisances that may cause injury or health hazards.

The proposed salt works will comply with the provisions of the Public Health Act.

### 4.2.8 Work Injuries Benefits Act 2007

Section 7 of the Act stipulates that every employer shall obtain and maintain an insurance policy with an insurance company approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees. An employee who is involved in an accident resulting in the employees' disability or death is subject to the provisions of this Act, and entitled to benefits provided for under the Act. Section 3 of the Act however states

that no employee shall be entitled to compensation if an accident, not resulting to serious disability or death, is caused by the deliberate and wilful misconduct of the employee. The proposed salt works will comply with the provisions and requirements of this Act.

## 4.3 Regulatory Framework

### 4.3.1 The Environment (Impact Assessment and Audit) Regulations, 2003

These regulations provide guidelines for conducting an EIA study as well as environmental auditing and monitoring. The Regulations state in Regulation 3 that "the Regulations should apply to all policies, plans, programmes, projects and activities specified in Part III and V of the Regulations" basically lists the guidelines of undertaking, submission and approval of the EIA/SEA Report.The Regulations requires proponents to conduct annual environmental audits to identify the environmental impacts of their undertakings and propose mitigation measures to improve their environmental performance. Section 17 of the same regulation stipulates that during the process of conducting the audit the proponent shall seek the views of persons who may be affected by their operations. The proponent of the proposed project would be required to comply with the provisions of this legislation.

### 4.3.2 Building Operations and Works of Engineering Construction Rules, 1984

The provisions of the Factories Act relevant to building operations and engineering construction works are contained in the Abstract of the Act for Building Operations and Works of Engineering Construction Rules. These rules specify the minimum safety and health measures to be taken during construction works which include that the proponent should:

- Give notice of particular operations or works;
- Such notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction;
- Post printed copies or prescribed abstracts of the Occupational Safety and Health Act at the site of operations or works (Section 61 of the Act);
- Provide sufficient and suitable sanitary conveniences for persons employed. These must be kept clean and well lit.

The contractor appointed by the proponent would be expected to adhere to these provisions.

### 4.3.3 Noise and Excessive Vibration (Pollution Control) Regulations, 2009

The regulations apply to persons wishing to operate or repair any equipment or machinery, engage in any commercial or industrial activity that is likely to emit noise or excessive

vibrations. The regulations specify the limits or levels within which these shall be undertaken. The Regulations also stipulate in the second schedule that construction activities undertaken during the night should not emit excessive noise beyond the permissible levels.

### 4.3.4 Environmental Management and Coordination (Water Quality) Regulations, 2006

These regulations provide protection to ground water or surface water from pollution by providing the limits and parameters of pollutants in treated waste water which can be discharged into the environment.

Relevant provisions of this regulation applicable to the proposed project include:-

- Every person shall refrain from any act which will directly or indirectly cause pollution and it shall be immaterial whether or not the water source was polluted before the enactment of these regulations;
- No person shall throw or cause to flow into or near a water source any liquid, solid or gaseous substance or deposit any such substance as to cause pollution;
- Discharge of effluent from sewer must be licensed according to the act;
- Water abstraction must only be done after approval of an Environmental Impact Assessment study.

### 4.3.5 Environmental Management and Coordination (Waste Management) Regulations, 2006

Part II of these regulations lists the responsibility of the waste generator and prescribes the proper mechanism of handling all waste through segregation and finally proposes environmental management programme through implementation of cleaner production mechanisms.

Relevant provisions of this regulation include:-

- Prohibition of any waste disposal on a public highway, street, road, recreational area or in any public place except in designated waste receptacle
- All waste generated to be collected, segregated and disposed in a manner provided for under these regulations
- All waste generators to minimize waste generated by adopting cleaner production methods
- All waste transporters to be licensed according to the Act

- Collection and transportation of the waste to be done in such a manner not to cause scattering of the waste
- The vehicle and equipment for waste transportation to be in such a manner not to cause scattering or escape of the waste

At the construction stage large volumes of construction debris would be generated. The proponent should ensure that the waste is managed in line with the provisions of these regulations.

### 4.3.6 Environmental Management and Coordination (Air Quality) Regulations, 2014

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (priority air pollutants) to exceed the ambient air quality levels as stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits). The proponent will be guided by provisions of this act, during operation phase. Air quality monitoring will be guided by the standards stipulated thereof.

# 5. BASELINE INFORMATION

## 5.1 Soils

### 5.1.1 Introduction

The proposed project area borders the mangrove swamps (the mangrove areas/swamps are out of the proposed project site). According to the Explanatory Soil Map and Agro-climatic zone Map of Kenya, the mangrove swamps/areas are predominantly composed of thionic fluvisols (a sub-category of the Fluvisols soil type) and gleyic solonchaks (a sub-category of the Solonchaks soil type). The proposed project site is dominated by solodic planosols (a sub-category of the Planosols soil type). An elaboration of these two types of soils is as follows.

#### 5.1.1.1 Thionic Fluvisols and Gleyic Solonchaks

Thionic Fluvisols belong to the Reference Soil Group-the Fluvisols. A Fluvisol in the FAO World Reference Base for Soil Resources is a genetically young soil in alluvial deposits. Other names for thionic Fluvisols are acid sulfate soils (ASS). Acid sulphate soils are of two categories

- Potential acid sulfate soils (PASS)
- Actual or active acid sulfate soils (AASS), sometimes named cat clays

The difference between the parent material of thionic Fluvisols and that of other Fluvisols is the presence of pyrite ($FeS_2$) in thionic Fluvisols. Thionic Fluvisols are commonly situated in coastal lowlands and are influenced by the following conditions:

- ✓ Sea water: contains sulfur (sulfate)
- ✓ Sediments: contain Fe-oxides
- ✓ Organic material: comes from mangroves
- ✓ Anaerobic conditions and sulfate reducing bacteria

Gleyic solonchaks are Solonchaks showing hydromorphic properties within 50 cm of the surface. Solonchak is a pale or grey soil type found in arid to sub-humid, poorly drained conditions. A Gley is a wetland soil (hydric soil) that, unless drained, is saturated with groundwater for long enough periods to develop a characteristic gleyic colour pattern. This pattern is essentially made up of reddish, brownish or yellowish colours at surfaces of soil particles (peds) and/or in the upper soil horizons mixed with greyish/blueish colours inside the peds and/or deeper in the soil.

### 5.1.1.2 General properties of Thionic Fluvisols and Gleyic Solonchaks

- ✓ Very poorly drained
- ✓ Very deep,
- ✓ Olive to greenish grey in colour
- ✓ Soft (unripe) soils
- ✓ Excessive saline,
- ✓ Moderately to strongly sodic,
- ✓ Loam to clay;
- ✓ In many places with sulfudic material

### 5.1.2 Solodic Planosols

A Planosol is a soil with a light-coloured, coarse-textured, surface horizon that shows signs of periodic water stagnation and abruptly overlies dense, slowly permeable subsoil with significantly more clay than the surface horizon.

They are characterized by a subsurface layer of clay accumulation. They occur typically in wet low-lying areas that can support either grass or open forest vegetation. They are poor in plant nutrients, however, and their clay content leads to both seasonal water-logging and drought stress.

Solodic planosols are Planosols having high sodium content, usually more than 6 percent sodium in the exchange complex of the slowly permeable horizon

### 5.1.2.1 General characteristics of solodic planosols

- ✓ Imperfectly drained,
- ✓ Deep,
- ✓ Greyish brown,
- ✓ Mottled,
- ✓ Firm,
- ✓ Slightly calcareous,
- ✓ Non-to slightly saline,
- ✓ Slightly sodic sandy clay loam,
- ✓ Abruptly underlying a thick top soil of friable loamy sand

## 5.2 Freshwater and seawater interaction

### 5.2.1 Freshwater-saline water interface

Along coastal areas seawater and fresh groundwater comes into contact. These two liquids have different densities and they cannot be mixed. Instead an interface is formed between the two liquids, which has a shape, established by the hydrodynamic balance along the contact plan. This interface has an inclination towards land and its toe intersects the bottom of the aquifer (Fetter, 1972, Kallergis, 1986, Todd, 1974) (see figure 3 below). Due to overdraft of fresh water wells, the seawater-fresh groundwater interface is moving towards land, developing thus an intrusion of seawater into fresh groundwater (Fetter, 1972, Kallergis, 1986). This intrusion is presented both as an advance of the whole interface towards land and an uplifting of the interface in the areas of overdraft, interface thickness being increased. Fresh water aquifers are consequently contaminated with ions of chlorine, sodium and Potassium; hence water becomes inadequate for drinking and sometimes for irrigating purposes.

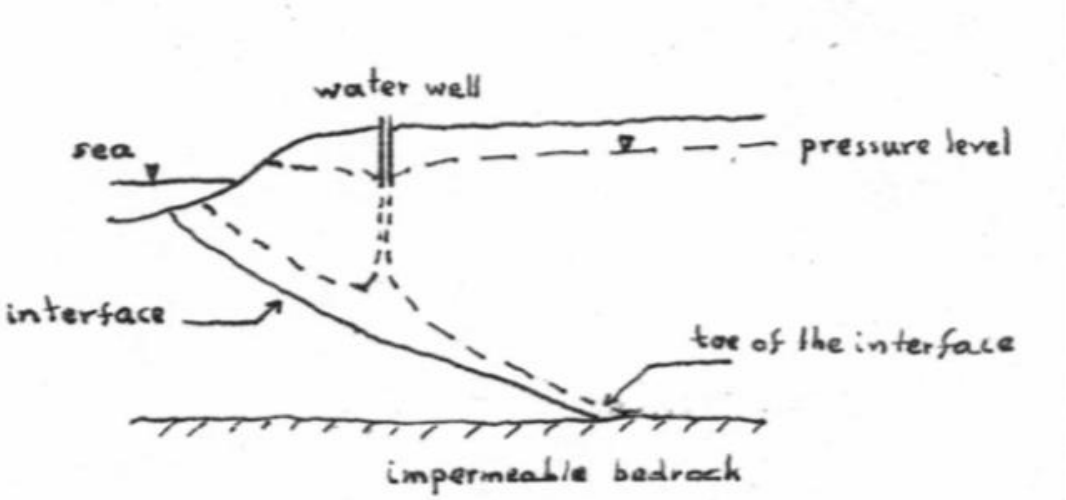


**Figure 3: The groundwater – seawater interface and the seawater intrusion (Kallergis, 1986 - with modifications)**

### 5.2.2 Groundwater contamination

The soils at the proposed project area are mainly solodic planosols. These soils are described in the Explanatory Soil Map of Kenya as being poorly drained, having low infiltration rate and low permeability. This therefore means that they are capable of upholding any leakages and preventing such leakages from infiltrating through the soil into the local ground water table.

## 5.3 Drainage and hydrology

Kenya's surface water resources are divided into five major drainage basins, namely; The Lake Victoria Basin, Rift Valley Basin, Athi River Basin, Tana River Basin and the Ewaso Ngiro River Basin. The proposed project site falls within the Athi River Basin. The Athi-River Basin measures approximately 67, 000 $km^2$. The basin comprises the southern part of Kenya, east of the Rift Valley and drains the southern slopes of the Aberdare Ranges and the flanks of the Rift Valley, as well as the North Eastern slopes of Mount Kilimanjaro before draining into the Indian Ocean through the Athi River. The major river flowing through Kilifi County is the Sabaki (Galana) River which drains into the Indian Ocean. The drainage pattern for the County is, in addition, formed by seasonal rivers, which drain into the Indian Ocean through the various creeks. The main rivers and streams are Nzovuni, Mleji, Kombeni, Rare, Goshi, Mtomkuu and Wimbi (GOK, 2005). The rivers and streams in the area form a dendritic drainage pattern with several seasonal and permanent rivers joining up to the main rivers. Since the area slopes towards the Indian Ocean, most of the rivers in the area flow towards that direction. The area has a low drainage density. The implication of this is that there is high ground water potential in some of the areas. Most of the rivers in the County are temporary due to low rainfall, low runoff rates, high evapo-transpiration rates and their location in areas of sandy soils which have high infiltration rates.

### 5.3.1 Ephemeral streams at the proposed projects site

The general flow of rivers/streams in the area is West-East direction, which ultimately drain into the Indian Ocean. Most of the rivers in the area are intermittent, flowing only during flood time, mostly during the months of April to July. Sections of the proposed project site have ephemeral streams flowing through them. During the environmental assessment for the purposes of this environmental impact assessment study report, a survey of the area was conducted to establish the streams that flow through the proposed project site. The following streams were recorded.

#### 5.3.1.1 Mbwageni Stream

On the upstream, this ephemeral stream flows from the Kamale, Mto wa Mbono area. As it flows downstream to the ocean, it crosses the Malindi-Lamu road at $02^0$ 47' 730"S and $040^0$ 08' 831"E where there is a culvert. Further downstream, the stream cuts into the project site at $02^0$ 47' 497"S and $040^0$ 08' 136"E.

**Plate 4: A section of the Mbwageni stream note water was downstream past the culvert at the road**

### 5.3.1.2 Kwa Kubanda stream

This stream also flows from the Kamale and Mto wa Mbono areas on the upstream. As it flows downstream, it meets the Malindi-Lamu highway at $02^0$ 48' 289"S and $040^0$ 08' 868"E where there is a culvert to allow the water on the stream to flow beneath the busy road. As the stream flows further downstream, it cuts through the proposed project site at $02^0$ 47' 882"S and $040^0$ 09' 165"E.

**Plate 5: A section of Kwa Kubanda stream note that water was available downstream after the culvert**

### 5.3.1.3 Kwa Nzai stream

Kwa Nzai stream flowing from Kamale and Mto wa Mbono areas on the upstream meets the Malindi-Lamu road at three sections i.e. $02^0$ 45' 787"S and $040^0$ 08' 724"E; $02^0$ 45' 807"S and $040^0$ 08' 728"E and $02^0$ 45' 822"S and $040^0$ 08' 730"E. Further downstream, the Kwa Nzai stream intersects the proposed project site the Pump Station 3 ($PS_3$) dyke at $02^0$ 46' 701"S and $040^0$ 09' 570"E.

**Plate 6: A section of the Kwa Nzai stream note most of it was dry except pockets of stagnant water downstream**

### 5.3.1.4 Magadi stream

The Magadi ephemeral stream, just like the other three streams discussed above, flows from Adu, Kamale and Mto wa Mbono areas on the upstream. As the stream flows downstream, it meets the Malindi-Lamu highway at a point GPS coordinates $02^0$ 47' 007"S and $040^0$ 08' 800"E. The stream empties its waters in the Indian Ocean. As it flows further downstream to empty its waters, it meets the proposed project site at a point GPS coordinates $02^0$ 47' 059"S and $040^0$ 09' 191"E.

**Plate 7: A section of Magadi stream most of it was dry with small pockets of stagnant water downstream**

### 5.3.2 Local ground water resource

Supplies of ground water in the area are obtained within the unconfined aquifer within the stretch of sand dunes along the coast line. Sections of the proposed project site serve as an important source of ground water for the local community. Potable water is a scarce resource in the area. Waters from the main pipeline by the Malindi Water and Sewerage Company (MAWASCO) and from other sources such as streams are inadequate and are supplemented by groundwater. Some of the groundwater aquifers in this area yield either saline or brackish water, but some are freshwater aquifers which the community relies on especially during dry

seasons. The water is used for drinking and other domestic uses. During the dry seasons, these wells serve as an important source of income for water vendors who sell water to area such as the Msumarini and Marereni trading centres. A survey of the area was conducted during this environmental impact assessment study process to document the wells and shallows wells used by the community. Table 2 below gives a list of the wells and shallow wells identified.

**Table 2: Wells surveyed**

| NAME OF WELL | Location (GPS Coordinates) |
|---|---|
| **KAKOMANI WELLS** | |
| Kakomani Well 1 | $02^0$ 47’ 854”S; $040^0$ 09’ 488”E |
| Kakomani Well 2 | $02^0$ 47’ 887”S; $040^0$ 09’ 458”E |
| Kakomani Well 3 | $02^0$ 47’ 882”S; $040^0$ 09’ 443”E |
| Kakomani Well 4 | $02^0$ 47’ 954”S; $040^0$ 09’ 445”E |
| Kakomani Well 5 | $02^0$ 47’ 961”S; $040^0$ 09’ 440”E |
| Kakomani Shallow Wells | $02^0$ 47’ 869”S; $040^0$ 09’ 516”E |
| **KWA MIKADZO WELLS** | |
| Kwa Mikadzo Well 1 | $02^0$ 46’ 366”S; $040^0$ 09’ 401”E |
| Kwa Mikadzo Well 2 | $02^0$ 46’ 346”S; $040^0$ 09’ 389”E |
| | |
| Kwa Christopher Kazungu Well | $02^0$ 46’ 188”S; $040^0$ 09’ 391”E |
| Kwa Mwamunda Well | $02^0$ 46’ 254”S; $040^0$ 09’ 483”E |
| Kwa Charo Piko Well | $02^0$ 46’ 288”S; $040^0$ 09’ 482”E |
| Kang’amboni Shallow Wells | $02^0$ 46’ 492”S; $040^0$ 09’342”E |
| Kwa Kenga-Tana Well | $02^0$ 46’ 089”S; $040^0$ 09’ 486”E |
| Kwa Shadrack Well | $02^0$ 46’ 040”S; $040^0$ 09’ 548”E |
| **KWA BIKACHE WELLS** | |
| Kwa Bikache Well 1 | $02^0$ 45’ 971”S; $040^0$ 09’ 280”E |
| Kwa Bikache Well 2 | $02^0$ 45’ 965”S; $040^0$ 09’ 279”E |
| | |
| Kwa Nzingo Mulangulo Well | $02^0$ 46’ 144”S; $040^0$ 09’ 183”E |
| KWA BICHARO WELLS | |
| Kwa Bicharo Well 1 | $02^0$ 46’ 196”S; $040^0$ 09’ 220”E |

| NAME OF WELL | Location (GPS Coordinates) |
|---|---|
| Kwa Bicharo Well 2 | $02^0$ 46’ 206”S; $040^0$ 09’ 234”E |
| Kwa Bicharo Well 3 | $02^0$ 46’ 211”S; $040^0$ 09’ 237”E |
| | |
| Kwa Mathias Charo Well | $02^0$ 46’ 255”S; $040^0$ 09’ 210”E |
| Kwa Mulwa Well | $02^0$ 46’ 265”S; $040^0$ 09’ 297”E |
| COBEC Well | $02^0$ 46’ 303”S; $040^0$ 09’ 286”E |
| Mwananyamala Shallow Wells | $02^0$ 47’ 345”S; $040^0$ 09’ 891”E |
| **KITHUNGU WELLS** | |
| Kithungu Well | $02^0$ 47’ 495”S; $040^0$ 10’ 220”E |
| Kithungu Shallow Well 1 | $02^0$ 47’ 476”S; $040^0$ 10’ 244”E |
| Kithungu Shallow Well 2 | $02^0$ 47’ 365”S; $040^0$ 10’ 195”E |
| **MUYU WA KAE WELLS** | |
| Kwa Chai Well 1 | $02^0$ 48’ 877”S; $040^0$ 10’ 480”E |
| Kwa Chai Well 2 | $02^0$ 48’ 881”S; $040^0$ 10’ 434”E |
| Kwa Chai Well 3 | $02^0$ 48’ 900”S; $040^0$ 10’ 396”E |
| Kwa Chai Well 4 | $02^0$ 48’ 917”S; $040^0$ 10’ 398”E |
| Kwa Kashuru Well 1 | $02^0$ 48’ 806”S; $040^0$ 10’ 420”E |
| Kwa Kashuru Well 2 | $02^0$ 48’ 823”S; $040^0$ 10’ 429”E |
| Kwa Kashuru Well 3 | $02^0$ 48’ 782”S; $040^0$ 10’ 410”E |
| Kwa Kashuru Well 4 | $02^0$ 48’ 783”S; $040^0$ 10’ 413”E |
| Kwa Bahathi wa Kaviha Well 1 | $02^0$ 49’ 105”S; $040^0$ 10’ 347”E |
| Kwa Bahathi wa Kaviha Well 2 | $02^0$ 49’ 105”S; $040^0$ 10’ 347”E |
| Kwa Peni Well | $02^0$ 48’ 882”S; $040^0$ 10’ 327”E |
| Kwa Kahaso wa Radhi Well | $02^0$ 48’ 783”S; $040^0$ 10’ 413”E |
| Kwa Katana wa Radhi Well | $02^0$ 48’ 651”S; $040^0$ 10’ 382”E |
| Kwa Garama wa Kayaa Well 1 | $02^0$ 48’ 621”S; $040^0$ 10’ 315”E |
| Kwa Garama wa Kayaa Well 2 | $02^0$ 48’ 653”S; $040^0$ 10’ 288”E |
| **KWA KALOKI WELLS** | |
| Kwa Kaloki Well 1 | $02^0$ 48’ 445”S; $040^0$ 10’ 175”E |
| Kwa Kaloki Well 2 | $02^0$ 48’ 418”S; $040^0$ 10’ 203”E |
| Kwa Kaloki Well 3 | $02^0$ 48’ 419”S; $040^0$ 10’ 220”E |

| NAME OF WELL | Location (GPS Coordinates) |
|---|---|
| Kwa Kaloki Well 4 | $02^0$ 48' 443"S; $040^0$ 10' 188"E |
| | |
| Kwa Jangili Well | $02^0$ 48' 456"S; $040^0$ 10' 265"E |
| **KWA PILI WELLS** | |
| Kwa Pili Well 1 | $02^0$ 48' 081"S; $040^0$ 10' 023"E |
| Kwa Pili Well 2 | $02^0$ 48' 123"S; $040^0$ 10' 012"E |

### 5.4 Groundwater quality

The quality of some selected local wells was benchmarked for purposes of future reference. The benchmarking involved sampling and analyzing the quality of water in selected wells within the local community. The sampling and analysis was carried out by Polucon Services (Kenya) Limited, an accredited laboratory. Three wells were randomly selected, water samples drawn and analyzed for physical, chemical and microbiological properties. The water samples analyses were drawn from the following wells tabulated in table 3 below. Appendix 6 is the detailed water quality laboratory analysis report for each of the water sample.

**Table 3: Wells from which water samples were drawn for analysis**

| NAME OF WELL | Location (GPS Coordinates) |
|---|---|
| Kakomani Shallow Wells | $02^0$ 47' 869"S; $040^0$ 09' 516"E |
| Kwa Bikache Well 1 | $02^0$ 45' 971"S; $040^0$ 09' 280"E |
| Kwa Kaloki Well 4 | $02^0$ 48' 443"S; $040^0$ 10' 188"E |

#### 5.4.1 Water sampling and analysis for Kakomani Shallow Wells

Water samples were drawn from the Kakomani Well by Polucon Services (Kenya) Limited and accredited laboratory. Well and analysed. Physical properties analysed included appearance, odour, suspended matter, colour hazen units (TCU) pH @ $25^0$C and conductivity (µS/cm). Chemical tests done included total dissolved solids (mg/L), total hardness as $CaCO_3$ (mg/L), chlorides as CL (mg/L), aluminium as Al (mg/L), manganese as Mn (mg/L), iron as Fe (mg/L) sodium as Na (mg/L), magnesium a Mg (mg/L) calcium as Ca (mg/L), Lead as Pb (mg/L), copper as Cu (mg/L) fluoride as F (mg/L), potassium as K (mg/L) sulphates as $SO_4$ (mg/L), total alkalinity as $CaCO_3$ (mg/L), and residual chloride as $CL_2$ (mg/L). Microbiological tests conducted included total plate count @ $37^0$C (cfu/ml), total plate count

@ $22^0$C (cfu/ml), total coliform count (cfu/100ml), *Escherichia coli* (cfu/100ml), and *Pseudomonas aeruginosa* (cfu/100ml). The results of the water sampled collected and analysed from the Kakomani shallow wells show that the water does not conform to the required specifications for natural potable water due to presence of high suspended matter, high total plate count, presence of total coliforms and *E.coli*.

**Plate 8: Sampling and Kakomani Shallow Wells**

### 5.4.2 Water sampling and analysis for Kwa Kaloki Wells

Water samples were drawn from the Kwa Kaloki Well by Polucon Services (Kenya) Limited and accredited laboratory. The samples were then analysed. Physical properties analysed included appearance, odour, suspended matter, colour hazen units (TCU) pH @ $25^0$C and conductivity (µS/cm). Chemical tests done included total dissolved solids (mg/L), total hardness as $CaCO_3$ (mg/L), chlorides as CL (mg/L), aluminium as Al (mg/L), manganese as Mn (mg/L), iron as Fe (mg/L) sodium as Na (mg/L), magnesium a Mg (mg/L) calcium as Ca (mg/L), Lead as Pb (mg/L), copper as Cu (mg/L) fluoride as F (mg/L), potassium as K (mg/L) sulphates as $SO_4$ (mg/L), total alkalinity as $CaCO_3$ (mg/L), and residual chloride as $CL_2$ (mg/L). Microbiological tests conducted included total plate count @ $37^0$C (cfu/ml), total plate count @ $22^0$C (cfu/ml), total coliform count (cfu/100ml), *Escherichia coli* (cfu/100ml), and *Pseudomonas aeruginosa* (cfu/100ml). On the basis of the tests done on the water sample collected from the Kwa Kaloki Well, the water does not conform to the required specification for natural potable water due to presence of suspended matter, high chloride ions, sodium ions, total plate count, presence of total coliforms and *E.coli*.


**Plate 9: Sampling at the Kwa Kaloki Well**

### 5.4.3 Water sampling and analysis for Kwa Bikache Wells

Water samples were collected from the Kwa Bikache Well and analysed. Physical properties analysed included appearance, odour, suspended matter, colour hazen units (TCU) pH @ $25^0$C and conductivity (µS/cm). Chemical tests done included total dissolved solids (mg/L), total hardness as $CaCO_3$ (mg/L), chlorides as CL (mg/L), aluminium as Al (mg/L), manganese as Mn (mg/L), iron as Fe (mg/L) sodium as Na (mg/L), magnesium a Mg (mg/L) calcium as Ca (mg/L), Lead as Pb (mg/L), copper as Cu (mg/L) fluoride as F (mg/L), potassium as K (mg/L) sulphates as $SO_4$ (mg/L), total alkalinity as $CaCO_3$ (mg/L), and residual chloride as $CL_2$ (mg/L). Microbiological tests conducted included total plate count @ $37^0$C (cfu/ml), total plate count @ $22^0$C (cfu/ml), total coliform count (cfu/100ml), *Escherichia coli* (cfu/100ml), and *Pseudomonas aeruginosa* (cfu/100ml). On the basis of the above tests only, the water does not conform to the required specification for natural potable water due to presence of suspended matter, high chloride ions, sodium ions, total plate count, presence of total coliforms and *E.coli*.

**Plate 10: Sampling at the Kwa Bikache Well**

## 5.5 Climatic conditions

On average, the temperatures are always high in Msumarini area of Kilifi County. Most of the rainfall (rainy season) in Msumarini is seen in April, May, October and November. On average, the warmest month is March and the coolest month is September. May is the wettest month while February is the driest month.

### 5.5.1 Temperature

On average, the temperatures in Msumarini are always high. The warmest month is March and the coolest month is July. The average annual maximum temperature is: 87.8° Fahrenheit (31.0° Celsius) and the average annual minimum temperature is 69.8° Fahrenheit (21.0° Celsius).

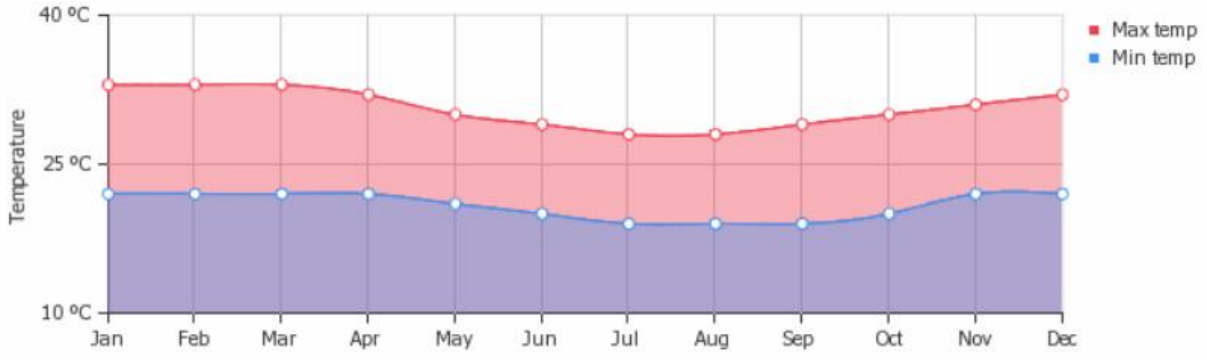


**Figure 4: Average minimum and maximum temperatures of Msumarini over the year**
Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (117.9 KM).

### 5.5.2 Sunshine

On average, January, March and October are the sunniest months while May has the lowest amount of sunshine. Figure 2 below is the monthly total of sun hours over the year in Msumarini.

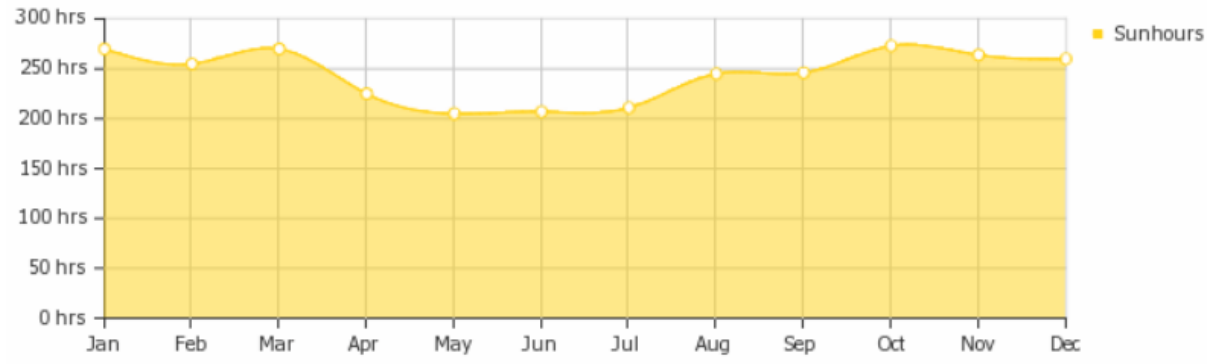


**Figure 5: Monthly total of sunshine hours over the year in Msumarini**
Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (117.9 KM).

### 5.5.3 Water Temperature

On average, March has the hottest water temperature while September has the coldest water temperature. Figure 3 below is the mean water temperature in Msumarini over the year.

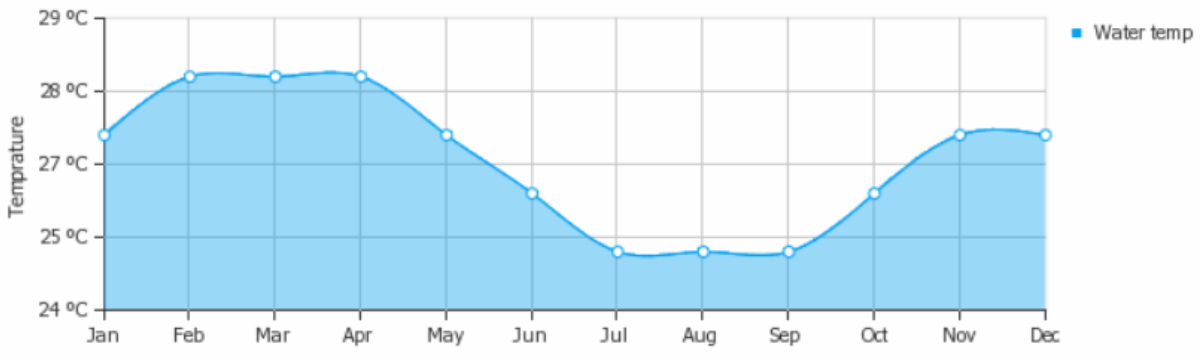


**Figure 6: Average mean water temperature in Msumarini over the year**

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

### 5.5.4 Precipitation

A lot of rain (rainy season) in Msumarini, falls in the months of April, May, October and November. On average, May is the wettest month while February is the driest month. The average amount of annual precipitation is: 39.37 in (999.9 mm) as shown in figure 4 below.

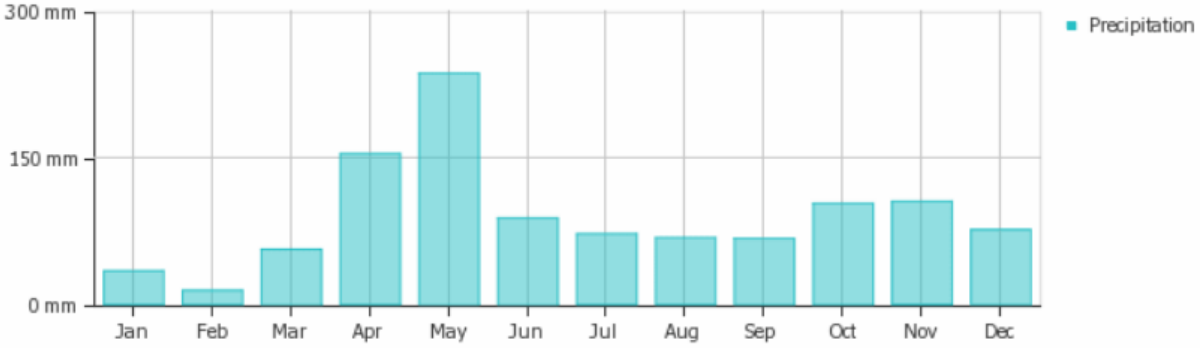


**Figure 7: Average precipitation in Msumarini over the Year**

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (117.9 KM).

### 5.5.5 Monthly Rainy Days

Most rainy days are in the months of April, May, October and November with May having the highest number of rainy days. February has the least number of rainy days. Figure 5 below shows the average monthly rainy days in Msumarini over the year.

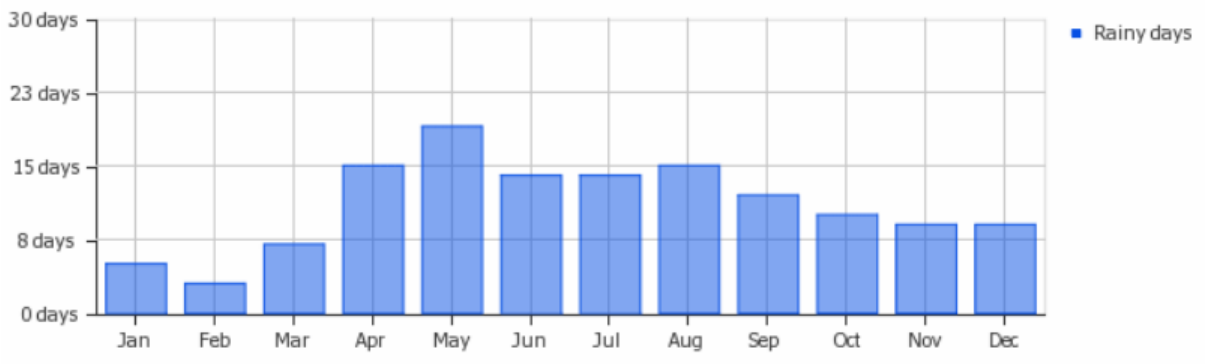


**Figure 8: Average Monthly Rainy Days in Msumarini over the year**
Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (117.9 KM).

### 5.5.6 Humidity

On average, May is the most humid month in Msumarini while February is the least humid. Figure 6 is the mean monthly relative humidity over the year in Msumarini.

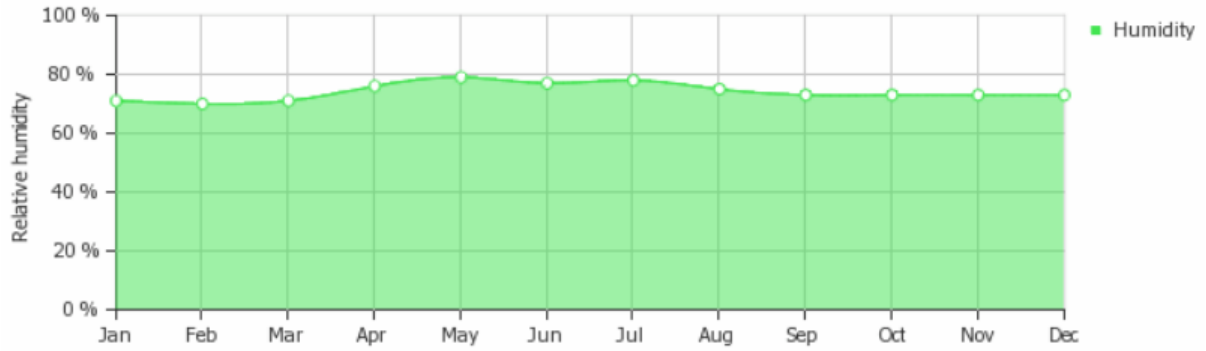


**Figure 9: Mean monthly relative humidity over the year in Msumarini**
Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (117.9 KM).

### 5.5.7 Wind Speed

On average, the windiest months in Msumarini are May and June while the least wind is seen in November. Figure 7 below is the mean monthly wind speed (meters per second).

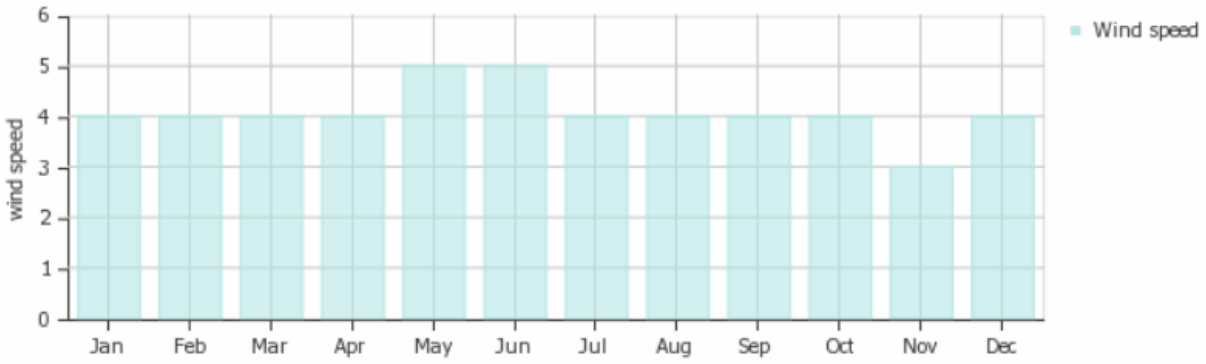


**Figure 10: Mean monthly wind speed over the year in Msumarini in meters per second**
Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (117.9 KM).

## 5.6 Biodiversity

The proposed project site is rich in biodiversity. Flora at the proposed project site includes trees, shrubs, herbs, grasses and sedge. Fauna at the proposed project site include herpetofauna mainly reptiles and amphibians, invertebrate and avifauna.

### 5.6.1 Flora diversity

Flora diversity at the proposed project site includes trees, shrubs, herbs, grasses and sedge. Trees at the proposed project site include Adansonia digitata, Tamarindus indica, Manilkara sansibarensis, Suregada zanzibariensis, Manilkara mochisia, Grewia bicolour, Dobera glabra, Ziziphus mauritiana, Flacourtia indica, Berchemia discolour among others. Table 4 is a list of tree observed at the proposed project site**.**

**Plate 11: Some of the trees at the proposed project site *Prosopis juliflora* & *Acacia nilotica respectively***

**Table 4: Species of trees observed**

| **Family** | **Genus** | **Species** |
|---|---|---|
| *Leguminosae* | *Acacia* | *nilotica* |
| | *Tamarindus* | *indica* |
| ***Burseraceae*** | ***Commiphora*** | ***edulis*** |
| | *Adansonia* | *digitata* |
| | *Manilkara* | *sansibarensis* |
| | *Berchemia* | *discolour* |
| | *Grewia* | *bicolour* |
| | *Flacourtia* | *indica* |
| *Combretaceae* | *Terminalia* | *brevipes* |
| | *Ziziphus* | *mauritiana* |
| *Bombacaceae* | *Adansonia* | *digitata* |
| *Leguminosae* | *Prosopis* | *juliflora* |

Shrubby vegetation observed at the proposed project included *Cassia occidentalis, Ricinus communis, Salvadora persica, Strychnos spinosa, Flueggea virosa, Thilachium africanum, Lannea alata*. Table 5 is a list of species of shrubs observed. Vegetation whose life form was sedge was rear few sedge species were observed *notably Cyperus denudatus and Cyperus compressus.*

**Plate 12: Shrubby vegetation at the proposed project site**

**Table 5: Species of shrubs**

| **Family** | **Genus** | **Species** |
|---|---|---|
| *Leguminosae* | *Cassia* | *occidentalis* |
| *Leguminosae* | *Aeschynomene* | *indica* |
| *Dracaenaceae* | *Sansevieria* | *suffruticosa* |
| *Leguminosae* | *Tephrosia* | *villosa* |
| *Asclepiadaceae* | *Calotropis* | *procera* |
| *Lythraceae* | *Lawsonia* | *inermis* |
| *Sterculiaceae* | *Melhania* | *ovata* |
| *Solanaceae* | *Solanum* | *incanum* |
| | ***Thilachium africanum*** | ***Thilachium africanum*** |

| Family | Genus | Species |
|---|---|---|
| *Tiliaceae* | *Triumfetta* | *rhomboidea* |
| *Sterculiaceae* | *Waltheria* | *indica* |
| | ***Strychnos spinosa*** | ***Strychnos spinosa*** |
| ***Tiliaceae*** | ***Grewia*** | ***plagiophylla*** |
| *Tiliaceae* | *Grewia* | *plagiophylla* |
| *Tiliaceae* | *Grewia* | *forbesii* |
| | ***Flueggea virosa*** | ***Flueggea virosa*** |
| *Agavaceae* | *Agave* | *sisalana* |
| | ***Ricinus communis*** | ***Ricinus communis*** |
| *Malvaceae* | *Hibiscus* | *vitifolius* |

Herbaceous vegetation dominated the proposed project site; some of the herbs observed include *Ocimum suave, Crotalaria malindiensis, Pedalium murex* among others. Table 6 gives a list of the herbaceous vegetation observed.

**Plate 13:** ***Herbaceous vegetation at the proposed project site*** *Pedalium murex* ***& Sida ovata respectively***

**Table 6: List of species of herbs**

| Family | Genus | Species |
|---|---|---|
| *Labiatae* | *Ocimum* | *suave* |
| *Commelinaceae* | *Commelina* | *benghalensis* |
| *Leguminosae* | *Zornia* | *glochidiata* |
| *Convolvulaceae* | *Ipomoea* | *mombassana* |
| *Nyctaginaceae* | *Boerhavia* | *erecta* |
| *Solanaceae* | *Datura* | *stramonium* |
| *Nyctaginaceae* | *Boerhavia* | *erecta* |

| Family | Genus | Species |
|---|---|---|
| *Boraginaceae* | *Heliotropium* | *steudneri* |
| *Malvaceae* | *Sida* | *ovata* |
| *Acanthaceae* | *Asystasia* | *gangetica* |
| *Nymphaeaceae* | *Nymphaea* | *Caerulea* |
| *Leguminosae* | *Crotalaria* | *malindiensis* |
| *Amaranthaceae* | *Aerva* | *lanata* |
| *Amaranthaceae* | *Gomphrena* | *celosioides* |
| *Compositae* | *Gutenbergia* | *cordifolia* |
| *Commelinaceae* | *Commelina* | *benghalensis* |
| *Polygonaceae* | *Oxygonum* | *sinuatum* |
| *Flacourtiaceae* | *Ludwigia* | *octovalis* |
| *Zygophyllaceae* | *Tribulus* | *terrestris* |
| *Amaranthaceae* | *Alternanthera* | *pungens* |
| *Amaranthaceae* | *Achyranthes* | *aspera* |
| *Pedaliaceae* | *Pedalium* | *murex* |
| *Convolvulaceae* | *Ipomoea* | *aquatica* |
| *Euphorbiaceae* | *Euphorbia* | *hirta* |

Grasses at the proposed project site include *Eragrostis cilliari*, *Heliotropium steudneri*, *Dactylotenium aegyptica and Sida ovate*. Table 7 is a list of grasses observed.

**Plate 14: Some of the grasses at the proposed project site *Dactyloctenium aegyptium & Eragrostis ciliaris* respectively**

**Table 7: List of species of grass at the proposed project site**

| Family | Genus | Species |
|---|---|---|
| *Gramineae* | *Digitaria* | *milanjiana* |

| Family | Genus | Species |
|---|---|---|
| *Gramineae* | *Eragrostis* | *ciliaris* |
| *Gramineae* | *Eleusine* | *indica* |
| *Gramineae* | *Digitaria* | *macroblephara* |
| *Gramineae* | *Urochloa* | *mosambicensis* |
| *Gramineae* | *Dactyloctenium* | *aegyptium* |
| *Gramineae* | *Cenchrus* | *ciliaris* |
| *Gramineae* | *Chloris* | *robusta* |
| *Gramineae* | *Chloris* | *roxburghiana* |

### 5.6.2 Fauna diversity

Fauna at the proposed project site include herpetofauna mainly reptiles and amphibians, invertebrate mainly insect pollinators; beetles, ants, crustaceans, and avifauna. Reptiles and amphibians include Black-lined plated lizard (*Gerrhosaurus nigrolineatus*), Puff Adder (*Bitis arietans)*, Black mamba (*Latastia longicaudata*), Flap-necked chameleon, python and green mamba. Invertebrates observed at the proposed project site include pollinators of the bee family mainly *Apis melifera*, butterflies mainly *Papilio demodocus, Junonia oenone* and *Euphaedra neophron and* grasshopper (*Byblia ilithyia*). Crustaceans observed include snails and crabs while avifauna at the site include Golden Pipit (*Tmetothylacus tenellus),* Malindi Pipit (*Anthus melindae),* Spotted Morning-thrush (*Cichladusa guttata),* Cattle Egret (*Bubulcus ibis)*, Namaqua Dove (*Oena capensis).*

**Table 8: Species of butterflies observed in and in the neighbourhood of the project site**

| Genus | Species | Genus | Species |
|---|---|---|---|
| *Papilio s* | *demodocu* | *Byblia* | *ilithyia* |
| *Pardopsis* | *punctatissima* | *Catopsilia* | *florella* |
| *Phalanta* | *phalantha* | *Colitis* | *daira* |
| *Physcaeneura* | *leda* | *Colitis* | *euippe* |
| *Salamis* | *parhassus* | *Colitis* | *vesta* |
| *Tirumala* | *petiverana* | *Colotis* | *danae* |
| *Tuxentius* | *calice* | *Colotis* | *protomedia* |
| *Vanessa* | *cardui* | *Colotis* | *vesta* |
| *Ypthima* | *asterope* | *Cupidopsis* | *iobates* |
| *Zizina* | *antanossa* | *Danaus* | *chrysippus* |

| | | | |
|---|---|---|---|
| *Zizula* | *hylax* | *Deudorix* | *antalus* |
| *Acraea* | *eponina* | *Eurema* | *floricola* |
| *Acraea* | *insignis* | *Eurema* | *regularis* |
| *Amauris* | *niavius* | *Eurytela* | *dryope* |
| *Amauris* | *ochlea* | *Freyeria* | *trochylus* |
| *Anthene* | *butleri* | *Graphium* | *angolanus* |
| *Axiocerses* | *harpax* | *Hypolimnas* | *misippus* |
| *Azanus* | *jesous* | *Hypolycaena* | *philippus* |
| *Baliochila* | *hildegarda* | *Junonia* | *hierta* |
| *Belenois* | *aurota* | *Junonia* | *natalica* |
| *Belenois* | *creona* | *Junonia* | *oenone* |
| *Belenois* | *thysa* | *Junonia* | *orithya* |

**Plate 15: Some of the fauna notably grasshopper and chameleon at the proposed project site**

**Table 9: Species of birds observed in and in the neighbourhood of proposed project site**

| **Species** | **Common Name** |
|---|---|
| *Halcyon leucocephala* | Grey-headed Kingfisher |
| *Merops nubicus* | Northern Carmine Bee-eater |
| *Cypsiurus parvus* | African Palm-swift |
| *Streptopelia capicola* | Ring-necked Dove |
| *Turtur chalcospilos* | Emerald-spotted Wood-dove |
| *Oena capensis* | Namaqua Dove |
| *Glareola pratincola* | Collared Pratincole |
| *Ardea melanocephala* | Black-headed Heron |
| *Bubulcus ibis* | Cattle Egret |

| | |
|---|---|
| *Threskiornis aethiopicus* | African Sacred Ibis |
| *Platalea alba* | African Spoonbill |
| *Mycteria ibis* | Yellow-billed Stork |
| *Anastomus lamelligerus* | African Openbill |
| *Lanius cabanisi* | Long-tailed Fiscal |
| *Hirundo rustica* | Barn Swallow |
| *Hirundo aethiopica* | Ethiopian Swallow |
| *Tmetothylacus tenellus* | Golden Pipit |
| *Anthus melindae* | Malindi Pipit |
| *Bubalornis niger* | Red-billed Buffalo-weaver |
| *Ploceus cucullatus* | Village Weaver |
| *Quelea erythrops* | Red-billed Quelea |
| *Egretta garzetta* | Little Egret |
| *Anthus cinnamomeus* | Grassland Pipit |

# 6. SALT PRODUCTION TECHNOLOGIES

## 6.1 Introduction

Salt producers use three basic technologies to create salt for its myriad uses. Now-buried dried-up oceans of geologic ages past have left many areas, under both land and sea, with concentrated salt sedimentary layers which can exceed fifty feet in thickness. Two technologies exploit these underground deposits: conventional shaft mining where miners go underground to remove solid rock salt and solution mining where water is pumped underground dissolving the solid salt and then pumping out the salty brine which is de-watered to crystallize the salt. The third method extracts salt from oceans and saline lakes, growing salt crystals much as a farmer grows crops of vegetables or grain. Respectively, the products of these technologies are known as rock salt, evaporated salt (or vacuum pan salt) and solar (or sea) salt. Among the three technologies, most producers around the world are engaged in solar salt production, the least expensive technology available, when favoured by a dry and windy climate. But vast quantities of rock salt are extracted in large commercial mines and chemical companies utilize an enormous amount of salt in the form of brine that never is crystallized into dry salt. Logistical considerations heavily influence production facility site selection decisions and these, in turn, heavily influence the size of production units and the structure of the salt industry.

## 6.2 Evaporated salt (Vacuum pan salt) production

The vacuum evaporation method involves salt production by evaporation of salt brine by steam heat in large commercial evaporators, called vacuum pans. This method yields a very high purity salt, fine in texture, and principally used in those applications requiring the highest quality salt. The method involves pumping brine into vacuum pans; these are huge closed vessels under vacuum about three stories high. They are normally arranged in a series of three, four or five, with each one in the line under greater vacuum than the preceding one. This series of vacuum pans operates on a very simple principle: Whenever pressure is lowered, the temperature at which water will boil is also lowered. For instance, under normal air pressure at sea level, water boils at 212°F. But at ten thousand feet above sea level, where air pressure is much less, water boils at 194°F. Vacuum pans may operate at as low as 100°F. In the vacuum pan process, steam is fed to the first pan. This causes the brine in the pan to boil. The steam from the boiling brine is then used to heat the brine in the second pan. The pressure in the second pan is lower, allowing the steam made by the boiling in the first pan to boil the brine in the second pan. The pressure is reduced still further in each succeeding pan.

This allows the steam made by the boiling brine in the previous pan to boil the brine in the next pan. While the boiling operation could be done with just one pan, several pans in a row produce more salt per pound of steam, thus allowing greater energy efficiency.

### 6.3 Rock salt production

Rock salt is mined from underground deposits by drilling and blasting. Deposits are reached through a circular shaft, typically about 20 feet in diameter and as deep as 2,000 feet, depending on the depth and location of the salt deposit. Shafts are lined with concrete, at least through the overburden and into the top of the salt deposit, and often all the way to the shaft bottom. Mining methods depend on whether the salt is configured as a relatively horizontal sedimentary deposit or a more vertical salt dome. The differences in mining methods depend on the thickness and structure of the salt deposit. Bedded or layered deposits are mined using the room and pillar mining method, as horizontal rooms or entries of about 10-25 feet high and 50 feet wide. Openings or cross-cuts are created perpendicular to the length of the rooms to connect the rooms at planned intervals. Salt pillars are left in place to provide structural support for the overlying roof and other layers. Most room-and-pillar mines recover about 45-65% of the salt available, with the remainder left behind as pillar supports with margins both above and below the mined area. Each day, based on production needs, several rooms are blasted, each blast bringing down 350-900 tons. In salt domes, after a level of room-and-pillar extraction is completed, the usual practice is to “bench” the mine by drilling and blasting the floor extending the excavation downward and removing vast quantities with each blast. Typically salt is mined using large, diesel-powered equipment designed for undercutting, drilling, blasting, loading and transporting the blasted salt. More recently, continuous mining machines have been more common; formerly they produced too many unusable fines. Diesel-powered trucks take the salt freed by blasting to a system of crushers and conveyor belts and, ultimately, to the hoist or “skip.” Sometimes the salt is stockpiled in the mine waiting hoisting; other operations maintain surface storage stockpiles. Each skip can lift 18-20 tons of salt and they move quickly – a large mine may be able to hoist up to 900 tons an hour.

### 6.4 Solar salt production

This is the oldest method of salt production. It has been used since salt crystals were first noticed in trapped pools of sea water. Its use is practical only in warm climates where the evaporation rate exceeds the precipitation rate, either annually or for extended periods, and ideally, where there are steady prevailing winds. Solar salt production is, typically, the capturing of salt water in shallow ponds where the sun evaporates most of the water. The concentrated brine precipitates the salt which is then gathered by mechanical harvesting machines. Any impurities that may be present in the brine are drained off and discarded prior to harvesting. Usually two types of ponds are used. First is the concentrating pond, where the salty water from the ocean or salt lake is concentrated. The second is called the crystallizing pond, where the salt is actually produced.

Commercial solar salt is produced by natural evaporation of seawater or brine in large, diked, earthen concentration ponds called condensers. Seawater averages about 3.5% NaCl when it enters the condensers. Climate is very important in solar salt production. The sun and wind provide the energy to evaporate the water and raise the salt concentration to the point of crystallization, 25.8% NaCl (25.4o Bé). As the water concentrates, calcium carbonate is the first chemical to crystallize. By moving the increasingly-saline brine through a series of ponds, over a period, the calcium carbonate is thus removed from the final salt product. When the concentration has increased to the most favorable crystallizing level, $26^{o}$ Bé, the brine is introduced into the crystallizing ponds. As salt crystallization proceeds, the concentration continues to increase. At $29^{o}$ or $30^{o}$ Bé between 72% and 79% of the total salt has been crystallized. Proper brine control during concentration and crystallization results in salt of purity of >99.7% NaCl. The crystallizing pond is then drained of the remaining highly concentrated magnesium brine (called “bitterns” because of its taste) which are either discharged or further processed for other minerals. The crystallised salt is harvested either mechanically using mobile harvester equipment by striping the newly-deposited layer of salt crystals or manually. The harvested salt is then washed (in clean brine to prevent loss), crushed and sometimes dried in kilns or fluidized-beds driers.

# 7. PROJECT DESIGN DESCRIPTION

## 7.1 Design components

The proposed salt works will consist of the following components:-

- ✓ Evaporators
- ✓ Serving ponds
- ✓ Crystallizers
- ✓ Three pump stations
- ✓ Dykes
- ✓ Site camp

Appendix 7 is the working design drawing for the proposed salt works

### 7.1.1Evaporators

The design of the salt works consists of seventeen evaporator ponds referred to as evaporators (E1-E17) of different sizes. The evaporators all combined will cover an area of about 613.8 hectares. Evaporator 1 (E1) will receive brine from the creek at the intake channel and circulate the brine sequentially up to evaporator 17 (E17).

### 7.1.2 Crystallizers

The design of the salt works provides for twenty crystallizer ponds (C1-C20). Each crystallizer pond will measure 200 metres by 100 meters. Each crystallizer pond will cover about 2 hectares hence all the twenty crystallizer ponds will cover about 40 hectares. The crystallizer ponds will be receiving the saturated brine from evaporator E-17 into crystallizer C1.

### 7.1.3 Serving ponds

The design of the proposed salt works provides for serving ponds that will cover an approximate area of 100 hectares. The serving ponds are also known as the bitten ponds, these ponds are the one that will receive the bitten from the crystallizer ponds once raw salt harvesting is complete.

### 7.1.4 Pump stations

There will be three pump stations i.e. pump station 1, pump station 2 and pump station 3. Pump station 1 will have two pumps each with the capacity to pump 45, 000litres of brine per minute. Pump station one will be located at the intake channel adjacent to the creek. Pump station 2 and pump station 3 will be located at the evaporator area specifically E-5 and E-10 respectively. Each of the pump station will have one pump with a capacity to pump 45,000 litres of the saturated brine per minute.

### 7.1.5 Dykes

Dykes will be constructed to separate the different categories of salt ponds. There will be dykes separating evaporator ponds from serving ponds, that separating serving ponds from crystallizer ponds. Further there will be a perimeter dyke there will make the whole salt works accessible.

### 7.1.6 Site camp

There will be a site camp that will consist of site offices, sanitary facilities, raw salt holding area, raw salt washery area, garage, workshop, fresh water storage tanks among other essential support facilities. Appendix 7 is the working drawing of the proposed salt works

## 7.2 Proposed project activities

The activities that shall be undertaken during the life cycle of the proposed project will include the following.

### 7.2.1 Construction phase activities

Activities that will be undertaken during the construction phase of the proposed salt works will include the following:-

- ✓ Clearance of vegetation and removal of cleared vegetation from the project site.
- ✓ Uprooting of tree stamps and roots from the cleared site.
- ✓ Site excavation, leveling and compaction.
- ✓ Trenching and stabilization of trench slopes.
- ✓ Construction of dykes, evaporator ponds, crystallizer ponds and serving ponds.
- ✓ Installation of the pumps in the three pump stations
- ✓ Construction of site camp with required facilities

### 7.2.2 Operational phase activities

During the operational phase some of the activities that will be undertaken will include

- ✓ Capturing of brine at the intake channel during high tide and circulating through the evaporator ponds and into the crystallizer ponds for salt crystallization to take place
- ✓ Harvesting of raw salt from the crystallizer ponds.
- ✓ Draining of bitten from crystallizer ponds into serving ponds after completion of raw salt harvesting
- ✓ Harvesting of generated low grade salt from crystallization of bitten in the serving (bitten) ponds.
- ✓ Washing of raw salt harvested
- ✓ Haulage of the washed raw salt out of the salt works.

- ✓ Repair and maintenance works

### 7.3 Construction of ponds and dykes

Construction of dykes and ponds (evaporator ponds, crystallizer ponds and serving ponds) will entail vegetation clearance, ground excavation and compaction.

#### 7.3.1 Vegetation clearance

Vegetation on the ground will be cleared to pave way for construction of dykes and ponds to begin. Trees, shrubs and grasses will be cleared from the site. Stamps of tree and roots will then be uprooted. Various tools and equipment will used to clear vegetation, uproot stumps of trees and roots on site. The equipment will include power saws and wood cutters.

#### 7.3.2 Ground excavation and compaction

Excavation of the cleared ground will be undertaken to attain required levels and depths. Excavation works will utilize heavy duty equipment including graders, excavators, backhoe loaders, wheeled loaders, dump trucks and soil compactors. Once excavation is complete ground leveling to attain desired gradient and compaction to required specifications will be undertaken using leveling and dumping unit with theodolite set and vibrating rollers respectively. The excavated earth material will be used to construct the dykes. At the end of it all the required ponds and separating dykes will be developed and constructed to respectively to the required specification.

#### 7.3.3 Production of raw salt

The proposed salt works will produce raw salt from brine using solar technology where solar radiation will be used in brine evaporation process to attain salt crystallization. Raw salt production will start with the capturing of brine during high tide at the intake point. It is anticipated that the brine concentration at the point of capturing will be about 3.5°Be. The captured brine will be pumped by the intake pumps at pump station 1 into evaporator pond 1 (E1) and then circulated sequentially up to evaporator pond 17 (E-17). During the circulation the concentration of the brine will increase as evaporation takes place and hence the brine will be saturated. At the last evaporator pond (E-17) under good sun radiation, the brine will be saturated and will be about 20°Be. The saturated brine will then flow from evaporator E-17 into crystallizer pond 1 (C-1 to C-20) where farther evaporation and condensation will take place to the point of salt crystallization when the brine concentration will be about 25°Be. Raw salt harvesting will take place once a salt crust of about two inches is attained in the crystallizers.

### 7.4Production of low grade salt

Law grade salt will be produced from the bitten in the serving ponds. The bitten in the bitten ponds will be left to evaporate and completely crystalize. The resulting salt is low grade salt it will be separately harvested and sold out as animal feed or sold to turneries.

### 7.5 Harvesting of raw salt

Salt harvesting at the proposed salt works will be done manually. Manual salt harvesting method will be labour intensive as it will involve a significantly large number of people harvesting salt in all the twenty crystallizer ponds. Manual salt harvesting will involve manually breaking the salt crusts in the crystallizer ponds before scooping the salt crystals using a spade into small heaps within the crystallizer ponds. The now gathered salt crystals in small heaps will be scooped out into buckets which are manually lifted and emptied into a waiting tractor mounted with trailer for transportation to the washing area.

### 7.6 Raw salt washing

The first level of washing of the harvested raw salt will be the primary salt washing. This will be done using a counter current of brine concentration of about 22°Be in a salt washery of rotating screws. The second level of raw salt washing in the salt washery will be done by aid of vibrating screens by spraying of brine the saturated brine of concentration 22°Be from the top of the vibrating screens. Draining of water from the washed salt will be done in the secondary vibrating screens before the washed raw salt is piled into cone shaped heaps.

### 7.7 Haulage of washed raw salt out of the salt works

The washed raw salt will either be sold by the proponent to other parties for refining, processing and packaging or be transported out of the salt works into a sister salt works within the salt belt which has a refinery for farther processing. In either way the raw salt will be transported out of the salt works in trucks.

### 7.8 Products and by-products

The product that will be produced from the proposed salt works will be raw salt for human consumption. The by-product that will be generated will be low grade salt. The low grade salt can either be used as an animal feed or sold to turneries for turning of skin and hides into leather.

### 7.9 Waste generation

Waste to be generated from the construction phase is organic plant matter from site clearing, overburden material from excavation works and trenching. Waste from operational phase will be bitten resulting from salt harvesting and effluent from salt washing.

#### 7.9.1 Waste management and disposal

Organic plant matter that will be realized from site clearance some will be solid as firewood. The overburden material from excavation work will be used to build dykes. Remaining overburden material will be used to fill up low-lying areas within the proposed project site. Bitten from salt harvesting will be channeled to bitten tanks and be used to produced low grade salt referred while effluent from salt washing will the channeled to settling ponds for sediments to settle down and the resulting salty water be recycling back to salt washing.

# 8. ANALYSIS OF PROJECT ALTERNATIVES

A Project Alternative (project option) is another combination of the project's costs, schedules, resources, and risks that allow achieving the same results as compared to the project base-line. It is one or more ways to produce the project and address its need while using the same resource base yet operating in a new way and facing new working conditions. Project alternative considered for the proposed salt works include the yes project alternative, the no project alternative, modified project alternative, alternative use of proposed project site and alternative project site. An analysis of each of the project alternatives to the project costs, schedules, resources, and risks is tabulate in table 10. Evaluation of each of the project options is as follows.

## 8.1 The No Project Alternative

The no project alternative means that the project as currently proposed i.e. salt works at the proposed project site to be totally rejected. This means that the proposed project site to remain undeveloped as currently is. The no project alternative implies that the developer will not be able to achieve the proposed plans to develop the company land that is not currently developed and has remained undeveloped for many years.

## 8.2 The Yes Project Alternative

The yes project alternative means that the proposed project of constructing a salt works at the proposed project site to be implemented as currently proposed. The yes project alternative will enable the project proponent achieve the proposal of developing the company land which for a long time has remained undeveloped and unproductive.

## 8.3 The modified project alternative

The modified project alternative means that the proposed project to be implemented but with modifications. The modifications may be in design i.e. to modify the project design, it may be in the components i.e. modifying the project components, or it may be in the size and magnitude i.e. scale up or scale down the size and magnitude of the project.

**Table 10: Tabulation of an of each of the project alternatives to the project costs, schedules, resources, and risks**

| Project alternative / Project aspect | Yes project alternative | No project alternative | Alternative project site | Alternative design |
|---|---|---|---|---|
| **Cost** | No change on current projected project cost | Loss of the project as it will not be implemented | Will change the project cost as an alternative site has to be procured | Redesigning the project will be an added cost |
| **Schedules** | No change on current project schedule | Proposed project schedule will not be used as the project will not be implemented | Will change the schedule to take care of time lost in obtaining alternative site | New schedules will have to be developed to take care of the requirements of the new design |
| **Resources** | No change on current planned project resources | Available project resources will not be used as the project will not be implemented | More resources ( time, expertise, finances) will be required | Resources needed will change depending on the new design |
| **Risks** | Risk of not implementing the project is minimal | All risks associated with implementation of the project will not be realized as the project will not be implemented | Risk of not implementing the project on schedule or failing to implement it all together is feasible | Risk of not getting a design that can be implemented within the project budget |

### 8.3.1 Alternative use of the proposed project site

The proposed project site can be used for other alternative projects besides the proposed salt works. Such alternative uses could include shrimp and prawn farming as stated in one of the special conditions of the grant of land reference .number 13536.

### 8.3.2 Alternative site for the proposed project

Alternative site for the proposed project will have to be land available within the salt belt. Such areas should have large and expansive undeveloped parcels of land adjacent to a creek with clay soils which is relatively impermeable to favor solar salt production from sea water. Potential areas that can be considered may include other undeveloped slat areas within the salt belt.

### 8.3.3 Alternative technology

The proposed project proposes to use solar technology to produce salt from brine by evaporating brine in salt pond until salt crystalizes out. This technology requires a fairly large space of land to construct the salt ponds. An alternative technology will be production of salt from brine using the vacuum evaporation method. The method involves pumping brine into vacuum pans; these are huge closed vessels under vacuum about three stories high. They are normally arranged in a series of three, four or five, with each one in the line under greater vacuum than the preceding one. In the vacuum pan process, steam is fed to the first pan. This causes the brine in the pan to boil. The steam from the boiling brine is then used to heat the brine in the second pan. The pressure in the second pan is lower, allowing the steam made by the boiling in the first pan to boil the brine in the second pan. The pressure is reduced still further in each succeeding pan. This allows the steam made by the boiling brine in the previous pan to boil the brine in the next pan. While the boiling operation could be done with just one pan, several pans in a row produce more salt per pound of steam, thus allowing greater energy efficiency. This technology requires less land space compared to the solar technology.

# 9. OCCUPATIONAL SAFETY AND HEALTH

## 9.1 Introduction

Occupational Health and Safety (OHS) is of importance at project sites. It is important for mechanisms to be put in place to predict potential risks, incidents and hazards in the said working environment. This is because the occupational environment directly affects employees involved in project, the neighborhood, visitors, contractors, sub-contractors and the general public. Therefore before commissioning of the project, a number of safety measures have to be in place to ensure the safety of employees, neighbors and the general public. Employees and visitors to the project site may be exposed to a variety of personal health and safety risks. The type and level of exposure is generally related to factors controlled by the employer/ developer. Such factors include design, equipment, tools, work procedures, project, and employee training. Occupational health and safety risks that should be considered by the employer arise from normal functions and operations and during unusual circumstances such as accidents and incidents. The employer/ developer is responsible for:

- Implementation of appropriate national and internal recognised OHS standards, practices and guidelines.
- Inclusion of meaningful participation of employees in implementation and maintenance of procedures and processes.
- Implementation of a programme to change employee culture and altitudes regarding health and safety.
- Planning, implementing and monitoring programs and s required to ensure OHS at the workplace.
- Provide and maintain workplaces, equipment, tools and machinery and organise work so as to eliminate or control hazardous ambient work factors.
- Provide appropriate occupational health and safety training for all employees.
- Provide adequate personal protective equipment to all employees at no cost to employees.
- Record and report occupational injuries and illness.
- Ensure contract specifications include demands for service providers, contractors, and sub-contractors to have or establish enabling them to meet the OHS requirements of the employer.

### 9.2. Occupational Health and Safety Management

An Occupational Health and Safety Management system (OHSMS) will be established, managed and operated for the proposed project. The system will contain the following features:

1. Occupational Health and Safety Policy for the company
2. Organizational framework of the OHSMS
    - ✓ Staffing of OHSMS
    - ✓ Competence requirements
    - ✓ Operating procedures
    - ✓ Training programs
    - ✓ Documentation
        - ✓ Communication
3. OHSMS objective (documentation)
4. Hazard prevention
    - ✓ Risk assessment
    - ✓ Prevention and control measures (active and negative)
    - ✓ Management of changes
    - ✓ Emergency preparedness and response
    - ✓ Procurement (tools, equipment, services, contractors)
5. Performance monitoring and measurements
    - ✓ Hazard prevention measures
    - ✓ Ambient working environment
    - ✓ Work related injuries, ill health, disease and injuries
6. Evaluation
        - ✓ Feedback
        - ✓ Corrective measures
        - ✓ Action plan

### 9.3. Employee safety

In addressing requirements and needs to ensure employee safety, the following will be in place: -

- ➢ Provision of adequate personal protective equipment.
- ➢ Enforcement and proper use of personal protective equipment by all employees.
- ➢ Provision of first aid and emergency services on site.

- In case of injury of employee during work; management must have a clear policy on treatment of the injured employee.
- In case of permanent disability arising from injury at work place, adequate compensation should be available within the law.
- Appropriate tools and equipment in sound working condition must be provided to employees to enable them work safely.
- All practical measures must be in place to ensure that the work place is free of dust and excessive noise.

### 9.4. Safety of neighbours and general public

Project sites are associated with incidents and accidents that endanger neighbours and general public. The contractor must ensure the safety of all neighbours and the general public is taken care of by putting the following measures in place: -

- ✓ All neighbours to be informed of the date of commencement of project.
- ✓ Heavy vehicles and trucks that will be ferrying in project equipment to the project site to observe required minimum speed limit when approaching the site to avoid accidents.
- ✓ There should be notices and warning prominently displayed at entry of project site and strategically around the project boundaries informing general public of on-going activity and safety requirements.

### 9.5 Machine use and Electrical Safety

During the implementation of the proposed project, it is expected that different machines, tools and equipment will be used. Most of this machine will be powered internally by use of diesel. In regard to electrical safety, the following will have to be undertaken: -

- Installation and fitting of proper electrical appliances to enable supply of electrical energy to utility point.
- All electrical installations and fittings are done according to electrical safety rules.
- All electrical wires must be safely insulated.
- Sockets and other electrical outlets must be securely fitted.
- When not in use all machines should be shut down.
- Qualified and well-experienced electrician should be hired to carry out all electrical work.
- Safety slogans should be strategically posted as a reminder to employees.

- Operating manuals of equipment should be available for use whenever needed.

### 9.6. Internal Safety

During the entire project implementation and operation cycle, safety of the employees on the site should be taken care of. Some of the things that need to be in place include:-

- ✓ Emergency preparedness
- ✓ First aid
- ✓ Welfare facilities
- ✓ Personal protective equipment

### 9.7. First-Aid

i. Contractor to ensure qualified First Aiders are available to administer first aid to affected employees at all times.
ii. An appropriately equipped First-Aid station to be easily accessible at the project site.
iii. The First Aid station to be adequately equipped to meet first aid needs at the project site.
iv. A written Emergency Procedure to be in place.

### 9.8. Welfare facilities

i. Changing rooms for workers to be provided.
ii. Shower rooms and washing facilities to be provided.
iii. Contractor to avail potable drinking water to all employees at site.
iv. Appropriate and adequate Personal Protective Equipment to be provided
v. The enforcement on the consistence of the correct use of PPE provided
vi. The PPE provided are to maintain clean and replaced when damaged or worn out.

### 9.9. Ambient factors in the project site

#### 9.9.1 Noise

Management will put in place a comprehensive noise conservation programme which will include the following:-

i) Training of workers in noise prevention, control and management.
ii) Provision of appropriate noise protective devices to workers.
iii) Training of the workers on the importance of making appropriate use of the protective devices provided.
iv) Monitoring of noise levels through periodic noise survey.

v) Use of appropriate noise attenuators.

vi) Audiometric test of workers

### 9.9.2 Dust

- ✓ Exposure to dust to be controlled by ensuring dust accumulation at project site is controlled.
- ✓ Equipment to be selected, especially that with in-built dust extraction.
- ✓ Employee exposed to dust to be provide with disposable dust masks.

## 10. STAKEHOLDER CONSULTATION

Consultation with stakeholders that are likely to be affected and those that are likely to have an interest in the proposed salt works project was conducted as provided for in Regulation 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003. The consultation was vital and served to:-

- Inform local community especially those drawn from the proposed project site of the proposed development within their locality.
- Explain to the local community the nature of the proposed project, its objectives and scope.
- Give local community especially those drawn from the proposed project site an opportunity to present their views, concerns and issues regarding the proposed.
- Obtain feedback and suggestions from the local community and other stakeholders on the proposed salt works project.

The consultation was twofold, namely;

- Public meetings (barazas)
- Questionnaire survey

### 10.1 Public meetings

Public consultation through public meetings involved carrying out three public meetings within the neighborhood of the proposed project site. Prior to conducting the public meetings invitation letters to political leaders, administration, community based organizations were sent (appendix 8); and notices to the general public were also prepared and posted in strategic locations inviting and informing the public concerning the proposed barazas, the venue, date and time of each baraza. Farther the barazas were also publicized through the local administration Mzee wa Mtaa-Nyumba Kumi communication channel. This issued that every household in every nyumba kumi cluster within the proposed project site and the catchment of the proposed project was reached out to.

#### 10.1.1 First stakeholder consultation and public participation baraza

The first stakeholder consultation and public participation baraza was attended by approximately 122 people most of them drawn from villages neighbouring the proposed project from Musumarini area; appendix 9 is the attendance list of the participants. There were various contributions from different speakers during the first baraza. While some

speakers noted that the proposed project will be a sources of employment for the local people and hence supported its implementation, other speakers had issues relating to the proposed development that they felt needed to be addressed first. Appendix 10 is detailed minutes of the proceedings and contribution from different speakers at the baraza. In summary the issues that were brought out included the following:

- ✓ Streams passing through the proposed project site should not be interfered with but rather left to flow naturally.
- ✓ Water wells within the vicinity of the proposed project site to be developed for use by the members of the community.
- ✓ Sections of the developer's land occupied by squatters should be left intact and that squatters should not be evicted.
- ✓ Employment opportunities arising from the proposed development be offered on merit and rights of employees be respected.
- ✓ All workers that shall be involved in the activities of the proposed salt works be provided with the appropriate personal protective gears.
- ✓ The mangrove areas should not be interfered with at all.
- ✓ Health assessment programmes be carried out within members of the community to establish a baseline of health status prior to project implementation.
- ✓ Co-operation between the developer, local leadership and members of the community to be forged.

**Plate 16: Area MCA and Ward Administrator respectively make their contribution during the first baraza**

### 10.1.2 Second stakeholder consultation and public participation baraza

The second stakeholder consultation and public participation baraza was attended by approximately 197 people most of them drawn from villages neighbouring the proposed project from Muyi Wa Kae area; appendix 11 is the attendance list of the participants.

Various issues and concerns were discussed during this consultative meeting. Appendix 12 is detailed minutes of the proceedings and contribution from different speakers at the baraza. A summary of the main issues that were discussed is as follows:-

- ✓ The community needs an assurance on the land issues in form of a written agreement first before any project activity commences.
- ✓ Squatters be assured in writing that they will not be affected before any project activity commences.
- ✓ Developers in the area do not adhere to recommendations of the EIA reports and the license conditions.
- ✓ Appropriate measures be put in place to safeguard streams flowing through the Al-Sherman land, the community water wells and the mangrove areas.

**Plate 17: A community member makes his presentation during the second baraza**

### 10.1.3 Third stakeholder consultation and public participation baraza

The third stakeholder consultation and public participation baraza was attended by approximately 199 people most of them drawn from villages neighbouring the proposed project from Kadzuyuni area; appendix 13 is the attendance list of the participants. Appendix 14 is detailed minutes of the proceedings and contribution from different speakers at the

baraza. Besides those who supported the implementation of the proposed project, there were those that opposed its implementation. A summary of the main issues that were discussed is as follows:

- ✓ The community first requires an assurance on the land issues in form of a written agreement first before any project activity commences.
- ✓ Previous meetings and agreements between the proponent and the community on matters land have been dishonoured.
- ✓ Preservation of existing community and mangrove areas
- ✓ Creation of a buffer zone between the salt pans and the neighboring homesteads and farms.

**Plate 18: A community member contributing during the third baraza**

## 10.2 Questionnaire survey

A questionnaire survey was carried out targeting as many stakeholders of the proposed project as possible. These included the local administrative leaders, the political leaders, learning institutions in the area, civil society groups working in the area, business community and the community members. The following are the respondents to the questionnaire the key issues/concerns raised.

### 10.2.1 Questionnaire survey responses from Local Administration Leaders

The following leaders in the Local administration responded to the questionnaire.

1. Mwamuye C. Yawa –Snr. Asst. Chief Marereni Sub-Location
2. Festus Gunga Baya –Asst. Chief Fundi-Issa Sub-Location
3. Patterson Jilani Makupe –Village Elder Kadzuyuni A
4. Gilbert Katana Chibo –Village Elder Kadzuyuni B
5. Kadii Kitsao Karisa –Village Elder Kadzuyuni C
6. Kazungu Chengo Kambi –Village Elder

Detailed responses from each of the respondent in this category are in appendix 15. The following is a summary of the responses:-

**a) Issues and Concerns of the Proposed Al Sherman Salt Works Project**

- ✓ Employment for the locals.
- ✓ Waste management and pollution.
- ✓ Community and company relations.
- ✓ Displacement of persons from the habitation areas.
- ✓ Corporate social responsibilities.

**b) Potential positive impacts of the proposed salt works**

- ✓ Employment
- ✓ Socio-structural development
- ✓ Corporate social activities of the company will enhance lives.

**c) Potential negative impacts of the proposed salt works**

- ✓ Increased water salinity/contamination of water sources.
- ✓ Destruction of marine environment.
- ✓ Climatic change.
- ✓ Increased iron rusting.
- ✓ Loss of aquatic life.
- ✓ Loss of grazing lands.
- ✓ Pollution.

**d) Suggestions/recommendations in regard to the proposed salt works**

- ✓ Compensate displaced persons.

- ✓ Proper waste management.
- ✓ Buffer the community from salt works activities.
- ✓ Plant trees
- ✓ Give priority to residents whenever opportunities arise in the company.
- ✓ Develop a blissful relationship with the local community.
- ✓ Carry out corporate social responsibilities
- ✓ The project is welcome.

### 10.2.2 Questionnaire survey responses from Political Leaders

The following political leaders responded to the questionnaire.

1. Stanley Karisa Kenga; MCA - Adu Ward and Deputy Speaker, County Assembly of Kilifi
2. Samson Zia Kahindi –Ward Liaison Officer (MP's Office, Magarini Constituencey

Detailed responses from each of the respondent in this category are in appendix 16. The following is a summary of the responses:-

**a) Issues and concerns of the proposed salt works**

- ✓ Evictions of people from the area
- ✓ Water contamination
- ✓ Deforestation
- ✓ Pollution
- ✓ Blockage of waterways & Floods
- ✓ Blockage of access roads
- ✓ Boundary (Identification) of the proposed project.
- ✓ Formation of corporate social responsibility's committee.
- ✓ Establish the population to be affected by the proposed project.

**b) Potential positive impacts of the proposed salt works**

- ✓ Employment opportunities
- ✓ Improve the living standards of the people.
- ✓ Enhance security in the hood.
- ✓ Infrastructural development.
- ✓ Transfer of skills/technology.
- ✓ Market opportunities

- ✓ Corporate social responsibility projects in the hood.

**c) Potential negative impacts of the proposed salt works**

- ✓ Evictions of residents within the area.
- ✓ Lack of land title deeds for residents.
- ✓ Extension of the boundaries from the proposed site.
- ✓ Destruction of resident's property.
- ✓ Blockage of waterways and floods.
- ✓ Blockage of access roads
- ✓ Pollution.
- ✓ Contamination of fresh water sources
- ✓ Deforestation
- ✓ Climatic impacts.
- ✓ Pollution
- ✓ Increased poverty
- ✓ Low agricultural production
- ✓ Destruction of socio-cultural centres.

**d) Suggestions/Recommendations**

- ✓ Subdivide the remaining land and issue the community with land title deeds.
- ✓ Provide access roads.
- ✓ Waterways should not be blocked.
- ✓ Enshrine community water sources.
- ✓ Boundaries of the proposed project should be clearly marked.
- ✓ Plant trees.

The proposed project should not be undertaken before:

- ✓ Addressing the issue of land
- ✓ The Al Sherman Company providing their project development plan to the residents
- ✓ Provision of a comprehensive plan of addressing the issues and concerns raised.

### 10.2.3 Questionnaire survey responses from other Leaders in the community

The following leaders under this category responded to the questionnaire.

1. Vincent Yeri Chengo –Ward Administrator –Adu Ward

2. Patrick Gambo –Liaison Officer, Kenya Association of Manufacturers –Salt Sub-Sector
3. Kinda Zia Thoya –Salt Sub-Sector
4. Samuel Mwandoro Lewa –Salt Sub-Sector

Detailed responses from each of the respondent in this category are in appendix 17. The following is a summary of the responses:-

**a) Issues and Concerns of the Proposed Al Sherman Salt Works Project**

- ✓ Provision of title deeds to persons living outside the proposed project site.
- ✓ Salt impact on iron sheets/roofs.
- ✓ Implementation of the proposed suggestions/recommendations by the company.
- ✓ Consideration of locals for the job opportunities should be prioritized.
- ✓ Environmental degradation need to be addressed comprehensively.
- ✓ Displacement of persons may arise and should be done in a humane manner.
- ✓ The developer/investor and community need to develop a common understanding.

**b) Potential Positive Impacts of the Proposed Al Sherman Salt Works Project**

- ✓ Generation of income to the government.
- ✓ Creation of employment opportunities.
- ✓ The proposed project will spur development and or economy of the area.
- ✓ The project will save lives of persons drowning in existing ponds
- ✓ Improved living standards of persons.
- ✓ Corporate social responsibility projects will be implemented.

**c) Potential Negative Impacts of the Proposed Al Sherman Salt Works Project**

- ✓ The project will greatly impact on flora and fauna (Land & Marine life).
- ✓ Human displacement.
- ✓ Wastes will affect the environment.
- ✓ Logging to provide fuel energy for the company will have adverse impacts on local forests.
- ✓ Pollution.

**d) Suggestions/Recommendations in regard to the Proposed Al Sherman Salt Works Project**

- ✓ Concentrate the proposed activities in areas not inhabited by residents as planned.

- ✓ Develop programs to conserve the environment.
- ✓ Good waste management systems should be put in place.
- ✓ Alternative sources to fuel wood that friendly to the environment should be exploited.
- ✓ Employ locals to improve their living standards.
- ✓ Create access roads to the sea.
- ✓ The company should plant trees to buffer the community from its activities/impacts.
- ✓ The company should come in terms with persons to be directly affected by the proposed project to avoid unnecessary conflicts.
- ✓ Implement the proposed project to aid in addressing joblessness and insecurity.
- ✓ Undertake corporate social responsibilities.
- ✓ Continue engaging the community/stakeholders for more updates.

### 10.2.4 Questionnaire survey responses from local learning institutions

The following institutions responded to the questionnaire.

1. Kurawa Secondary School –Elvis Mwasaha
2. Kurawa-Kanagoni Primary School –Erastus Katana Kenga
3. Kanagoni Primary School –Rehema Rashid (H/T)
4. Kadzuyuni Primary School –Daniel Salim Karisa
5. Muyu Wakae Primary School –Agnes N. Nzai
6. St. Francis of Assis Academy –Rose Kazungu Karisa
7. Ungwana Academy

Detailed responses from each of the respondent in this category are in appendix 18. The following is a summary of the responses:-

**a) Issues and concerns of the proposed salt works**

- ✓ There are persons/families living on the proposed land and we hope no displacement will occur to implement the proposed project/the land in question has squatters.
- ✓ Communal water sources will be affected.
- ✓ Fishing industry shall be affected
- ✓ Loss of vital plants and animals.
- ✓ Blocking of access roads/paths.
- ✓ Loss of livelihoods.
- ✓ Climatic change.
- ✓ Impact on agriculture.

- ✓ Environmental Pollution.
- ✓ Health concerns for workers as well as locals.

**b) Potential positive impacts of the proposed salt works**

- ✓ Creation of job opportunities.
- ✓ Pooling of resources in the hood and development of the area.
- ✓ Urbanization will occur.
- ✓ Source of revenue to the government.
- ✓ Improved business activities in the area.
- ✓ Possible donors/investors in community developmental projects.

**c) Potential negative impacts of the proposed salt works**

- ✓ Pollution and thus a risk to the residents' health.
- ✓ Displacement of persons from their local areas.
- ✓ Livelihoods of the local persons shall be affected.
- ✓ Loss of arable land for farming.
- ✓ Roof/iron rusting will accelerate.
- ✓ Clearance of vegetation to pave way for the proposed project.
- ✓ The project shall lead to child labour and increased school drop outs.
- ✓ Reduced lifespan for salt workers.
- ✓ The proposed project may arise conflicts between the investor and the community.

**d) Suggestions/recommendations**

- ✓ Implement this project in a sparsely populated area or not inhabited and the rest be subdivided among the residents.
- ✓ The company should implement this project in an alternative site to safeguard the lives of learners and their future hopes as well as barring the community from the negative impacts.
- ✓ The project should not be implemented here for people to live in harmony in their ancestral lands.
- ✓ Compensate displaced persons.
- ✓ Provide the community with clean and safe drinking water before implementing in this project.

- ✓ Persons from the community around this project should be given priority in any job opening.
- ✓ Give youths jobs to reduce insecurity in the area.
- ✓ Buffer the community against adverse impacts of the proposed project.
- ✓ Construct a hospital/dispensary in the local areas.
- ✓ Salaries and remuneration should be reasonable.
- ✓ Support the people around the locale to eradicate poverty.
- ✓ The company needs to develop a plan of enhancing/facilitating community development oriented projects.
- ✓ Involve many more stakeholders before implementing the project.

### 10.2.5 Questionnaire survey responses from civil society groups working in the area

The following civil society groups responded to the questionnaire:-

1. MMUKADO –Harrison K. Katana
2. Mkuko CBO –Michael Charo Kaingu

Detailed responses from each of the respondent in this category are in appendix 19. The following is a summary of the responses:-

**a) Issues and concerns of the proposed salt works**

- ✓ The agreement between the company and community should be respected.
- ✓ Rights of squatters should be observed.
- ✓ Destruction of the environment (Vegetation clearance and or tree cutting).
- ✓ Displacement of locals should not be done and if so, compensation has to be given.
- ✓ Blockage of rivers/waterways and access roads should not occur.
- ✓ Corporate social responsibilities of the company in the area should be key part of the project.
- ✓ Prioritization of job opportunities for the community members.
- ✓ Systems should put in place to address emergency issues at the company.

**b) Potential Positive Impacts of the Proposed Al Sherman Salt Works Project**

- ✓ Employment opportunities will arise.
- ✓ Business opportunities shall emerge.
- ✓ Socio-infrastructural development shall occur.

- ✓ Corporate-social responsibility programs shall be undertaken in the neighborhood.
- ✓ Relationship between the salt investors and the community shall be enhanced for environmental sanity.

**c) Potential Negative Impacts of the Proposed Al Sherman Salt Works Project**

- ✓ Land conflicts between the investor and the community
- ✓ Deforestation.
- ✓ Land erosion.
- ✓ Change of watercourses and flooding.
- ✓ Environmental pollution.
- ✓ Poor waste management practices.
- ✓ Contamination of communal fresh water sources.

**d) Suggestions/Recommendations**

- ✓ Implementation of the proposed project should be restricted at the agreed site.
- ✓ Peaceful mechanisms should be sought in addressing the land and other emerging issues for the harmony of all parties involved.
- ✓ There should be no rush of implementing this project before addressing the residents' settlement concerns.
- ✓ The project is okay but the human rights should be respected.
- ✓ The management of the company should work hand in hand with the locals for the realization of its goals and objectives.
- ✓ Plant trees in open areas.
- ✓ Proper mechanism to manage wastes should be instituted.
- ✓ Buffer the community from the company's activities.
- ✓ Give priority to locals whenever opportunities arise at the company.
- ✓ The proposed project should be implemented within the confines of the environmental laws to respect the local ecological set up.

### 10.2.6 Questionnaire survey responses from Community Members

The following community members responded to the questionnaire

1. Edson Kahindi Nzai
2. Felix Yeri Kombe
3. John M. Mwendar
4. Florence Mramba
5. Valerian Chengo Kenga
6. Mathias Baraka
7. Albert Mlewa Mkare
8. Irene Janita Charo
9. Jeremiah Kivuno Ngumbao
10. Margaret Kadzo Katana

11. William Gona Kenga
12. Janet Ngonyo Mwambegu
13. Eunice Nyevu Baya
14. Eunice Sidi Thomas
15. Mary Karesa Maitha
16. Kahindi Mwaura Nguma
17. Ziro Jackson Wanje
18. Joseph Ndoro Kaingu
19. Harrison Kazungu Kenya
20. Kazungu Unda Kiraga
21. Elizabeth Baya Ngolo
22. Barawa Kafedha Khungumanga
23. Jumwa Ndege Masha
24. Festus Nyale Baya
25. Alikano Dariga Isumaeli
26. Kahindi Changawa Ngala
27. Jonathan Ngowa Masha
28. Kazungu Kadenge
29. Elvis Kazungu Kitsao
30. Gharama Charo Thoya
31. Maurice Lefani Wanje
32. Stanely Katana Goho
33. David Shukurani Joram
34. Bongo Martin Thoya
35. Mary Guyatho Gafo
36. Dickison Nyale
37. Emmanuel Gona Karisa
38. Katana Peter Madaba
39. Michael Jospeh Yeri
40. Said Abdalla Suleiman
41. Victor Kahindi Luganje
42. Festus Kalu Kithi
43. Mwanakambo Chiringa Dena
44. Gladys Riziki Lazaro
45. Peterson Kalu Thinga
46. Baraka Dickson Fondo
47. Kalume Katana Sanzua
48. Khadija David Yeri
49. Humphery Karisa Charo
50. Musa Katana Radhi
51. Said Emmanuel Kayaah Yeri
52. Changawa Masha Wanje
53. Margaret Luganje
54. Lamington Charo Kadenge
55. Kanze Mweni Maitha
56. Zawadi Charo Jefwa
57. Jefwa Saidi Charo
58. David Mure Yaa
59. Changawa Masha Wanje

Detailed responses from each of the respondent in this category are in appendix 20.

**a) Issues and concerns of the proposed salt works**

- ✓ Loss of communal lands and the squatter problem.
- ✓ The project should not be implemented before the agreement between the community and the project implementers is fulfilled.
- ✓ Salinity of water in the area will increase and thus the company needs to provide alternative water sources.

- ✓ A lot trees shall be cut or vegetation cleared which will affect the climatic condition of the area.
- ✓ Marine and other breeding sites shall be destroyed.
- ✓ Agricultural production will decline.
- ✓ Access roads will be blocked.
- ✓ Watercourses shall be blocked resulting in floods.
- ✓ Pollution.
- ✓ The host community should be given priority in case of job openings.
- ✓ Long period taken to implement the corporate social responsibilities.
- ✓ Long term impacts of harvesting salt within the host community.

**b) Potential positive impacts of the proposed salt works**

- ✓ Creation of employment opportunities.
- ✓ Socio-cultural interactions will occur.
- ✓ Possible donors to community projects.
- ✓ Revenue generation to the government.
- ✓ Economic growth and urbanization of the area.
- ✓ Improved living standards of people working directly or indirectly as well as their associates.
- ✓ Environmental rehabilitation programs may be initiated.

**c) Potential negative impacts of the proposed salt works project**

- ✓ Loss of land for settlement.
- ✓ Displacement of persons
- ✓ Loss of grazing lands.
- ✓ The project will lead to scarcity of clean and safe drinking water in the area.
- ✓ Decline in agricultural production.
- ✓ Distortion of the landscape.
- ✓ Soil erosion.
- ✓ Massive clearance of vegetation cover.
- ✓ Blockage of watercourses will lead to floods in the area.
- ✓ Access roads/paths may be blocked.
- ✓ Implementation of the proposed project will change the area climate.
- ✓ Pollution.

- ✓ Poor waste management practices.
- ✓ Deterioration of people's health.
- ✓ Livelihoods like fishing shall be affected.
- ✓ Increased poverty in the community as livelihoods will have been destroyed.
- ✓ Loss of important tree and animal species.
- ✓ Child labour.
- ✓ Unfavorable employment terms for employees and working conditions.
- ✓ Accidents and injuries during project implementation.
- ✓ The local socio-cultural practices may be watered down due to the socio-cultural interaction with the outside world.

**d) Suggestions/recommendations**

- ✓ The company should respect the agreement between them and residents of not displacing persons before implementing this proposed project.
- ✓ The work plan of the proposed project should be availed to the residents before implementing the proposed project.
- ✓ The project should be implemented as long as it does not interfere with the livelihood of the locals.
- ✓ The proponent should seek the blessings of the host community before commencing the project.
- ✓ The issues and concerns should be addressed and the project be implemented as the accruing benefits are immense.
- ✓ Peaceful means should be sought while addressing the land and emerging issues during project implementation.
- ✓ Buffer the residents from the activities of the company.
- ✓ Access to the public beaches should be provided.
- ✓ The environmental and social concerns raised should be addressed before implementing this proposed project.

### 10.3. Written submissions

One written submission (appendix 21) was received from Mr. Sholo Benjamini Kambi, a resident of Muyu Wa Kae area.

# 11. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

## 11.1 Impact identification and predication

The type, scale and location of the proposed project guided the scope of the impact identification. The direct and indirect project-related impacts on the environment and local community and residual impacts were considered during the assessment of impacts. The extent of impact covers the project site, specific project activity at particular period and affect areas beyond the project site. Duration in which the impact takes place is also considered in the evaluation of the impact. The period can be specific to the period of certain activities or could be related to the occupancy period of the project development. Thus, in terms of duration an impact can be viewed as a short, medium, long term impact or permanent. Impact can affect biodiversity partially or completely. For instance only small part of habitat, ecological processes or small population of species can be destroyed by the impact. Thus, magnitude of an impact was evaluated as proportion of the environmental entity affected. The probability of the impact to happen was derived from the frequency of the activity and frequency of impacts. The four characteristics described above were used to synthesise significance of the impact as shown in impact significance assessment criteria (figure 11) that is used to generate the risk assessment matrix (figure 12).

**EXTENT**

| | |
|---|---|
| Localized (At localized scale and a few hectares in extent) | 1 |
| Study area (The proposed site and its immediate environs) | 2 |
| Regional (County and Regional level) | 3 |
| National (Country) | 4 |
| International (Beyond Kenya) | 5 |

**MAGNITUDE**

| | |
|---|---|
| Small and will have no effect on the environment | 0 |
| Minor and will not result in an impact on the processes | 2 |
| Low and will cause a slight impact on the processes | 4 |
| Moderate and will result in process continuing but in a modified way | 6 |
| High (processes are altered to the extent that they temporarily cease) | 8 |
| Very high and results in complete destruction of patterns and permanent cessation of the processes | 10 |

| DURATION | | PROBABILITY | |
|---|---|---|---|
| Very short (0 – 1 Years) | 1 | Highly improbable (<20% chance of occurring) | 1 |
| Short (1 – 5 Years) | 2 | Improbable (20 – 40% chance of occurring) | 2 |
| Medium term (5 – 15 years) | 3 | Probable (40% - 70% chance of occurring) | 3 |
| Long term (>15 years) | 4 | Highly probable (>70% - 90% chance of occurring) | 4 |
| Permanent | 5 | Definite (>90% chance of occurring) | 5 |

**Figure 11: Impact significance assessment criteria**

### 11.2 Determination the environmental and social risk of the impacts

The environmental and social risk of each of the identified impact was calculated by multiplying impact consequence by impact probability. Impact consequence is the summation of the extent of the impact, its duration and magnitude as shown in the risk assessment matrix below.

| | | CONSEQUENCE (Extent+Duration+Magnitude) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| PROBABILITY | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 |
| | 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 |
| | 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 |
| | 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |

**Figure 12: Risk assessment matrix**

**NOTE 1**: Risk = Consequence x Probability

**NOTE 2:** Consequence = Extent + Duration + Magnitude

**NOTE 3**: Confidence assessment (low, medium and high) based on combination of available information and expert judgement

**Low impact (<30)** this impact would not have a direct influence on the decision to implement the proposed project

**Medium impact (30-60)** the impact could influence the decision to implement the proposed project unless the impact is effectively mitigated

**High impact (>60)** the impact will have a direct influence on the decision to implement the proposed project

## 11.3 Potential Environmental Impacts

The implementation of the proposed salt works will potentially result in environmental impacts that will affect the biophysical environment. The **biophysical environment** includes living things (bio), such as plants and animals, and non-living things (physical), such as rocks, soils and water. The biophysical environment is made up of four parts: the atmosphere, hydrosphere, lithosphere and biosphere. Interactions occur between the four spheres. The **atmosphere** refers to the whole mass of air surrounding the earth. At a local level it refers to the air of a locality. The **hydrosphere** is the portion of the earth that is composed of water in all forms i.e. running water, ice and water vapour. The lithosphere refers to the rocks and soils on the crust of the earth. The **biosphere** is the zone of the earth and adjoining parts of the atmosphere in which plants and animals exist.

### 11.3.1 Potential negative environmental impacts during construction phase of the proposed salt works

Constructions of the proposed salt works within the open (unoccupied areas of land L.R.No. 13536) will potential result to the following negative impacts to the biophysical environment:-

- ✓ Negative impacts on local flora
- ✓ Negative impacts on local fauna
- ✓ Negative impacts on local hydrology
- ✓ Negative impacts on local air quality
- ✓ Negative impacts on local soils disturbance
- ✓ Noise and vibration from site equipment use
- ✓ Construction phase waste impacts

#### 11.3.1.1 Potential negative impacts on local flora

Vegetation at the proposed project site includes trees, shrubs, herbs, climbers, grasses and sedge. Trees at the proposed project site include *Adansonia digitata*, *Tamarindus indica*, *Manilkara sansibarensis*, *Suregada zanzibariensis*, *Manilkara mochisia*, *Grewia bicolour*, *Dobera glabra*, *Ziziphus mauritiana*, *Flacourtia indica*, *Berchemia discolour* among others. Shrubs include at the proposed project site include *Cassia occidentalis*, *Ricinus communis*, *Salvadora persica*, *Strychnos spinosa*, *Flueggea virosa*,, *Thilachium africanum*, *Lannea*

*alata among others.* Grasses at the proposed project site include *Eragrostis cilliari, Heliotropium steudneri, Dactylotenium aegyptica and Sida ovate.* Herbs at the proposed project site include *Ocimum suave, Cassia occidentalis, Aerva lantana, Solanum incunum* among others. Implementation of the proposed salt works will require that vegetation at the proposed project site be cleared to pave way for the construction of the salt works.

Clearing of the vegetation at the proposed project site will result in loss of environmental and ecological services derived from the vegetation. The environmental services that will be lost include reduction in local carbon sink, loss of local shade and loss of local wind break. Ecological services likely to be lost include loss of soil conservation as tree roots bind soil aggregates thus minimising soil erosion, nitrogen fixing, and windbreak. Potential negative environmental impacts likely to result from vegetation clearing from the proposed project site will include:-

- ✓ Direct loss of native vegetation abundance and biodiversity due to the clearing of vegetation within the proposed project area
- ✓ Direct and indirect loss of fauna abundance and biodiversity through habitat loss resulting from vegetation clearance.
- ✓ Diminishing of local carbon sink resulting in reduced area capacity of carbon sequestration.
- ✓ Destruction and fragmentation of fauna and avifauna habitats that may result in migration of the affected species that will disrupt local food chain.
- ✓ Overall reduction of flora in the area and overall loss and/or reduction of ecological and economic services derived from the lost floral species.
- ✓ Loss and or reduced foliage for local fauna species that will negatively impact on the growth, reproduction and development of the affected faunal species.

An assessment of the environmental risk associated with vegetation loss from the project site as a result of implementation of the proposed project was informed by the identified potential negative impacts. The assessment was done using the risk assessment matrix. The confidence of assessment of negative impacts to vegetation when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated in table 11 below.

**Table 11: Assessment of environmental risk of vegetation loss from project site**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 10 |
| Duration of impact | 5 |

| | |
|---|---|
| Probability of impact | 5 |
| Risk = (Extent + Magnitude + Duration) x Probability | 85 |
| Environmental risk of site vegetation clearing | High impact |

The outcome of the assessment of the environmental risk associated with site vegetation clearing and resulting potential negative impacts of vegetation loss from the proposed project site is high. This implies impacts associated with vegetation clearing from the proposed project site could have a direct influence on the decision to implement/ not implement the proposed project.

**11.3.1.2 Potential negative impacts on local fauna**

Fauna at the proposed project site include herpetofauna mainly reptiles and amphibians, invertebrate mainly insect pollinators; beetles, ants, crustaceans, and avifauna. Reptiles and amphibians at the proposed project site include Black-lined plated lizard (*Gerrhosaurus nigrolineatus*), Puff Adder (*Bitis arietans)*, Black mamba (*Latastia longicaudata*), Flap-necked chameleon, python and green mamba. Invertebrates observed at the proposed project site include pollinators of the bee family mainly *Apis melifera*, butterflies mainly *Papilio demodocus*, *Junonia oenone* and *Euphaedra neophron.* Others include Green Grasshopper (*Byblia ilithyia*). Crustaceans observed include snails and crabs while avifauna at the site include Golden Pipit (*Tmetothylacus tenellus),* Malindi Pipit (*Anthus melindae),* Spotted Morning-thrush (*Cichladusa guttata),* Cattle Egret (*Bubulcus ibis),* Namaqua Dove (*Oena capensis)* among others.

Implementation of the proposed salt works will involve activities that will likely negatively affect ecological fauna species within the proposed project site. Project activities such as vegetation clearing, excavation and removal of top soil, creation of ponds, compaction and levelling will significantly modify the ecological environment which the fauna species depend on for shelter, cover, nesting, roosting, feeding and reproduction. Creation of salt works structures such as ponds and dykes will affect the normal and routine movement of various faunal species within the proposed project site. Further these structures and associated activities could potentially damage ecological habitats and ecological processes in the environment of the proposed project site in the absence of their control.

Potential negative impacts to local ecological fauna as a result of implementation of the proposed project will include:-

- ✓ Direct and indirect loss of ecological fauna abundance and biodiversity through habitat loss resulting from vegetation clearance.
- ✓ Noise disturbances to fauna from project tools and machinery and vibration impacts as a result of machinery operation and construction related to operational noise that will affect feeding, roosting and reproduction of the ecological fauna.
- ✓ Ecosystem modification will result in disruption and or alteration of the feeding chains and feeding webs of ecological fauna species. Such disruption and or alteration will contribute to change in reproductive pattern and frequency of the affected fauna species.
- ✓ Direct restriction and hindrance of free movement of ecological fauna within the project site and its neighbourhoods. Such hindrances will affect access to feeding, roosting and areas used for reproduction purposes by the ecological fauna. The net result will be stress to the affected fauna species which could lead to species hibernation or migration.

An assessment of the environmental risk associated with local ecological fauna at the project site as a result of implementation of the proposed project was informed by the identified potential negative impacts to local ecological fauna. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts to ecological fauna when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 12 below.

**Table 12: Assessment of environmental risk of ecological fauna loss from project site**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 6 |
| Duration of impact | 4 |
| Probability of impact | 4 |
| Risk = (Extent + Magnitude + Duration) x Probability | 48 |
| Environmental risk of site vegetation clearing | Medium impact |

The outcome of the assessment of the environmental risk associated with ecological fauna loss from the proposed project site is medium. This implies that impacts associated with ecological fauna at the proposed project site could influence the decision to implement or not implement the proposed project unless the impacts are effectively mitigated.

### 11.3.1.3 Potential negative impacts on local hydrology

The proposed project site and its neighbourhood are served by both surface and underground water resources. The surface water resources at the project area are mainly ephemeral streams while underground water resources are mainly wells. There are four ephemeral streams that drain from the upper part of Adu area down to the proposed project site and its neighbourhood and into the creek. These ephemeral streams are Mbwageni Stream, Kwa Kubanda stream, Kwa Nzai stream and Magadi stream. The neighbourhood of the proposed project site has numerous wells. The wells are mainly shallow in nature and are located at Kakomani, Kwa Mikadzo, Kwa Bikache, Kwa Bicharo, Kithungu, Muyu Wa Kae, Kwa Kaloki, and Kwa Pili. Both the surface and ground water resources in the area define the hydrology of the project area and its immediate neighbourhood.

Hydrological benefits derived from these ephemeral streams include protection against flooding, filtering of pollutants, nutrient recycling, food and habitat to fish, recharge underground aquifers, supply drinking water and ensure continuous flow of water to surface water. Proposed project activities such as construction of dykes could negatively affect local hydrology especially the natural flow of ephemeral streams in the project area and the neighbourhood. Dykes could potentially block the natural flow of some of the ephemeral streams resulting in ponding, flooding and stagnation of stream water. The dykes can also alter the natural course of the stream by diverting the stream flow. Such blockage and diversion could affect the hydrological and biological connection of the streams to downstream waters.

Potential negative impacts to local hydrology as a result of implementation of the proposed project could include:-

- ✓ Flooding
- ✓ Diminishing downstream groundwater aquifer recharge
- ✓ Diminishing downstream continuous flow of clean water
- ✓ Reduced nutrient supply downstream that affect downstream fish
- ✓ Threat to downstream habitats
- ✓ Alteration in hydrology and hydrogeology of the environment of underlying aquifer(s), and ephemeral streams as a result of disturbance to groundwater-surface water connectivity

- ✓ Indirect surface water contamination risks associated with construction activities adjacent to ephemeral streams environment due to fuel spills from construction equipment, unmanaged storm water flows and run-off

An assessment of the environmental risk associated with local hydrology at the project site as a result of implementation of the proposed project was informed by the identified potential negative impacts to local hydrology. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts to local hydrology when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 13 below.

**Table 13: Assessment of environmental risk on local hydrology**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 4 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 30 |
| Environmental risk of site vegetation clearing | Medium impact |

The outcome of the assessment of the environmental risk associated with alteration of local hydrology of proposed project site is medium. This implies that impacts associated with local hydrology at the proposed project site could influence the decision to implement or not implement the proposed project unless the impacts are effectively mitigated.

#### 11.3.1.4 Negative impacts on local air quality

Implementation of the proposed salt works will involve a number of activities at the proposed project site. Some of the activities may potentially make the soil susceptible to wind erosion. Some of the activities that will be carried on site as part of the construction phase will include vegetation clearing and removal of all vegetation from the project site where the salt works will be constructed. Other activities will include stripping off of all overburden (top soil), excavation works to create ponds, construction of dykes among other activities. These stated activities will open the ground; make the soil loose and hence susceptible to wind action. During windy period loose soil particles from such an opened ground will easily be blown off and become airborne. Dust emissions may be generated as a result of earthwork activities, particularly during dry and windy conditions. Excessive dust generation may be detrimental to human health, reduce visual amenity as well as smother vegetation and impact fauna. An increase in airborne dust to the environment could be likely due to construction operations, onsite equipment movements on earth roads and clearing of flora and vegetation exposing

dust. However, dust generated from construction activities will likely be limited within the construction period and more so the windy days of the construction period and hence will be short term.

Potential negative impacts of such loose airborne particulate matter may include the following:-

- ✓ Smothering of vegetation foliage (food crops, and other vegetation in the neighbourhood) from dust mobilised through excavation and other soil disturbances.
- ✓ Reduced local visibility within the project site and immediate neighbourhood
- ✓ Eye irritation when fine dust particles being blown by the wind enter the eye.
- ✓ Chocking effect when airborne particulate matter is inhaled

An assessment of the environmental risk associated with local air quality pollution at the project site as a result of implementation of the proposed project was informed by the identified potential negative impacts resulting from local air quality pollution. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts to local air quality when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 14 below.

**Table 14: Assessment of environmental risk on local air quality**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 4 |
| Duration of impact | 2 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 24 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with alteration of ambient air quality of proposed project site is low. This implies that impacts associated with ambient air quality alteration at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

### 11.3.1.5 Negative impacts resulting from disturbance of local soils

Construction phase activities of the proposed salt works that are likely to have an impact on local soil will include clearing and removal of vegetation at the project site, uprooting of stumps of trees and other plants from site, stripping of overburden material, excavations works and compaction. Roots of plants bind soil aggregates together; when such are removed they loosen the soil particles and make them susceptible to agents of erosion. Further vegetation helps to increase infiltration of water into the soil when it rains as it minimizes

surface runoff, increases retention time for the water to percolate the soil. In the absence of vegetation cover on site, surface runoff will increase when it rains, this will result in soil erosion. Excavation works will loosen soil particles and make them susceptible to agents of erosion. Soil compaction will on the other hand reduce soil porosity hence reduce the ability of the compacted soil to absorb water when it rains. This will contribute to generation of surface runoff and hence soil erosion. Disturbance to local soils is likely to be limited to the project construction period hence will be short term. Resulting potential negative impacts could include the following:-

- ✓ Sediment runoff from newly exposed surfaces of the project site
- ✓ Sedimentation of the channels of the ephemeral streams, shallow wells and low lying areas
- ✓ Sedimentation of creeks
- ✓ Increased turbidity in creeks and associated waterways
- ✓ Sediment runoff/water pooling during heavy rainfall events

An assessment of the environmental risk associated with local soil disturbance at the project site as a result of implementation of the proposed project was informed by the identified potential negative impacts resulting associated with local soil disturbance. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from disturbance of local soil when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 15 below.

**Table 15: Assessment of environmental risk resulting from local soil disturbance**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 4 |
| Duration of impact | 2 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 21 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with disturbance of local soils at the proposed project site is low. This implies that impacts associated with local soil disturbance at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

#### 11.3.1.6 Noise and vibration from site equipment use

Construction equipment will be used at the proposed project site to shape the site to the desired salt works. The equipment will include those that will be used in site clearing, those

that will be used in stripping off the overburden (top soil), those that will be excavating the soil to create ponds, those that will be loading the stripped overburden and the excavated soil for removal from site and those that will be used for haulage of the overburden and the excavated soil from site and those that will be used to compact the site to create dykes and ponds. These equipment could include power saws, graders, excavators, backhoe loaders, wheeled loader, dump trucks and soil compactors. The use of these heavy equipment could result in noise and vibration on site and the immediate neighborhood.

Noise is unwanted or undesirable sound derived from point sources such as construction site while vibration is the transmission of low frequency energy through the medium of ground or buildings. Noise travels through the air as waves of minute air pressure fluctuations caused by vibration, and travels away from the noise source as an expanding spherical surface. As a result, the energy contained in a sound wave is spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source. Noise levels at different distances can be affected by factors such as topographic features, structural barriers and atmospheric conditions (wind speed and direction, humidity levels, and temperatures). Vibration consists of rapidly fluctuating motions; human response to vibration is a function of the average motion over a longer (but still short) time period, such as 1 second. Use of construction equipment at the site that are capable of resulting in noise and vibration will likely be for a short period limited to the construction phase. The potential resulting impact will therefore be short term. Potential impacts of noise and vibration from use of heavy construction equipment at the proposed project site could include the following:-

- ✓ Interfere with conversation and communication
- ✓ Hinder sleep.
- ✓ Interfere with recreation.
- ✓ Negate general work performance, thought and concentration.
- ✓ Negate relaxation.
- ✓ Causes annoyance.
- ✓ Induces hearing loss if heard long enough and is loud enough.

An assessment of the environmental risk associated with noise and vibration at the project site as a result of using heavy construction equipment at the proposed project was informed by the identified potential negative impacts associated with noise and vibration. The assessment was done using the risk assessment matrix. The confidence of assessment of

impacts resulting from noise and vibration when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 16 below.

**Table 16: Assessment of environmental risk resulting from noise and vibration**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 2 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 15 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with noise and vibration from construction equipment at the proposed project site is low. This implies that impacts associated with noise and vibration at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

#### 11.3.1.7 Construction phase waste impacts

Implementation of the proposed salt works will involve site clearing of vegetation, stripping of overburden (top soil), exaction and compaction to create the salt pans. These site preparation activities could generate waste. The use, servicing and maintenance of construction equipment at the site could also result in waste generation. Solid waste likely to be generated from site preparation activities could include plant and vegetation matter, soil and rock material. On the other hand servicing and maintenance of construction equipment could generate used oil and used oil filters. Waste that will be generated from the site during the construction phase will be for a limited period and hence short term. Potential negative impacts of the waste likely to be generated could include the following:-

- ✓ Sedimentation of the creek and ephemeral streams by the excavated soil
- ✓ Excavated soil could be a source of particulate matter that will alter local ambient air when windy
- ✓ Used oil spills on site could contaminate local soil, local surface and ground water sources.

An assessment of the environmental risk associated with construction phase waste at the project site as a result project activities was informed by the identified potential negative impacts associated with the waste likely to be generated. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from construction

phase waste when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 17 below.

**Table 17: Assessment of environmental risk resulting from construction phase waste**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 2 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 15 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with construction phase waste at the proposed project site is low. This implies that impacts associated with construction phase waste at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

### 11.3.2 Potential negative environmental impacts during the operational phase of the proposed salt works

The operational phase of the proposed project will potentially result in the following negative impacts:-

- Bitten generation, handling and disposal impacts
- Generation of effluent from raw salt washing
- Blockage of free flow of tides within the creek from by the constructed dykes
- Increased electricity demand and use
- Increase fresh water demand and use
- Impacts of waste generated in the operational phase

#### 11.3.2.1 Bitten generation, handling and disposal impacts

During the operation of the salt works, bitten or mother liquor will be generated. Bitten or mother liquor is the remnant concentrated brine that remains in the salt crystallizer once harvesting of the raw salt is complete. Considering that crystallization of salt in the crystallizers in the salt works takes place when the brine concentration (salinity) has significantly risen from the initial 3°Be -3.5°Be at the creek to about 26°Be -26 .5°Be in the crystallizers, the remnant brine (bitten) left in the crystallizers after raw salt has been harvested will be of high concentration too. Poor handling and disposal of such high concentrated brine (bitten) will potentially result in pollution of the environment. Potential

negative impacts likely to result from poor handling and disposal of the remnant bitten from the crystallizers after raw salt harvesting is completed may include the following:-

- ✓ Poorly disposed bitten (accidentally, by mistake or intentionally) can potentially contaminate local soils. The contamination will include its contribution to increase the salinity of the affected soil.
- ✓ Poorly disposed bitten (accidentally, by mistake or intentionally) may potentially pollute local surface and ground water resources. The local communicate depend on existing shallow wells for the supply of water for domestic use, watering their livestock among other use.
- ✓ Bitten disposed into the creek (accidentally, by mistake or intentionally) will potentially pollute the creek and result in death of marine life.
- ✓ Bitten if disposed in the creek (accidentally, by mistake or intentionally) will potentially pollute the mangroves within the creek. Mangroves within the creek are important spawning grounds for marine fisheries if the mangrove ecosystem within the creek is polluted then eggs of marine fisheries, juvenile fisheries and other marine organisms hatching and developing within the mangrove areas will be destroyed.

An assessment of the environmental risk associated with handling and disposal of bitten from operational phase was informed by the identified potential negative impacts associated with the bitten likely to be generated if poorly handled and disposed. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from handling and disposal of bitten from operation phase when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 18 below.

**Table 18: Assessment of environmental risk associated with handling and disposal of bitten**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 6 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 33 |
| Environmental risk of site vegetation clearing | Medium impact |

The outcome of the assessment of the environmental risk associated handling and disposal of bitten generated during the operational phase of the proposed project site is medium. This implies that impacts associated with handling and disposal of generated bitten at the proposed

project site could influence the decision to implement or not implement the proposed project unless the impacts are effectively mitigated.

#### 11.3.2.2 Generation of effluent from raw salt washing

The harvested raw salt will be washed to remove impurities such as soil and other sediments; this washing is the primary washing of the raw salt. The washing of the raw salt will be done using saturated brine to ensure that the salt does not dissolve. Salt washing will generate effluent; the generated effluent will have sediments. Poor handling and disposal of effluent generated from salt washing will potentially result in pollution of the environment. Potential negative impacts likely to result from poor handling and disposal effluent generated from raw salt washing may include the following:-

- ✓ Poorly disposed effluent generated from raw salt washing (accidentally, by mistake or intentionally) may potentially pollute local surface and ground water resources. The contamination could include saturation of the fresh water and the introduction of sediments in surface and ground water resources.
- ✓ Effluent generated from raw salt washing if disposed into the creek (accidentally, by mistake or intentionally) will potentially pollute the creek and result in death of marine life.

An assessment of the environmental risk associated with handling and disposal of effluent generated from raw salt washing was informed by the identified potential negative impacts associated with the effluent likely to be generated from raw salt washing if poorly handled and disposed. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from handling and disposal of effluent generated from raw salt washing when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 19 below.

**Table 19: Assessment of environmental risk associated with handling and disposal of effluent generated from raw salt washing**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 4 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 27 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with effluent generated from raw salt washing at the proposed project site is low. This implies that impacts associated

with raw salt washing at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

**11.3.2.3 Blockage of free flow of tides within the creek**

Construction of the salt works will involve construction of perimeter dykes and internal dykes. The perimeter dykes will define the boundary of the water ponds within the salt works while the internal dykes will separate different salt ponds (evaporator ponds, serving ponds and crystallizer ponds). The dykes will also serve as access roads within the salt works and also link the salt works with the neighbourhood. If a perimeter dyke will be constructed parallel to the coast line and that such a perimeter dyke will be adjacent to the highest water mark then such a dyke will potentially block free low of tides during low and high tide. Such blockage of free flow of tides will affect circulation of tides within the creek. Potential negative impacts likely to result from blockage of free from of tides could include:-

- ✓ Limitation of nutrient flow and availability in all parts of the creek which will result in deficiency of nutrients in the creek. The free flow of nutrients in the creek during high and low tides defines the healthiness of the creek. Tidal flow aid in nutrient distribution and or circulation within the creek. This ensures marine flora and fauna are well nourished and hence the healthiness of the creek.
- ✓ Limitation of movement of marine fauna within the creek. Tides aid in free movement of marine fauna within the creek. Movement to and away from feeding grounds of some marine fauna such as crabs and other crustaceans is dependent on the tidal flow. Some marine organisms come out to feed during low tide while others get their food/nutrient deposited in the feeding areas within the creek during high tide.
- ✓ Limitation in the breathing system of some mangrove species within the creek. Some mangrove species within the creek breathing is best during low tide using the aerial roots. These roots get exposed during low tide when waters within the creek are lowest exposing the aerial roots to atmospheric oxygen. Interference of the tidal flow within the creek will affect such mangrove species.

An assessment of the environmental risk associated with blockage of free tidal flow within the creek was informed by the identified potential negative impacts associated with the blockage. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from such blockage when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 20 below.

**Table 20: Assessment of environmental risk associated with blockage of free flow of tides within the creek**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 4 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 27 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with of tidal flow within the creek adjacent to the proposed project site is low. This implies that impacts associated with blockage of tidal flow within the creek adjacent to the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

#### 11.3.2.4 Increased electricity use

Electricity use within the salt works will be at various utility points. Electricity will be used to pump tidal brine during high tide from the intake channel at pump station one into the first set of ponds referred to as evaporator ponds (evaporators). Significant amount of electricity will be used at pump station one as at this station could have 3-5 pumps that will pump the captured tide brine and pump it out of the intake channel to the said evaporators. Pump station two will pump brine from the evaporator ponds into the serving ponds. Pump station two will be equipped with lifting pumps which will be using electricity. Pump station three will pump the brine into the last set of ponds called the crystallizers. This pump station will be equipped with lifting pumps that will be using electricity. The next utility point where electricity will be used will be at the washing of the harvested raw salt. The harvested raw salt will be washed at the salt wahery. The source of energy at the salt washery will be electricity. Other areas where electricity will be used will be in the site offices, in lighting of security lights. Cumulatively implementation of the proposed salt works will increase the amount of electricity demand and use in the area. Potential impacts likely to result from increased demand for electricity will include the following:-

- ✓ Potential rationing of electricity during peak demand hours. Electricity rationing will negatively affect other users especially during periods when they are put offline.
- ✓ Increased use of diesel generators to supplement power supply from the grid. Increase in use of diesel generators will translate to emission of greenhouse gases to the atmosphere. Such greenhouse emission contributes to global warming which eventually contribute to climate change.

An assessment of the environmental risk associated with increased electricity use at the proposed project site was informed by the identified potential negative impacts associated with the potential increase in electricity usage. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from such electricity use increase when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 21 below.

**Table 21: Assessment of environmental risk associated with increased demand and use of electricity**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 4 |
| Probability of impact | 4 |
| Risk = (Extent + Magnitude + Duration) x Probability | 28 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with increased in demand and use of electricity at the proposed project site is low. This implies that impacts associated with increased electricity demand and use at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

### 11.3.2.5 Increase in demand and use of freshwater

Freshwater demand and use during the operational phase of proposed salt will likely increase to meet the demand and requirement of workers and employees at the salt works among other uses. Uses of freshwater in the salt works will be for domestic (drinking, cooking), cleaning offices in the sanitary facilities among other areas. Sources of freshwater in the area are the community freshwater wells, the ephemeral streams and rainwater harvesting. Increased freshwater demand and use in the salt works may exert pressure on available local freshwater sources. Potential negative impacts that may result may include:-

- ✓ Competition of the limited freshwater from local sources will affect the local people negatively as they will be forced to walk long distances to access freshwater.
- ✓ Increased demand for freshwater may result in increased abstraction of freshwater from local freshwater wells. Increased abstraction of freshwater may exert pressure on the freshwater aquifer resulting in diminishing of the freshwater column which will finally result in intrusion of saline water in the aquifer hence the salinization of freshwater wells.

- ✓ Increased demand and use of freshwater in the area may contribute to decline in available freshwater for use by the local community, his may result in waterborne diseases within the local community.
- ✓ Increased demand and use of freshwater may necessitate the proponent to sink their own freshwater wells this will exert pressure on local freshwater aquifers.

An assessment of the environmental risk associated with increased demand and use of freshwater at the proposed project site was informed by the identified potential negative impacts associated with the potential increase in demand and usage of freshwater. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from such increase in demand and use of freshwater when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 22 below.

**Table 22: Assessment of environmental risk associated with increased demand and use of freshwater**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 4 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 27 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with increased in demand and use of freshwater at the proposed project site is low. This implies that impacts associated with increased freshwater demand and use at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

### 11.3.2.6 Impacts of waste generated in the operational phase

During the operational phase of the proposed salt works waste will likely be generated. The likely waste to be generated will be solid and liquid. Likely solid waste will be generated from de-silting of the salt ponds, repair of worn out timber linings of crystallizer ponds, equipment repair and maintenance. Potential solid waste that will be generated will therefore include sediments and other soil particles from de-silting of the ponds, pieces of worn-out timber from the lining of crystallizer ponds, scrap metal, used oil filters from service and maintenance of equipment such as tractors used in transportation of raw salt harvested. Liquid waste will be generated from servicing of equipment and sanitary facilities within the

salt works. Liquid waste likely to be generated will include used oil from equipment servicing and sewage from sanitary facilities. Potential negative impacts that may result from the waste likely to be generated may include:-

- ✓ Soil contamination as a result of spillage of used oil during equipment
- ✓ Surface and groundwater pollution if used oil spills into surface and ground water sources in the area.
- ✓ Faecal contamination of water sources if sewage from sanitary facilities drains into surface and ground water sources in the area.
- ✓ Injuries to workers and visitors from poorly kept scrap metal .

An assessment of the environmental risk associated with potential waste likely to be generated at the proposed project site was informed by the identified potential negative impacts associated with the potential waste. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from such potential waste when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 23 below.

**Table 23: Assessment of environmental risk associated with potential waste that could be generated**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 21 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with potential waste that could be generated at the proposed project site is low. This implies that impacts associated with the potential waste at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

### 11.4 Potential social impacts

The implementation of the proposed salt works will potentially result in social impacts that will affect the social environment. Social environment refers to the aggregate of social and cultural institutions, forms, patterns, and processes that influence the life of an individual or community. It includes the immediate physical and social setting in which people live or in which something happens or develops. Social environment also includes the culture that the

individual lives in, and the people and institutions with whom they interact. The interaction may be in person or through communication media. Potential social impacts can positive, negative or a combination of both. The potential social impacts can affect individuals, households or a community and they can be caused directly by project activities such as job creation or by environmental changes brought about by project activities such as increased ambient noise levels, reductions in air quality or alterations of the quality of local water sources.

### 11.4.1 Potential positive social impacts during construction phase of the proposed salt works

Potential positive social impacts likely during the construction phase of the proposed salt works could include:

- ✓ Employment opportunities for the local community
- ✓ Support to existing local businesses
- ✓ On job training opportunities for local people

#### 11.4.1.1 Employment opportunities for the local community

Implementation phase of the proposed salt works will likely create direct employment opportunities. Direct labour force will be required in ground clearing to remove vegetation and other plant matter from the proposed project site. Other direct employment opportunities will include in the area of equipment operators such employees who will be hired to operate equipment such as power saws, graders, excavators, backhoe loaders, wheeled loader, dump trucks and soil compactors. This and other construction activities will create employment to the local community. The project also will provide indirect employment opportunities, this will include food outlets who will benefit from clientele drawn from workers at the proposed project site, hotels and lodges offering night accommodation who will draw customers from the construction workers, other service providers such as motor vehicle garages, financial institutions, shop outlets, entertainment joints such as bars and clubs that will draw clients from construction workers.

#### 11.4.1.2 Support to existing local businesses

Once the construction of the proposed salt works begins and local people and others get employed in the project, they will be remunerated for their work. This will translate to more money available in the pocket hence improved purchasing power. Local businesses are likely to benefit from improved purchasing power of people in the area as a result of their remuneration. There is likelihood that there will be more money in the pockets of people who

will be directly or indirectly employed in the project and that part of the money will be spent in the local economy hence benefits local businesses.

#### 11.4.1.3 On job training opportunities for local people

Implementation of the proposed project will present an opportunity for non-skilled local people to be involved in the project and acquire skills through on-job training. Skills that will be acquired could include how to construct a stable dyke, how to construct salt ponds, how to arrange them in series for appropriate brine circulation to attain crystallization among money more. Further skilled but inexperienced local people will have an opportunity to sharpen their skills and develop experience.

### 11.4.2 Potential positive social impacts during the operational phase of the proposed salt works

Potential positive social impacts likely during the operational phase of the proposed salt works could include:

- ✓ Potential for local economic improvement
- ✓ On job training opportunities for local people
- ✓ Technology transfer
- ✓ Support for development of local community through company CSR programme
- ✓ Contributes to improved competition in the salt sub-sector
- ✓ Contribution to ensure Kenya is a net producer of salt
- ✓ Taxes to National government
- ✓ Taxes to Kilifi County Government
- ✓ Foreign exchange earnings through exports

#### 11.4.2.1 Potential for local economic improvement

Implementation of the proposed project and the actual operation of the salt works will over time contribute to improvement of local economy. Economic changes affecting job opportunities, business viability and potential to enhance incomes will be some of the key gains that will likely be expected over time. It is expected that majority of the labour force that will be required in the salt works will be sourced locally. This will translate to improved household income meaning households will be in a better position to educate their children, provide food, shelter and medicare.

#### 11.4.2.2 On job training opportunities for local people

Once operational, the salt works will present an opportunity for on job training of local people especially those from Mushumarini area and its catchment. The training could be in different sections of the salt works. Such training will enable local people build capacity, gain new knowledge and experience to be completive in the job market.

#### 11.4.2.3 Technology transfer

The proposed salt works will utilise solar energy technology in evaporating brine to salt. Further the salt works will use other technologies in salt washing and in other areas. The people who will be working in the salt works will have an opportunity to lean and interact with the various technological aspects that will be used in the salt works. Through such interaction there will be transfer of the technologies that will be used to the local people.

#### 11.4.2.4 Support for development of local community through company CSR programme

The proponent will be required to plough back part of the proceeds from the investment into the local community by putting in place appropriate corporate social responsibility programmes. Salt works are regulated under the Mining Act 2016 among other legislations, Regulation 12 (1) of the Mining (Community Development Agreement) Regulations, 2017 defines how the proponent is required to spend part of the proceeds from the salt works in community development. Once implemented, proceeds from the proposed salt works will contribute to local community development.

#### 11.4.2.5 Contributes to improved competition in the salt sub-sector

The proposed salt works will be a new entrant to the salt sub-sector. Once implemented the proposed salt works will increase the net salt being produced within the salt belt and in Kenya as a whole. If more salt will be available in the market, it is likely that prices will reduced based on the law of supply and demand.

#### 11.4.2.6 Increased salt production in the country

Implementation of the proposed salt works will contribute to increase the net amount of salt produced in Kenya. This will contribute to ensuring Kenya remains a net producer of salt and hence saving of foreign exchange use on salt imports.

#### 11.4.2.7 Payment of Taxes to National government

The proposed salt works once operational will contribute to revenue earnings to government through payment of statutory taxes to the national government.

#### 11.4.2.8 Payment of Taxes to County Government of Kilifi

The proponent will require permits and licenses that will be issued by the County Government of Kilifi. Farther the proponent will pay cess to the County Government of Kilifi.

#### 11.4.2.9 Foreign exchange earnings

It is envisaged that part of the salt that will be produced from the salt works will be exported out of the country. The salt exports will earn the country foreign exchange.

### 11.4.3 Potential negative social impacts during the construction phase of the proposed salt works

Potential negative social impacts likely during the construction phase of the proposed salt works could include:

- ✓ Fear of displacement of squatters
- ✓ Labour influx
- ✓ Occupational injuries and accidents to construction workers

#### 11.4.3.1 Fear of displacement of squatters

Land reference number 13536 part of which the proposed project will be implemented has squatters in some parts while some parts are open with no squatters. The proponent of the proposed project has made it clear to the local community that the proposed salt works will be implemented only in the open areas of the said land parcel where there are no squatters . The proponent has also said no squatter will be displaced as a result of the proposed project. Whereas the project proponent has made it clear to the local community during the community consultative meetings that the proposed salt works will only be developed in the open areas of L.R.No. 13536, and that no squatter will be displaced, there is lack of trust, fear and uncertainty within the local community that the proponent will not take from them (local community) their settled areas within L.R.No. 13536. Social impacts associated with displacement of squatters will include the following:-

- ✓ Loss of shelter rendering the affected families homeless.
- ✓ Disruption of family unity
- ✓ Disruption of community social fabric
- ✓ Loss of faming land for the family
- ✓ Loss of existing long term food trees such as coconuts

- ✓ Loss of revenue earned from sell of produce from food tree crops such as coconut trees.
- ✓ Reduced family income from agricultural activities which will translate to reduced family purchasing power.
- ✓ Loss of community water sources (community water wells).

**11.4.3.2 Labour influx during construction phase**

Construction phase of the proposed salt works will require both skilled and unskilled labour force to be involved in the construction and supply of associated goods and services to the project. In the event that the required skilled workforce and associated goods and services cannot be obtained locally either because of lack of technical skills, capacity and or lack of the required goods and services locally, in such a scenario, the required labour force (total or partial) and or required goods and services may be sourced outside the project area. In such a scenario, there is a potential for potential construction workers together with other people who will be supplying goods and services to the proposed project in the short term to migrate and settle at the project area resulting in a labour influx into the project area. Social impacts associated with such labour influx will include the following:-

- ✓ Local inflation of commodity prices: Labour influx may result in a significant increase in demand of goods and services at Mushumarini and its environs; this may result in local price hikes and/or crowding out of community consumers.
- ✓ Increased pressure on local accommodation facilities and rent hiking. Sourcing of construction labour outside the project area will necessitate that they seek for convenient accommodation close to the project site. This will increase pressure on available accommodation facilities. Further due to increased demand for accommodation there may be increase of accommodation prices and crowding out of local residents.
- ✓ Incidence of child labour and school dropout the proposed project will potentially increase opportunities for the host community to sell goods and services to the incoming workers. Depending on the nature of the social fabric and individual local family dynamics, such an opportunity can be a temptation to parents who can allow their children to produce and deliver these goods and services at the expense of attending school. This will lead to school dropout.
- ✓ Gender-based violence: Construction workers in construction sites such as that of the proposed project are young males although more recently young females are now joining the construction workforce. Based on this it is likely that construction staff to the

proposed project site may be male dominated. Young males who are away from home on the construction job will be separated from their family and act outside their normal sphere of social control. This can lead to inappropriate behaviour, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the host community.

#### 11.4.3.3 Occupational injuries and accidents to construction workers

Construction workers at the proposed project site will potentially be exposed to risks associated with the construction occupation. Some of the risks include exposure to fugitive dust, exposure to noise and vibrations. Some of these risks may result to accidents and or injuries to the workers at the proposed project site. Injuries can arise from use of tools and equipment and from the construction process. The injuries can include cuts and bruises, falling from height and colliding. Social impacts associated with occupational injuries and accidents will include the following:-

- ✓ Injury to and or loss of family breed winner translating to diminished family income which translates to reduced family purchasing power and ability to meet family financial obligations.
- ✓ Ailment/sickness to affected worker that negatively affects the productivity of such a worker hence reducing financial earnings of such a worker which translates to reduced purchasing power of such a worker.
- ✓ Loss of productive workforce resulting in reduced productivity.
- ✓ Increase in down time resulting in diminished productivity.

### 11.4.4 Potential negative social impacts during the operational phase of the proposed salt works

Potential negative social impacts likely during the operation phase of the proposed salt works could include:

- ✓ Blockage of community beach access routes
- ✓ Restricted access to local fish landing sites
- ✓ Blockage of local ephemeral streams that could cause flooding in the local communities
- ✓ Labour influx
- ✓ Occupational injuries and accidents

#### 11.4.4.1 Blockage of community beach access routes

There are three community beach access routes that pass through the proposed project site namely Msumarini-Kaswakini Beach Access Route, Solar Camp-Kaswakini Beach Access Route and Kadzuyuni-Mbwana-Saidi Beach Access Route. Implementation of the proposed project could potentially block these access routes. Such blockage will affect the free movement of community members to and from their homes to the creek areas. Social impacts associated with blockage of community beach access routes could include:-

- ✓ Walking longer distances to access beach landing sites for the affected community members.
- ✓ Longer time will be spent to access the beach reducing the available time for other social and community activities for affected community members.
- ✓ Fatigue as a result of walking long distances, this will reduce productivity.
- ✓ More time will be spent to access social amenities for affected community services
- ✓ Responding to emergency services will be affected as more time will be required.

#### 11.4.4.2 Restricted convenient access to local fish landing sites

There are five fish landing site used by members of the community, access to some of these fish landing sites is through sections of the proposed project site. These beach landing sites are Muyu wa Kae Fish Landing Site, Kaswakini Fish Landing Site, Kwa Japheth wa Jaji Fish Landing Site, Kwa Walad Fish Landing Site and Mbwana-Saidi Fish Landing Site. Implementation of the proposed salt works could potentially restrict convenient access to the local fish landing site. Social impacts associated with blockage of community beach access routes could include:-

- ✓ Longer time spent to access the local fish landing sites by fisher folk
- ✓ Longer time spent to deliver fish catch from the landing site to local market; this could affect the quality of the fish at the end.
- ✓ Fish mongers who majority are women will take longer time to access the fish landing sites to purchase freshly landed fish for their business.
- ✓ Increase in distance to be covered and time spent to access the fish landing sites could potentially increase the coast of fish making it less affordable to local community members.

#### 11.4.4.3 Blockage of local ephemeral streams

There are four ephemeral streams that drain from the upper part of Adu area down to the proposed project site and its neighbourhood and into the creek. These ephemeral streams are

Mbwageni Stream, Kwa Kubanda stream, Kwa Nzai stream and Magadi stream. Construction of dykes as part of the proposed project could potentially block these streams and change the natural courses. Potential impacts from blockage of local ephemeral streams could include:-

- ✓ Pooling of stream water at the point of blockage that could result in flooding. The flooding will negatively affect the neighbouring households.
- ✓ Severe flooding during heavy downpour will render adjacent roads impassable hence halting movement of people in the community.
- ✓ Local social amenities including schools, health facilities will temporarily be inaccessible during heavy flooding.
- ✓ Blocked streams could flood and the flood water could spread to neighbouring farms and destroys crops.

#### 11.4.4.4 Labour influx during operational phase

Operational phase will require labour force that will operate the salt works. Workers will be required at the salt ponds to man and operate the pumps at the pump stations; other will be required at the salt ponds to ensure circulation of brine is taking place as intended. Harvesting of raw salt is labour intensive; a considerable workforce will be required to harvest the raw salt from the crystallizers. Workers will also be required to operate the plant and equipment within the salt works. This includes drivers of tractors used in transporting harvested salts, operator of the salt washery among others. Other workers will be required to work in the security section where guarding of the entire salt works will be necessary while others will be required to work in the stores, workshops, garage and offices. By and large the salt works for it to be fully operational will require a significant number of workers. In the event that the required skilled workforce to work at the various parts of the salt works cannot be obtained locally either because of lack of technical skills or lack of local capacity, in such a scenario, part of the required labour force could be sourced from outside the project area to make up for the deficit. In such a scenario, there is a potential of people from other communities outside of the project area to migrate and settle at the project area resulting in a labour influx into the project area. Social impacts associated with such labour influx will include the following:-

#### 11.4.4.5 Occupational injuries and accidents

During the operational phase of the salt works, workers at the salt works could be exposed to injuries and accidents as a result of routine work, working environment, condition of working

tools and equipment, lack of technical knowhow and experience. Injuries and accidents to workers while working could be as a result different reasons including:-

- ✓ Poorly serviced and maintained working tools and equipment.
- ✓ Lack of experience and technical knowledge on the use and operation of the equipment.
- ✓ Lack of use of appropriate personal protective equipment when working.
- ✓ Poor conditions of the working environment.
- ✓ Poor state of the mind of workers when working such as absent mindedness, stress and fatigue.
- ✓ Poor remunerations.

Social impacts associated with occupational injuries and accidents will include the following:-

- ✓ Injury to and or loss of family breed winner translating to diminished family income which translates to reduced family purchasing power and ability to meet family financial obligations.
- ✓ Ailment/sickness to affected worker that negatively affects the productivity of such a worker hence reducing financial earnings of such a worker which translates to reduced purchasing power of such a worker.
- ✓ Loss of productive workforce resulting in reduced productivity.
- ✓ Increase in down time resulting in diminished productivity

# 12. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

## 12.1 Introduction

This environmental and social management plan (ESMP) outlines measures to be put in place during the construction, operation and decommissioning phases of the proposed salt works to enhance positive impacts and mitigate negative impacts, identifies compliance requirements, training and capability building needs, safeguards implementation and grievance redress mechanism. More specifically, the ESMP address the following;

- ✓ Policies that need to be developed and implemented by the proponent
- ✓ Maximization of identified potential positive impacts.
- ✓ Mitigation of identified potential negative social impacts
- ✓ Mitigation of identified potential negative environmental impacts
- ✓ Monitoring for compliance with the provisions of relevant national legislations.
- ✓ Training, capacity development, implementation schedule and related costs**.**
- ✓ Institutional arrangements for safeguard implementation and reporting.
- ✓ Grievances redress mechanism.

## 12.2 Working policies to be developed and documented by the proponent to guide project implementation

Implementation of the proposed project will require careful and sound environmental planning to ensure that all issues and concerns raised by all stakeholders are fully addressed and that all potential negative impacts are appropriately mitigated to ensure environmental sustainability. To achieve this; Al-Sherman Limited who is the project proponent must develop binding policies that will guide the implementation of the proposed project. The policies once developed will be vital in the following ways among others:

- ✓ The policies will enable management to develop and maintain sound relations with construction workers and the neighbouring community.
- ✓ The policies will enable management put in place measures and structures that will care for the safety, health and welfare of all workers on site and the neighbouring community residents.
- ✓ The policies will provide a framework for management to plan for, and put in place, monitoring programmes that will ensure conservation and protection of the environment, appropriate waste management and disposal.

- ✓ The policies will provide a framework for management to assume its corporate responsibility for its activities with regard to conservation of the environment as well as for the well-being of the local community.

The following policies will need to be developed and documented by the project proponent:-

- Environmental and sustainability policy
- Occupational Health and safety policy
- Stakeholder engagement and involvement policy
- Training and development policy
- Risk Management policy

### 12.2.1 Environmental and sustainability policy

The project proponent will develop and document an environmental and sustainability policy that will enable the project proponent to carry out the proposed project activities with the highest regard to the natural environment, social environmental and sustainable utilisation of environmental resources and other resources therein. The policy will be in line with applicable national legislations, international guidelines, standards and best practices. The environmental and sustainability policy will therefore cover the following, among other issues:-

- ✓ All national statutory requirements that the proponent will have to comply with before commencement of project implementation.
- ✓ Systems to be put in place to ensure continuous environmental improvement and performance throughout the project lifecycle.
- ✓ Comprehensive measures to be adopted by the proponent to ensure that utilisation of natural resources are optimal with measures in place to ensure resource availability for future generation.
- ✓ Awareness creation to the surrounding community regarding sustainable utilisation of natural resources, protection of sensitive ecosystems and bio-diversity maintenance for communal livelihood.
- ✓ Measures that provide for and ensure balancing between natural resource use, environmental conservation and economic development.

### 12.2.2 Occupational Health and safety policy

The project proponent will develop and document an Occupational Health and Safety Policy that ensures that the project proponent put in place appropriate measures that will ensure that the health, safety and welfare of all employees is cared for. Further the policy will also ensure

and safeguard the health and safety of the local community within the project catchment. In addition to this the policy will safeguards the health and safety of visitors to the project site and all other stakeholders. The policy will highlight the following, among others:-

- ✓ Identity health and safety requirements of employees that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines best practices.
- ✓ Identity health and safety requirements of local community within the project catchment area that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines best practices..
- ✓ Identity health and safety requirements of visitors to the project site that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines best practices..
- ✓ Identity health and safety requirements of all other stakeholders that need to be safeguarded in line with requirements and provisions of national legislations, international guidelines best practices..
- ✓ Identify ways and means of safeguarding health and safety of employees, local community, visitors to the project site and all other stakeholders.
- ✓ Identify safety measures that need to be put in place for all machines and equipment to be used.
- ✓ Identify required appropriate safety and rescue equipment to be availed in all work places within the project site.
- ✓ Document an elaborate emergency procedures and actions.
- ✓ Identify ways of ensure risk is eliminated and or minimized within the project site
- ✓ Document required training needs in safety.

### 12.2.3 Stakeholder engagement and involvement policy

The project proponent will develop and document a comprehensive stakeholder engagement and involvement policy that will ensure that the project proponent develops and maintains sound relations with all stakeholders. The policy will identify all the project stakeholders including those who have an interest in the project and those that are affected by the project. In additions the policy will provide a broad framework on how each of the stakeholders will be engaged and involved in the project. The policy will highlight the following, among others: - The stakeholder engagement and involvement policy will highlight the following, among others:-

- ✓ Identify all project stakeholders and potential stakeholders
- ✓ Identify the stake/interest/role of each of the identified stakeholder
- ✓ Outline how management will address each stakeholder needs/requirements/interests
- ✓ Document how project management will engage and involve each of the stakeholders
- ✓ Document how the stakeholders will interact among themselves and with the project

### 12.2.4 Training and development policy

The project proponent will develop and document a comprehensive training and development policy to meet project environmental protection and sustainability needs, project occupational safety and health needs, community health and safety safeguard needs, and other training and development needs that will be necessitated by project activities. The training and development policy will be aligned to applicable national legislations, international guidelines and best practices. The policy will highlight the following among other issues:-

- ✓ In-house training and capacity development for project workforce to address and meet required project environmental protection and sustainability threshold.
- ✓ In-house training and capacity development for project workforce to address and meet required project occupational safety and health threshold.
- ✓ In-house training and capacity development for project workforce to address and meet required community health and safety safeguard threshold.

### 12.2.5 Risk Management policy

The project proponent will develop and document a comprehensive risk management policy to address all potential risks that are likely to be associated with the project. The policy will document guidelines of addressing each potential risk with the aim of preventing the risk from occurring while spelling out measures to be taken to address the risk should it occur. The risk management policy will cover project related environmental risks, project related social risks, and project related occupational risks among other risks. The risk management policy will highlight the following among others:-

- ✓ Identify all project related risks to the natural environmental and social environment.
- ✓ Spell out measures to be made to prevent identified project risks
- ✓ Spell out remedial measures that will be taken should the risk occur

## 12.3 Proposed measures to enhance identified potential positive social impacts

Potential positive social impacts identified that will likely results from implementation of the proposed project during construction phase are:-

- ✓ Employment opportunities for the local community

- ✓ Support to existing local businesses
- ✓ On job training opportunities for local people

Potential positive social impacts identified that will likely results from implementation of the proposed project during operation phase are:-

- ✓ Potential for local economic improvement
- ✓ On job training opportunities for local people
- ✓ Technology transfer
- ✓ Support for development of local community through company CSR programme
- ✓ Contributes to improved competition in the salt sub-sector
- ✓ Contribution to ensure Kenya is a net producer of salt

Table 24 tabulates proposed measures to enhance the positive impacts.

### 12.4 Proposed mitigation measures for identified potential negative social impacts

Potential negative social impacts identified that will likely results from implementation of the proposed project during construction phase are:-

- ✓ Fear of displacement of squatters
- ✓ Labour influx
- ✓ Occupational injuries and accidents to construction workers

Potential negative social impacts identified that will likely results from implementation of the proposed project during operational phase are:-

- ✓ Blockage of community beach access routes
- ✓ Restricted access to local fish landing sites
- ✓ Blockage of local ephemeral streams
- ✓ Labour influx
- ✓ Occupational injuries and accidents

Table 25 tabulates proposed measures to mitigate the identified negative social impacts.

### 12.5 Proposed mitigation measures for identified potential negative environmental impacts

Identified potential negative impacts on local flora include:-

- ✓ Direct loss of native vegetation abundance and biodiversity.
- ✓ Direct and indirect loss of flora abundance.
- ✓ Diminishing of local carbon sink.
- ✓ Destruction and fragmentation of fauna and avifauna habitats.

- ✓ Overall reduction of flora in the area.
- ✓ Loss and or reduced foliage for local fauna species.

Table 26 tabulates proposed measures to mitigate the identified negative environmental impacts

**Table 24: Proposed measures to enhance identified positive social impacts**

| Potential positive impacts | Proposed measures to enhance the positive impacts |
|---|---|
| **Construction phase** | |
| Employment opportunities for the local community | - Local people from the project area to be given first priority to benefit in direct employment opportunities during the construction.<br>- Local women to be considered for employment during construction period, the contractor should ensure that the women are retained throughout the construction period to improve gender equality and reduce disparities. This should be put in place as part of the contractor's terms of reference and procedure for monitoring.<br>- There should be no sourcing of unskilled or semi-skilled construction labour force from outside the project area.<br>- Local youths of both male and female gender and local women who form the bulk of local labour force to be given utmost priority when sourcing construction labour force<br>- Both the male and female gender to be given equal priority by allocating equal slots for each gender when sourcing construction labour force.<br>- Daily checking of records of numbers of each gender working at the construction site to be done to ensure the ratios are maintained. |
| Support to existing local businesses | - Construction materials that is available locally to be sourced locally.<br>- Required services such as security to be sourced from locally owned security farms.<br>- Women from the local community who can over food catering services at the project site to be given priority. |

| Potential positive impacts | Proposed measures to enhance the positive impacts |
|---|---|
| On job training opportunities for local people | - Local youths to be given opportunities to learn and develop their skills at the project site.<br>- Local students in local tertiary institutions to be given opportunities for attachment at the project site to be exposed to the work environment<br>- Local youths who have graduated from tertiary institutions to be given internship positions to sharpen their skills and acquire experience. |
| **Operational phase** | |
| Potential for local economic improvement | - Local people working in the salt farm are encouraged to invest part of their earnings locally.<br>- Proponent encouraged to support local business by purchasing required goods and services locally |
| On job training opportunities for local people | - Local youths to be given opportunities to learn and develop their skills at the project site.<br>- Local students in local tertiary institutions to be given opportunities for attachment at the project site to be exposed to the work environment<br>- Local youths who have graduated from tertiary institutions to be given internship positions to sharpen their skills and acquire experience |
| Technology transfer | - Local people to be given priority to work in different sections of the salt works to learn new technological skills. |
| Support for development of local community through company CSR programme | - Proponent to invest part of the proceeds from the salt works as prescribed in Regulation 12 (1) of the Mining (Community Development Agreement) Regulations, 2017.<br>- Local community to appropriately prioritize community projects to be financed under the CSR programme. |
| Contributes to improved competition | - The project proponent to actively compete with similar salt works in the area and avoid colluding to |

| Potential positive impacts | Proposed measures to enhance the positive impacts |
|---|---|
| in the salt sub-sector | fix salt prices but rather allow the market forces of supply and demand determine the price. |
| Contribution to ensure Kenya is a net producer of salt | - Proponent to maximize on salt production by substantially investing in the salt works to significantly contribute to the salt produced in the country. |

**Table 25: Proposed measures to mitigate potential negative social impacts**

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| **Construction phase** | |
| Fear of displacement of squatters | - An appropriate platform to be provided which will bring together the local community together with their leadership and the project proponent to dialogue and address all fears and mistrust that could exist to clear it all prior to project implementation. The outcome of the dialogue to be documented in writing and be signed by both parties and appropriately witnessed for future reference.<br>- The project proponent to keep his word to the local community that the proposed project will only be undertaken in the open areas where there are no squatters and that no squatter will be removed from where they are currently.<br>- The proposed project to be strictly limited to the open areas as defined by the GPS coordinates in the provided drawing of the salt works ensuring that such areas do not have any squatters in them.<br>- No squatter should be displaced in the name of implementing the proposed project. |
| Labour influx | - First priority to be given to people from the local community when recruiting construction workers.<br>- Unskilled and semi-skilled labor to be strictly sourced from the local community<br>- Skilled labor to be sourced out of the local community when it has been ascertained that there is no person from the local community with such a skill. |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| Occupational injuries and accidents to construction workers | - All construction workers to be given appropriate personal protective equipment.<br>- All construction workers to first be trained on the appropriate use of the provided personal protective equipment.<br>- Project proponent to ensure each construction worker and visitors to the construction site also use the provided personal protective equipment.<br>- The project proponent to ensure that tools and equipment provided for use at the proposed construction site are well serviced and maintained.<br>- Project proponent to ensure that the construction site is free of hazards.<br>- The project proponent to ensure that among the construction workers are trained first aiders.<br>- Project proponent to ensure there is a fully equipped first aid station at the proposed project site.<br>- Project proponent to ensure appropriate measures are put in place to minimize fugitive dust by regularly flooding with water all dusty working areas especially during windy periods. |
| **Operational phase** | |
| Blockage of community beach access routes | - All the community beach access road that pass through sections of the proposed project site to be identified and appropriately documented.<br>- Design of the proposed salt works to factor in the access roads and ensure that they are not interfered with.<br>- In a case where an existing community beach access road has to be altered consultations with the local community together with the local leadership to be done first to obtain consensus prior to the change. |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| Restricted access to local fish landing sites | - The design of the salt works should ensure that access to local fish landing sites is not restricted.<br>- All the community beach access road that pass through sections of the proposed project site to be identified and appropriately documented.<br>- Design of the proposed salt works to factor in the access roads and ensure that they are not interfered with.<br>- In a case where an existing community beach access road has to be altered consultations with the local community together with the local leadership to be done first to obtain consensus prior to the change. |
| Blockage of local ephemeral streams | - The design of the salt works should ensure that no local ephemeral stream or any other surface water body flowing through sections of the proposed project site is blocked or its natural course altered.<br>- Project proponent to ensure that the proposed project to comply with all the provisions of the Water Act 2016 and its relevant subsidiary legislations. |
| Labour influx | - First priority to be given to people from the local community when recruiting workers for the operational phase.<br>- Unskilled and semi-skilled labor who will be hired during the operational phase of the proposed salt works to be strictly sourced from the local community<br>- During the operational phase of the proposed salt works, required skilled labor to be sourced out of the local community after exhausting those available in the local community. |
| Occupational injuries and accidents | - During operational phase all workers to be given appropriate personal protective equipment. |

| Potential negative social impact | Proposed mitigation measure |
|---|---|
| | - Workers hired during the operational phase to first be trained on the appropriate use of the provided personal protective equipment.<br>- Project proponent to ensure all operational phase workers and visitors to the salt works also use the provided personal protective equipment provided appropriately.<br>- The project proponent to ensure that tools and equipment provided for use during the operational phase of the salt works are well serviced and maintained.<br>- The project proponent to ensure that among the operational phase workers are trained first aiders.<br>- Project proponent to ensure there is a fully equipped first aid station at various sections of the proposed salt works. |

**Table 26: Proposed mitigation measures for identified negative environmental impacts**

| Potential negative environmental impacts | Proposed mitigation measures |
|---|---|
| **Construction phase** | |
| Negative impacts on local flora | - Vegetation to only be cleared from the actual areas where the salt ponds will be constructed and associate support infrastructure.<br>- Large trees such the Baobab within the project area to be preserved.<br>- Management to plant more trees and other vegetation in open areas of the project site were project activities will not be constructed.<br>- Management to support tree planting in areas outside the proposed project site such as in schools, health centers, compounds of religious institutions to boost |

| Potential negative environmental impacts | Proposed mitigation measures |
|---|---|
| | local green cover and carbon sink |
| Negative impacts on local fauna | - Ensuring there is no killing, trampling on, capturing and or removal of any fauna from the proposed project site during implementation.<br>- Minimize noise and vibration from equipment activity during construction phase that might course some fauna to migrate, hyparnate and or relocate.<br>- Maintain ecological sensitive vegetation that is essential for the sustenance of local fauna.<br>- Fauna feeding areas not with salt pan areas to be preserved by maintaining pockets of vegetation within the proposed project site in identified strategic areas. |
| Negative impacts on local hydrology | - There should be no blocking or diverting any of the ephemeral streams or any other surface water body passing through the proposed project site without the written permission of the Water Resources Authority.<br>- No encroachment to community water wells<br>- Proponent to ensure that proposed project activities do not compromise the existing community water wells quality |
| Negative impacts on local air quality | - Water sprinkling on dusty surfaces to be done to minimize fugitive dust<br>- Flooding with water opened areas for construction of salt pans to be done during dry spells and windy conditions to reduce clouds of dust.<br>- Ensure construction equipment are properly serviced and maintained to minimize |

| Potential negative environmental impacts | Proposed mitigation measures |
|---|---|
| | noise and vibration |
| Negative impacts on local soils disturbance | - Minimize soil erosion by planting vegetation on all open areas of the proposed project site where salt pans will not be constructed |
| Noise and vibration from site equipment use | - Ensure construction equipment are properly serviced and maintained to minimize noise and vibration |
| Construction phase waste impacts | - Excavated soil to be used in construction of dykes<br>- Waste generated from equipment servicing and maintenance to be managed and disposed as per the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.<br>- Provide waste receptacles for dropping of generated waste<br>- Where possible try to reduce potential waste generation, reused and or recycle generated waste. |
| **Operational phase** | |
| Bitten generation, handling and disposal impacts | - Generated bitten to be channeled into bitten ponds, ensure the bitten ponds are of adequate capacity to handle all the bitten to be generated in each salt harvesting season.<br>- Ensure the bitten ponds lined with appropriate clay soil and other impervious material to ensure no seepage of bitten into the soil.<br>- Allow the bitten in the bitten ponds to crystalize into low grade salt which can be harvested and sold as cattle salt |

| **Potential negative environmental impacts** | **Proposed mitigation measures** |
|---|---|
| Generation of effluent from raw salt washing | - Provide for adequate capacity settling ponds for handling effluent from salt washing<br>- Effluent from salt washing to be channeled into settling ponds were sediments settle down and the resulting clear saturated brine recycled back to salt washing<br>- Scoop out settled sediments from the settling ponds and use them to fill low-lying areas with the salt works |
| Blockage of free flow of tides within the creek from constructed dykes | - The design of the salt works should as much as possible avoid construction of perimeter dykes that are parallel to the coastline<br>- Avoid construction of dykes at or close to the high water mark |
| Increased electricity demand and use | - Water pumps at the pump stations to be solar energy power as opposed to drawing energy from the grid |
| Increase fresh water demand and use | - The proponent should not source freshwater to be used at the salt works from local community water wells. |
| Impacts of waste generated in the operational phase | - All solid waste to be generated to be handled and disposed as provide for in the Environmental Management and Coordination (Waste Management) Regulations 2006.<br>- Waste oil and any other liquid waste to be generated to be handled and disposed as provided for in the Environmental Management and Coordination (Water Quality) Regulations 2006. |

## 12.6 Environmental and Social Management Action Plans

In order for the proposed project to be socially acceptable and environmentally sustainable, the following management sub-plans complete with action plans are proposed. Thesub- plans and action plans will be operationalized throughout the lifecycle of the proposed project.

- ✓ Social protection and inclusion action plan
- ✓ Labor influx action plan
- ✓ Occupational safety and health action plan
- ✓ Biodiversity conservation action plan
- ✓ Water resources conservation action plan
- ✓ Waste management action plan
- ✓ Pollution prevention action plan

### 12.6.1 Social protection and inclusion action plan

The management objective of the social protection and inclusion action plan is to ensure that:-

- ✓ No community member currently occupying parts of Land reference number 13536, those adjacent to open areas of Land reference number 13536 where the proposed project is to be implemented or those adjacent to Land reference number 13536 is displaced as a result of implementation of the proposed project.
- ✓ No local community member is discriminated against when hiring workers to work at the proposed project site.

The social protection and inclusion action plan guiding principle will be continuous and sustained improvement in dialogue between the local community and the project proponent, building trust between the proponent and the community, safety and environmental performance, supported by regular feedback from all stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions, all stakeholders to be involved in actions taken. The proponent and the local community will need to dialogue on a number of issues including; squatter concerns and worries, working relationship between the company and the local community, potential environmental degradation, hiring and employment of people from the community and corporate social responsibility.

**Table 27: Social protection and inclusion action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| Fear of displacement of squatters | - Loss of shelter<br>- Disruption of family unity<br>- Disruption of community social fabric<br>- Loss of faming land for the family<br>- Loss of existing long term food trees such as coconuts<br>- Reduced family income from agricultural activities<br>- Loss of | - The local community together with their leadership and the project proponent to dialogue and address all fears and mistrust that could exist<br>- The project proponent to keep his word to the local community that the proposed project will only be undertaken in the open areas where there are no squatters.<br>- The proposed project to be strictly limited to the open areas<br>- No squatter should be displaced | - Company directors<br>- Leaders of the community<br>- Local Administration<br>- Local political leadership<br>- Local residents<br>- Local Civil Society groups | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | - Signed agreements between the local community and the proponent<br>- Proceedings of meetings held including minutes and attendance lists. | 300.000 to facilitate meetings and other dialogue platforms |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| | community water sources | | | | | |

### 12.6.2 Labour influx action plan

The management objective of the labour influx action plan is to ensure that:-

- ✓ Project activities and how the project will be managed and implemented should not contribute to labor influx.
- ✓ Required skilled and unskilled labor force for project implementation be sourced from the local community first prior to sourcing from elsewhere.
- ✓ Employment opportunities for the local community at the proposed project site should not contribute to child labour and school dropout in the area.
- ✓ Interaction of employees at the construction site with the local community should not result in inappropriate behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors.

The labour influx action plan guiding principle will be continuous and sustained improvement in project management activities, giving priority to local people when recruiting workers for the project, putting measures to safe guard local people from undue completion, safety and environmental performance, supported by regular feedback from all stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions, all stakeholders to be involved in actions in actualizing this action plan.

**Table 28: Labour influx action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| Influx of labour from areas outside the host community of the proposed project | - Loss of employment opportunity for host community members<br>- Local inflation of commodity prices<br>- Increased pressure on local accommodation facilities and rent hiking<br>- Incidence of child labour and school dropout<br>- Gender-based violence | - When employing people to work in the proposed project, first priority to be given to people from the local community.<br>- All required unskilled and semi-skilled labor to be strictly sourced from the local community<br>- Skilled labor to be sourced out of the local community when it has been ascertained that there is no person from the local community with such a skill. | - Company directors<br>- Leaders of the community<br>- Local Administration<br>- Local political leadership<br>- Local residents<br>- Local Civil Society groups | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | - Employment records | 100,000 for advertisement of jobs available for local people |

### 12.6.3 Occupational safety and health action plan

The management objective of the occupational safety and health action plan is to ensure that:-

- ✓ None of the construction workers at the construction site will be exposed to risks associated with the construction occupation.
- ✓ None of the visitors visiting the construction site will be exposed to risks associated with the construction sites.
- ✓ None of the neighbors of the construction site will be exposed to risks associated with the construction sites.

The occupational safety and health action plan guiding principle will be continuous and sustained improvement in working environment and conditions for all workers, visitors and neighbours of the construction site, safety and environmental performance, supported by regular feedback from all neighbours and stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions; workers and other stakeholders to be involved in actions that will be taken. Occupational safety and health matters of concern include injuries and accidents at the workplace, occupational diseases and illness, provision and use of personal protective equipment, access to welfare facilities, training in occupational safety and health.

**Table 29: Occupational safety and health action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| Occupational accidents, injuries and diseases arising from the work environment | - Injuries to workers at the workplace<br>- Loss of productive workforce<br>- Loss of man-hours<br>- Reduced productivity<br>- Delays in project implementation<br>- Company litigations for compensations<br>- Tainting of company image | - All workers to be provided with appropriate personal protective equipment.<br>- All workers to be trained in the appropriate use of personal protective equipment provided.<br>- Management to enforce on the use of provided personal protective equipment.<br>- Working equipment to be serviced and maintained on schedule.<br>- Workers to have the appropriate training on operation and use of work tools and equipment.<br>- Workers to be appropriately trained in safety<br>- .Equipment operating manuals to | - Company directors<br>- The project manager on site<br>- The company compliance Manager<br>- The project workers<br>- The local community | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life<br>- List of | - Equipment maintenance records<br>- Training records of workers<br>- Minutes of safety meetings<br>- Medical examination records of workers<br>- List of welfare facilities provided | 1,000,000.00 |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| | | be provided<br>- Welfare facilities such as first aid boxes, canteen, potable water, changing rooms to be provided and maintained in good condition.<br>- Pre- employment and post-employment medical examination of workers | | accidents, injuries and near miss at the workplace | | |

### 12.6.4 Biodiversity conservation action plan

Management objectives of the biodiversity conservation action plan are as follows:

- ✓ Minimisation and management of impacts on flora and vegetation not required to be cleared for construction works.
- ✓ Minimisation of ground disturbance
- ✓ Promotion of the growth of local species and a stable vegetation community through reducing access and maintenance of preserved areas
- ✓ Minimisation and management of impacts on terrestrial fauna that use the project site for feeding, roosting, camouflaging or nesting.
- ✓ Minimisation and management of impacts to terrestrial fauna habitats including their protection.
- ✓ Eliminate and or minimise potential entrapment, sickness, stress, injury or death to terrestrial fauna

The biodiversity conservation action plan guiding principle will be continuous and sustained improvement in local flora and fauna conservation and protection, improvement on site construction activities, safety and environmental performance, supported by regular feedback from all neighbours and stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions, all stakeholders to be involved in actions taken.

**Table 30: Biodiversity conservation action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| Vegetation clearing | - Direct loss of native vegetation abundance and biodiversity<br>- Diminishing of local carbon sink<br>- Destruction and fragmentation of fauna and avifauna habitats<br>- Loss and or reduced foliage for local fauna species. | - Vegetation to only be cleared from the actual areas where the salt ponds will be constructed and associate support infrastructure<br>- Large trees such the Baobab within the project area to be preserved<br>- Management to plant more trees and other vegetation in open areas<br>- Management to support tree planting in areas outside the proposed project site such as in schools, health centers, compounds of religious institutions | - Company directors<br>- The project manager on site<br>- The project workers<br>- The local community | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | Vegetation survey to be biannual throughout the project life. | 500,000 p.a |
| Disturbance of local fauna | - Loss of fauna roosting and nesting grounds | - Preserving key habitats of the fauna such as the large baobab trees. | - Company directors<br>- The project | The proposed mitigation measures to | Local fauna and avifauna habitat survey | 400,000 |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| habitats | - Loss of fauna feeding grounds<br>- Loss of protective cover for the fauna<br>- Disturbance of fauna breeding pattern | - Identifying feeding areas of the fauna including avifauna and preserving them by maintaining pockets of vegetation within the proposed project site in identified strategic fauna feeding areas.<br>- Ensuring there is no capturing and or removal of any fauna from the proposed project site during implementation.<br>- Minimising noise and vibration from equipment activity during construction phase that might course some fauna to hyparnate and or relocate.<br>- Maintain ecological sensitive vegetation that is essential for the sustenance of local fauna. | manager on site<br>- The project workers<br>- The local community | be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | biannual throughout the project life. | |

### 12.6.5 Water resources conservation action plan

The management objectives of water resources conservation action plan are as follows:-

- ✓ Protection of the ecosystem surrounding the project area
- ✓ Project activities not to adversely affect local hydrology
- ✓ Minimization and management of potential impacts to the quality of surface and underground water resources caused by project activities
- ✓ Maximization of the efficient use of water for the project
- ✓ Ensure the continued use of water resources
- ✓ Ensure no sediment, nutrients and pollutants being released off site

The water resources conservation action plan guiding principle will be continuous and sustained improvement in local water resource conservation and protection, improvement on site construction activities, safety and environmental performance, supported by regular feedback from all neighbours and stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions, all stakeholders to be involved in actions taken. The water resources at the proposed project site that will need to be protected and conserved include Mbwageni Stream, Kwa Kubanda stream, Kwa Nzai stream and Magadi stream, all identified wells including those located at Kakomani, Kwa Mikadzo, Kwa Bikache, Kwa Bicharo, Kithungu, Muyu Wa Kae, Kwa Kaloki, and Kwa Pili. and the ground water resources potential of the proposed project site.

**Table 31: Water resource conservation action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| Blockage of local ephemeral streams<br>- Pollution of local wells | - Flooding<br>- Diminishing downstream groundwater aquifer recharge<br>- Diminishing downstream continuous flow of clean water<br>- Reduced nutrient supply downstream<br>- Threat to downstream habitats<br>- Alteration of local hydrology<br>o Indirect | - No blocking or diverting any of the ephemeral streams.<br>- No encroachment to community water wells<br>- Proponent to ensure that proposed project activities do not compromise the existing community water wells quality | - Company directors<br>- The project manager on site<br>- The project workers<br>- The local community | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | Physical checking of the state of the water resources every six months | 200,000 p.a |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| | surface water contamination risks associated with construction activities | | | | | |

### 12.6.6 Waste management action plan

The management objectives of the waste management action plan are as follows:

- ✓ All solid waste to be generated from the proposed project site to be managed and disposed as provided for in the Environmental Management and Coordination (Waste Management) Regulations, 2006
- ✓ All liquid waste to be generated from the proposed project site to managed and disposed as provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006

The waste management action plan guiding principle will be continuous and sustained improvement in waste management and disposal activities, improvement on site construction activities, safety and environmental performance, supported by regular feedback from all neighbours and stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions, all stakeholders to be involved in actions taken.

**Table 32: Waste management action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| - Environmental pollution from poor disposal of bitten and effluent | - Pollution of fresh water sources<br>- Pollution of marine environment<br>- Contamination of local soils<br>- Pollution of fish hatcheries | - All solid waste to managed and disposed as provided for in the Environmental Management and Coordination (Waste Management) Regulations 2006.<br>- All liquid waste to be managed and disposed as provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006.<br>- All bitten generated to be drained into properly constructed bitten ponds which are lined with impermeable material at the bottom to ensure no ground seepage of the bitten.<br>- The bitten to be held in the bitten pond and be used to produce low | - Company directors<br>- The project manager on site<br>- The project workers<br>- The local community | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | - Quarterly sampling and analysis of the effluent to be carried out by accredited laboratory as outlined in the Environmental Management and coordination (Water Quality) | 200,000 p.a |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| | | grade salt i.e. cattle salt.<br>- There should be no disposal of any bitten at any time to the environment.<br>- Effluent from salt washing to be sent to settling ponds where particles settle down and before recycling back into the salt washing process..<br>- There should be no disposal of any effluent from salt washing at any time into the environment. | | | Regulations 2006 and reports submitted to NEMA | |

### 12.6.7 Pollution prevention action plan

Management objectives of the pollution prevention action plan are as follows:

- ✓ Project activities do no result in pollution of the environment in any form or way.
- ✓ All cases of pollution, then it should be handled as per the site pollution incident contingency plan.
- ✓ Appropriate measures be put in place to address any potential pollution including immediate reporting the pollution incident to NEMA and other relevant lead agencies

The pollution prevention action plan guiding principle will be continuous and sustained improvement in pollution prevention from proposed project activities, improvement on site construction activities, safety and environmental performance, supported by regular feedback from all neighbours and stakeholders through consultative meetings, management reviews and evaluations. To ensure adherence to the set conditions, all stakeholders to be involved in actions taken. Potential pollution that may arise from implementation of proposed project activities may include pollution of freshwater sources within and outside the proposed project site, air pollution, soil pollution, pollution of the marine environment, noise and dust pollution.

**Table 33: Pollution prevention management action plan**

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| - Air, water and soil pollution from proposed project activities | - Pollution of water resources<br>- Pollution of marine environment<br>- Contamination of local soils<br>- Air pollution | - All solid waste to managed and disposed as provided for in the Environmental Management and Coordination (Waste Management) Regulations 2006.<br>- All liquid waste to be managed and disposed as provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006.<br>- All bitten generated to be drained into properly constructed bitten ponds which are lined with impermeable material at the bottom to ensure no ground seepage of the bitten.<br>- The bitten to be held in the bitten | - Company directors<br>- The project manager on site<br>- The project workers<br>- The local community | The proposed mitigation measures to be employed concurrently with the implementation of the project, to be improved on and sustained throughout the project life | - Quarterly sampling and analysis of the effluent to be carried out by accredited laboratory as outlined in the Environmental Management and coordination (Water Quality) | 2,000,000 p.a |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| | | pond and be used to produce low grade salt i.e. cattle salt.<br>- There should be no disposal of any bitten at any time to the environment.<br>- Effluent from salt washing to be sent to settling tanks where particles settle down and before recycling back into the salt washing process..<br>- There should be no disposal of any effluent from salt washing at any time into the environment.<br>- Salt pans under construction to be flooded with water to arrest dust pollution when dry and windy<br>- Construction equipment to be | | | Regulations 2006.<br>- Bi annual sampling and testing water from domestic sources to establish any change in the quality of domestic water sources<br>- Annual sampling and testing of local air quality | |

| Issue/Concern | Potential Negative Impacts | Proposed mitigation measures | Responsible Actors | Timeframe | Monitoring | Cost estimates KSH |
|---|---|---|---|---|---|---|
| | | appropriately serviced and maintained to minimise noise and vibration | | | | |

## 12.7 Environmental monitoring

### 12.7.1. Water quality monitoring

The current water quality of selected water wells being used by the local community for domestic purposes has been benchmarked. Monitoring of the quality of local well water as a source of water for domestic use by the local community will be carried out as provided for in the second schedule of the Environmental Management and Coordination (Water Quality) Regulations.2006 Legal notice Number 120. The following will be monitored:

**Table 34: Water quality monitoring parameters**

| Parameter | Results | |
|---|---|---|
| | Observed value | Guide value( maximum allowable) |
| pH | | 6.5-8.5 |
| Suspended solids | | 30 (mg/L) |
| Nitrates-$NO_3$ | | 10 (mg/L) |
| Ammonia-$NH_3$ | | 0.5 (mg/L) |
| Nitrite-$NO_2$ | | 3 (mg/L) |
| Total dissolved solids | | 1200 (mg/L) |
| E-coli | | Nil /100ml |
| Floride | | 1.5 (mg/L) |
| Phenols | | Nil (mg/L) |
| Arsenic | | 0.01 (mg/L) |
| Cadmium | | 0.01 (mg/L) |
| Lead | | 0.05 (mg/L) |
| Selenium | | 0.01 (mg/L) |
| Copper | | 0.05 (mg/L) |
| Zinc | | 1.5 (mg/L) |
| Alkyl benzl sulphonates | | 0.5 (mg/L) |
| Permanganate value | | 1.0 (mg/L) |

Source: The Environmental Management and Coordination (Water Quality) Regulations.2006 Legal notice Number 120

### 12.7.2 Noise and excessive vibrations monitoring

The noise levels should be monitored quarterly to ensure they are in line with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

**Table 35 Maximum permissible noise levels for constructions sites (Measurement taken within the facility).**

| Facility | | Maximum Noise Level Permitted (Leq) in dB(A) | |
|---|---|---|---|
| | | Day | Night |
| **i.** | Health facilities, educational institutions, homes for disabled etc. | 60 | 35 |
| **ii.** | Residential | 60 | 35 |
| **iii.** | Areas other than those prescribed in (i) and (ii) | 75 | 65 |

Timeframe: Day; 6:01am-6:00pm & Night; 6:01pm-6:00am

*Source: Second schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.*

### 12.7.3 Effluent discharge monitoring

The fourth schedule of the Environmental Management and Co-ordination (Water Quality) Regulations, 2006 lists the parameters to be monitored for Combined sewage (Domestic+ and Industrial effluent) as being; BOD, TSS, pH, Faecal Coliforms/Ecoli, Oil & Grease, COD, Colour/Dye/Pigment, Total Phosphorus, Ammonia (as N), Organic Nitrogen as N, Nitrate, Flow, Phenols, Sulphide/Sulphur, Total Chromium, Chromium VI, Chrome, Copper, Nickel, Zinc, Cn total, Fluorine, Free Available Chlorine, Cadmium, Lead, Iron, Tin, Silver, Gold, Iridium, Palladium, Rhodium, Ruthenium, Mercury, Aluminium, Arsenic, Selenium, Barium, Manganese, Tannin, Oil, Surfactants and any other parameters and/or discharging facilities as may be prescribed by the Authority from time to time. The project management will be monitoring separately the parameters of domestic sewage and effluent generated to ensure they are within the prescribed legal limits.

### 12.7.4 Air Quality Monitoring

Monitoring of particulate matter to ensure that the project activities adhere to the Ambient Air Quality requirements at Property Boundary for General Pollutants. Part (b) of the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations,

2014 require that the particulate matter for at a property boundary should not exceed 70µg/$m^3$. The proponent will be monitoring particulate matter from the project site during construction phase to ensure they are within the legal limits.

### 12.7.5 Solid waste disposal monitoring

Monitor the type of solid waste generated, quantity of solid waste generated, frequency of collection and disposal, where the waste is disposed and proof of waste tracking documents in the format provided in FORM III schedule one of the Environmental Management and Co-Ordination (Waste Management) Regulations 2006. This monitoring is to be done monthly.

### 12.7.6 Tree planting monitoring

Monitoring the number of trees cut per specie, monitoring the number of trees planted per specie and the survival rate. This should be done biannually during the construction phase of the project for the first five years.

## 12.8 Training and capacity building

The following training and capacity building is proposed:-

- Sensitization of the Proponent, and Contractor who will undertake the construction of the proposed project on the importance of the ESMP, its contents, how it is applied and who is responsible for the implementation of each part of the ESMP.
- Training and capacity building for contractor and the construction labour on the importance and proper use of PPEs.
- Training and capacity building for Contractor and construction labour on acceptable waste management practices.
- Training and capacity building of the construction site occupational safety and health committee on construction site occupational safety and health requirements and individual safety obligations.
- Training and capacity building of construction site first aid.
- Training and capacity building on construction site fire safety
- Sensitization on HIV and AIDS and other communicable diseases to construction workforce.

## 12.9 Institutional arrangements for safeguard implementation and reporting

### 12.9.1 Institutional arrangement

The responsibility of implementation of the safeguards proposed in this ESMP is vested on the project proponent who is Al-Sherman Limited. The National Environment Management

Authority (NEMA) and other relevant lead agencies will enforce compliance. During the construction phase, the contractor will be required to prepare monthly progress reports and submit the progress reports to the proponent on the contractor's contractual obligations on safeguards implementation responsibilities specified in the ESMP. The contractor will be supervised on the ground directly by the proponent or proponent representative as will be determined by the proponent. The proponent will be required to promptly addressing and responding to improvement orders issued by NEMA and other lead agencies. The proponent will be required to prepare periodic monitoring reports and annual environmental audit reports and submit these reports to NEMA and other relevant lead agencies.

### 12.9.2 Reporting obligations

The following reports will be prepared:

- ✓ Monthly progress reports by the contractor on the implementation status of every obligation of the contractor on safeguards implementation specified in the ESMP. These monthly reports will be submitted by the contractor to the Proponent.
- ✓ Periodic monitoring reports to be prepared by the proponent and submitted to NEMA on the status of :-
  - i) Air quality as prescribed in the Environmental Management and Coordination (Air Quality) Regulations, 2014.
  - ii) Noise and excessive vibration as prescribed in the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.
  - iii) Effluent discharge into the environment as prescribed in the Environmental Management and Coordination (Water Quality) Regulation, 2006.
  - iv) Water Quality as prescribed in the Environmental Management and Coordination (Water Quality) Regulation, 2006.
  - v) Waste management as prescribed in the Environmental Management and Coordination (Waste Management) Regulation, 2006.
- ✓ Initial Environmental and Social Audit report to be prepared by the proponent and submitted to NEMA in the first year of operation of the project to confirm the efficacy and adequacy of the ESMP.
- ✓ Self-environmental and social audit report to be prepared annually by the proponent and submitted to NEMA to report on the progress of implementation of the ESMP.

- ✓ Reports responding to NEMA improvement orders to be prepared by the proponent and submitted to NEMA as and when such improvement orders are issued.

### 12.10 Environmental auditing

The project proponent will carry out an initial environmental audit and Annual Environmental Audit for the project activities as provided for in the Environmental (Impact Assessment and Audit) Regulations 2003. The Audits will serve to confirm the efficacy and adequacy of the proposed Environmental Management Plan.

### 12.11 Decommissioning

Decommissioning of the project will involve terminating project operations, dismantling of all project equipment and allied infrastructure and rehabilitating the site to the original status. Before decommissioning will be done, the Project Management will communicate in writing to the National Environment Management Authority stating their intension to decommission and provide a detailed decommissioning plan for approval.

### 12.12 Grievance redress mechanism

#### 12.12.1 Definition and purpose

This Grievance redress Mechanism (GRM) is defined as organizational system and resources established as part of the ESMP for the implementation of the proposed construction of a salt works to receive and address concerns about the impact of the implementation of the proposed salt works project on any stakeholder (persons, groups or communities). The stakeholder input handled through this GRM system and procedures are called "grievances," "complaints," or "feedback," This GRM is intended to be accessible, collaborative, expeditious, and effective in resolving concerns raised by any stakeholder on the implementation and operation of the proposed salt works project through dialogue, joint fact-finding, negotiation, and problem solving. This GRM will be the "first line" of response to stakeholder concerns that have not been addressed and or prevented by proactive stakeholder engagement.

#### 12.12.2 Formation

There is a need for the formation and establishment of a GRM to address grievances that may arise during the implementation and operation of the proposed salt works project. This need has been necessitated by the fact that currently there is no GRM to address grievances that may arise during the project cycle. There is need therefore to establish this GRM as part of the ESMP implementation process to ensure transparency and accountability where an

individual, a group or a community is aggrieved by the implementation of aspects of the proposed project. Formation of the GRM will entail formation of a committee at the local level (project implementation level).

### 12.12.3 GRM Committee Members

It is proposed that there be one level of this grievance redress process; the level will have a committee established with defined membership. The level will be at the local (project implementation level). The GRM committee will comprise of experienced and competent persons able to command the respect of affected persons, groups and communities. Membership of the GRM Committee at the local level will be as follows:-

- ✓ Member of County Assembly, Adu Ward (or appointed representative).
- ✓ Ward Administrator Adu Ward (or appointed representative).
- ✓ Liaison Officer MP's Office Magarini Constituency representing Adu Ward
- ✓ Chief Fundi Isa Location
- ✓ Assistant Chief, Marereni Sub- Location
- ✓ Two members (one male and one female) to represent Nyumba Kumi
- ✓ Two Members (one male and one female) to represent Wazee Wa Mtaa
- ✓ Two youth representatives (one male and one female).
- ✓ One representative of people with disability
- ✓ One representative of civil society ( from a civil society active in the project area)
- ✓ Two members (one male and one female) from the local CSR Salt Sub-Sector Committee.
- ✓ Three members from the project proponent
- ✓ Liaison Officer Kenya Association of Manufactures (KAM) Salt Belt Sub-Sector

The members will select the Chair Person and the Secretary for the Committee.

### 12.12.4 Mode of Communication

The grievances will be submitted to the Grievance Redress Committee at the local level in any of the following ways:-through SMS, written letter, email or raise the grievance in a local meeting where the grievance will be captured in the form of minutes to be forwarded to the local Grievance Redress Committee.

### 12.12.5 Process

When there is a grievance at the project area, it is proposed that the affected individual(s), affected group(s), or affected community will be required to forward complaints to the local GRC. The local GRC will be required to record the grievances and call a meeting of the committee to resolve the grievances. The next step in the process will be for the GRC to meet and resolve each grievance forwarded to them at the project community level 7-10 working days of receiving the grievance.

### 12.12.6 Information Awareness

To ensure appropriate dissemination of information, transparency and accountability, it is proposed that this grievance redress mechanism procedure be printed in both English and Swahili and posted on a notice board at the project site, Chief's Office and MCA's Office.

### 12.12.7 Record keeping

All submitted complaints will be captured in a register or a project file at the local project level by the GRC. This file should always be in the custody of the GRC. The status of the grievances submitted and the grievance redress at the site will be reported on a regular basis to the affected persons as soon as it is practically possible as well as other stakeholders.

# 13. CONCLUSIONS AND RECOMMENDATIONS

## 13.1 Conclusions

The following are some of the conclusions drawn from the assessment findings of the proposed implementation of the proposed salt works by Al-Sherman Limited in the open areas of land parcel number 13536.

- ✓ There is evidence on the ground that there was a previous unsuccessful attempt to construct a salt works at the proposed open areas of land parcel number 13536. The evidence includes an old site camp with dilapidated buildings, three dilapidated pumps stations, disintegrating dykes and silted salt ponds.
- ✓ Implementation of the proposed salt works will likely have both positive and negative social and environmental impacts.
- ✓ Consultations with the local community residing within land parcel number 13536 but outside the open areas of the same parcel of land where the proposed salt works is to be constructed have fears that the project proponent could displace them.
- ✓ There is an urgent need for a platform for a structured dialogue and negotiation between the local community and the proponent to address fears, concerns and suggestions raised by the local community during the stakeholder consultation forum.
- ✓ Some of the area ephemeral streams drain through sections of the proposed project site, implementation of the proposed project could potentially affect their natural channels.
- ✓ There are significant numbers of community shallow water wells in the occupied areas of parcel number 13536. There are concerns from the local community that the proposed project could affect the quality of water in the wells.
- ✓ Some community beach access routes pass through sections of the proposed project site. There concerns from the local community that implementation of the proposed project could potentially block beach access roads.
- ✓ The proposed project site is rich in biodiversity including flora, reptiles, insects, avifauna among others. Implementation of the proposed project will negatively affect area biodiversity.
- ✓ Nine out of the thirteen potential negative environmental impacts likely to result from implementation of the proposed salt works are of low magnitude; three of the thirteen impacts are of moderate magnitude one is of high magnitude.

- ✓ The proposed mitigation measures if systematically implemented and strict environmental monitoring carried out as proposed the potential negatively impacts likely to result will be effectively be either eliminated and or reduced to acceptable legal limits.

### 13.2 Recommendations

The following recommendations are suggested:

- ✓ The project proponent, Al-Sherman Limited to be patient and wait until the EIA Process is concluded and should only begin implementation of the proposed salt works when the National Environment Management Authority issues an Environmental Impact Assessment License to the project proponent for the implementation of the proposed project.
- ✓ There is a need for a suitable platform for dialogue between the proponent and the leadership of the local community to iron out pertinent issues raised by the community.
- ✓ Mitigation measures proposed to be fully implemented and monitored to ensure environmental protection and sustainability once the proposed project is licensed for implementation

## 14. REFERENCE LIST

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