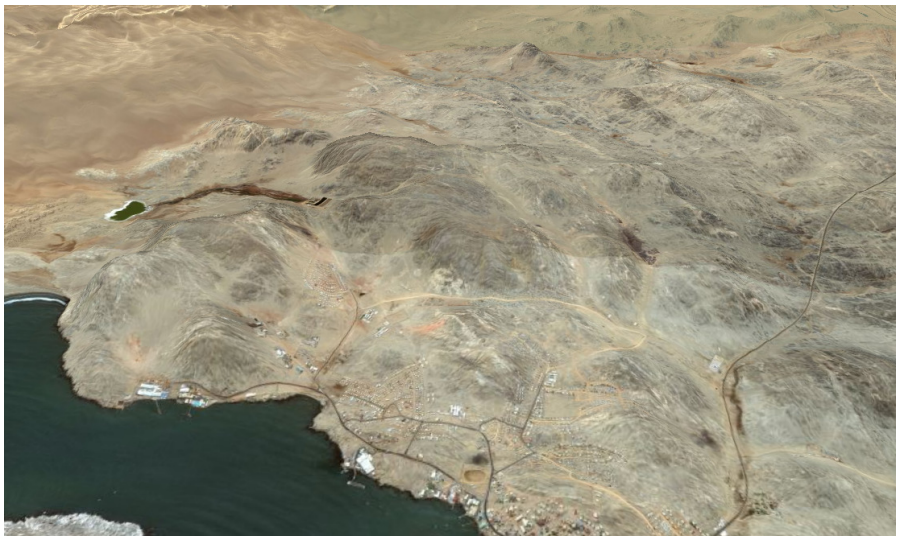
PROPOSED SEAL PROCESSING PLANT IN LUDERITZ

EFFLUENT AND BIOWASTE ASSESSMENT



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ABBREVIATIONS

BOD	biological oxygen demand
COD	chemical oxygen demand
µg/l	microgram per litre
m^3/h	cubic meter per hour
TDS	total dissolved solids
ml	millilitre
mg/l	milligram per litre

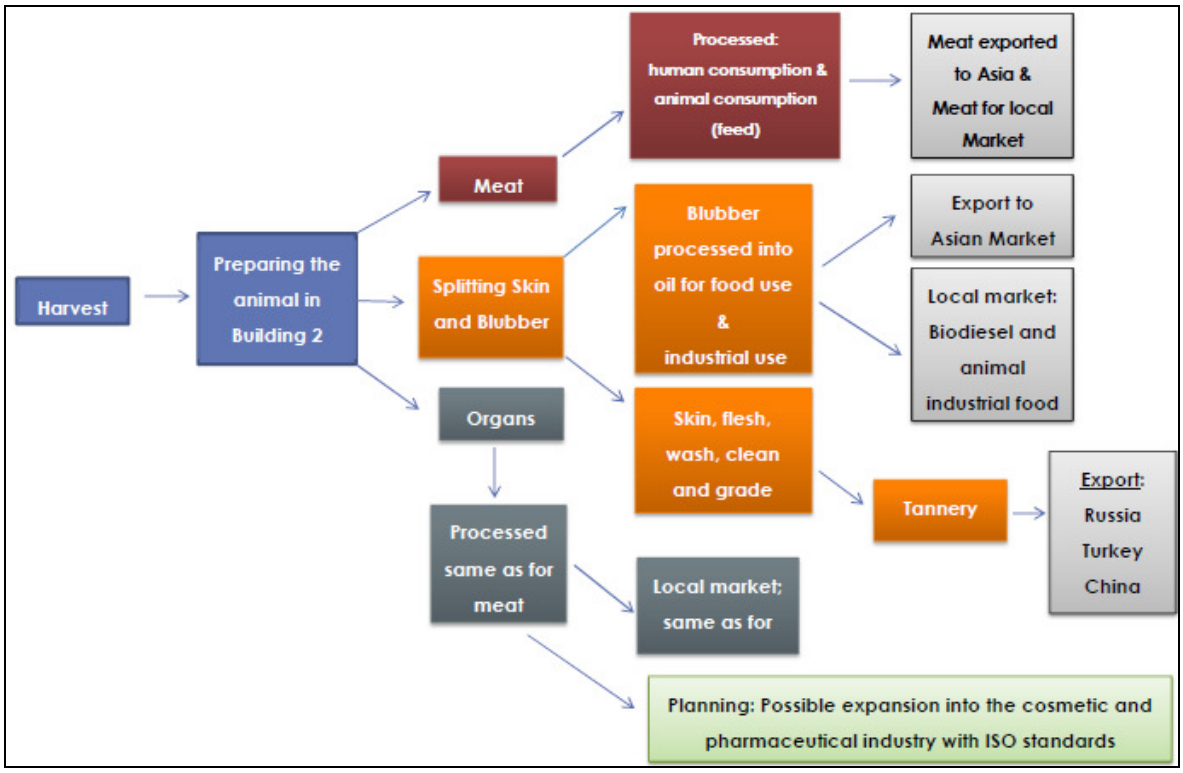
1. INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was requested by Enviro Dynamics to conduct an effluent and biowaste evaluation of the proposed Seal Processing Plant in Lüderitz for Uukumwe Youth Empowerment Consortium (Pty) Ltd.

The processing plant will be built in the Nautilus Industrial Area of Lüderitz on a 3363 m² serviced erf (erf nr 802). Previously the site was used as a factory, but only its ruin remains visible.

The plant will be erected to accommodate the different processes needed to process the seals. Products produced are likely to stay in its primary form, but with added elements to diversify usage. For example,

- Skins will be pelted then sold.
- Oil from the blubber can be made fit for human and animal consumption, as well as create biodiesel.
- The meat will be processed and placed on the local and international markets.
- Organ processing and market set-off is still in the early planning stage.



2. SCOPE OF WORK

The scope of the study was to:

- Evaluate and characterise the proposed effluent water and biowaste generating processes based on engineering information provided - focusing specifically on chemicals used, disposal methods and proposed treatment methods;
- Document any relevant policy/legislation which the proponent would need to be aware of relating to water effluent and bio-waste;
- Provide a description and assessment of the significance of any significant effects including anticipated cumulative effects of the proposal and its alternatives (consider advantages/disadvantages on the environment and communities);
- Suggest relevant recommendations / mitigation measures to minimize impacts or enhance benefits associated with this section of the development;

- Describe the way forward and/or requirements for further detailed investigation in the assessment phase (if necessary); and
- Include descriptions of any assumptions, uncertainties and gaps in knowledge.

3. POLICY AND LEGAL FRAMEWORK

This section presents an overview of the most relevant legislation related to Ground and Surface water with the aim of informing the applicant of the legal requirements pertaining to the project for all phases of development.

3.1. The Constitution of the Republic of Namibia, 1990

Article 95 of Namibia's constitution provides that:

"The State shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at the following:

(l) management of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future; in particular the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian territory."

This article recommends that a relatively high level of environmental protection is called for in respect of groundwater utilization, management, pollution control and waste management.

3.2. Environmental Management Act of Namibia (2007)

The Act provides a broad definition to the term "*environment*" - land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, palaentological or social values.

3.3. Water Act (No. 54 of 1956)

The purpose of the Act is "to consolidate and amend the laws relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in certain respects, of the use of sea water for certain purposes; for the control of certain activities on or in water in certain areas; for the control of activities which may alter the natural occurrence of certain types of atmospheric precipitation; for the control, in certain respects, of the establishment or the extension of townships in certain areas; and for incidental matters." It further controls the disposal of effluent.

The Act makes it a criminal offence to:

"*Pollute fresh water or the sea in a way that makes the water less fit for any purpose for which it is or could be used by people, including use for the propagation of fish or other aquatic life, or use for recreational or other legitimate purpose*."

This Act requires that water used for industrial purposes be purified before it is returned to a public stream or the sea, so as to conform with requirements (General Standard Quality restrictions as laid out in Government Gazette R553 of 5 April 1962) established by the Minister of Agriculture, Water and Rural Development, but can be exempted from doing so, subject to certain conditions. The Minister may issue a permit to allow the discharge of waste water, effluent or waste in an un-purified or semi-purified state into a public stream, subject to such conditions that it does not cause pollution of "public or other water, including sea water" or provided that the discharge point is sufficiently close to the sea that no person will be prejudicially, and no aquatic or marine life detrimentally, affected by such discharge.

TABLE 5 GENERAL STANDARDS FOR ARTICLE 21 PERMITS (EFFLUENTS)

Arsenic	0.5 mg/l as As
Biological Oxygen Demand (BOD)	no value given
Boron	1.0 mg/l as B
Chemical Oxygen Demand (COD)	75 mg / l as O
Chlorine, residual	0.1 mg/l as Cl_2
Chromium, hexavalent	50 µg/l as Cr(VI)
Chromium, total	500 µg/l as Cr
Copper	1.0 mg/l as Cu
Cyanide	500 µg/l as CN
Oxygen, Absorbed (OA)	10 mg / l as O*
Oxygen, Dissolved (DO)	at least 75% saturation**
Detergents, Surfactants, Tensides	0.5 mg/l as MBAS
Fats, Oil & Grease (FOG)	2.5 mg/l (!gravimetric method)
Fluoride	1.0 mg/l as F
Free & Saline Ammonia	10 mg/l as N
Lead	1.0 mg/l as Pb
pH	5.5 – 9.5
Phenolic Compounds	100 µg/l as phenol
Phosphate	1.0 mg/l as P
Sodium	not more than 90 mg/l Na more than influent
Sulphide	1.0 mg/l as S
Temperature	35°C
Total Dissolved Solids (TDS)	not more than 500 mg /l more than influent
Total Suspended Solids (TSS)	25 mg/l
Typical faecal Coli.	no typical coli should be counted per 100 ml
Zinc	5.0 mg/l as Zn

** Also known as Permanganate Value (or PV).*

*** In Windhoek the saturation level is at approx. 9 mg/l O_2.*

3.4. Water Resources Management Act (No. 24 of 2004) (Not implemented yet)

The Act aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level.

The purpose of this Act is to broadly control the use and conservation of water for domestic, agricultural, urban and industrial purposes; to control, in certain respects, the use of sea water; to control certain activities on or in water in certain areas; and to control activities which may alter the natural occurrence of certain types of atmospheric precipitation.

3.5. Soil Conservation Act 76 Of 1969

The Act aims to consolidate and amend the law relating to the combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of the water sources in the Republic and the territory of South-West Africa; and to provide for matters incidental thereto.

3.6. Pollution Control and Waste Management Bill (guideline only)

Part 7 states that any person who sells, stores, transports or uses any hazardous substances or products containing hazardous substances shall notify the competent authority, in accordance with sub-section (2), of the presence and quantity of those substances.

The competent authority for the purposes of section 74 shall maintain a register of substances notified in accordance with that section and the register shall be maintained in accordance with the provisions.

Part 8 provides for emergency preparedness by the person handling hazardous substances, through emergency response plans.

3.7. Public Health Act (No. 36 of 1919)

Section 111 it is the duty of every local authority to take all lawful, necessary and reasonably practical measures for preventing the pollution so as to endanger health of any supply of water within its district and to take measures against any person so polluting any such supply.

Section 119 states that no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health.

Section 132 empowers the Minister to make regulations regarding, inter alia, the drainage of land or premises, the disposal of liquids and the removal and disposal of rubbish, refuse, manure and waste matters as well as regarding the establishment and carrying on of factories or trade premises which are liable to cause offensive smells or effluvia or to discharge liquid or other material liable to cause such smells or effluvia or to pollute streams and prohibiting the establishment or carrying on of such factories in unsuitable localities.

3.8. Local Authorities Act, 1992 (Act No. 23 of 1992)

The Act aims to provide for the determination, for purposes of local government, of local authority councils; the establishment of such local authority councils; and to define the powers, duties and functions of local authority councils; and to provide for incidental matters.

This act prohibits, without municipal approval, the discharge into the sewer system of the following:

- any gas or steam;
- any liquid other than domestic waste water of a temperature higher than 40 degrees Celsius;
- any petrol or oil or substances containing petrol or oil;
- any liquid refuse from any abattoir;
- any chemical refuse;
- any industrial, trade or manufacturing waste.

Section 94(1) of the Local Authorities Act, 1992, empowers the local authority, after consultation with the Minister responsible for local government, to promulgate regulations in relation to, the supply, distribution and use of water in its local authority area, including the protection of water from pollution.

Lüderitz Towns Council made regulations regarding waste management in Notice No. 248; Town of Lüderitz: Regulations relating to waste management: Local Authorities Act, 1992.

3.9. Namibian Ports Authority Act 2 of 1994

Functions given to the Ports Authority by the Act are:

"*undertake the management and control of ports and lighthouses in Namibia and the provision of facilities and services related thereto; and to provide for matters incidental thereto.*"

This includes:

(i) to protect the environment within its areas of jurisdiction;

Regulation 47 prohibits the deposit of foreign material. The regulation states:

"(1) No person shall throw, discard, discharge or deposit or allow to be thrown, discarded, discharged or deposited within a port any article, material or liquid which is liable to cause an obstruction, danger, pollution or nuisance."

3.10. *Marine Resources Act (No. 27* of 2000)

Section 52 (4) of this Act provides the following:

(d) Any person who, in a marine reserve, without having been granted permission to do so under section 51(3), dredges or extracts sand or gravel, discharges or deposits waste or any other polluting matter, or constructs or erects any building or structure or in any way disturbs, alters or destroys the natural environment, shall be guilty of an offence and liable on conviction to a fine not exceeding N$500,000.

And/or

(e) discharges in or allows to enter or permits to be discharged in Namibian waters anything which is or may be injurious to marine resources or which may disturb or change the ecological balance in any area of the sea, or which may detrimentally affect the marketability of marine resources, or which may hinder their harvesting shall be guilty of an offence and liable on conviction to a fine not exceeding N$500,000.

4. MUNICIPAL EFFLUENT TREATMENT

Effluent from the town of Lüderitz was treated until fairly recently in two oxidation ponds. A more formal treatment system was constructed not only to enhance the sewerage treatment system to environmentally acceptable standards, but to also to reclaim water for reuse due to the scarcity of potable water in the area.

The design capacity of the new plant is to treat a total of 2,000 m³ per day of raw sewage, split and treated in two trains. Major treatment processes and equipment provided for include the following:

- Mechanical Screening to remove large objects such as rags, plastic bags and other foreign objects;
- Anaerobic ponds for anaerobic digestion of the raw sewage;
- Activated sludge reactor that incorporates an anaerobic, anoxic and aerobic zone;
- Secondary clarification in circular, up flow clarifiers with a rotating mechanical scraper bridge;
- Disinfection with chlorine gas.

The plant is fitted with all necessary nitrate-rich, return activated sludge and waste activated sludge measures to ensure that efficient nitrification/denitrification and phosphate removal can be achieved.

5. MUNICIPAL WASTE DISPOSAL

The current Lüderitz waste disposal facility is a normal dump site and does not have hazardous waste handling capabilities. At this stage the facility does not have an Environmental Clearance Certificate and therefore the validity of any disposal permits are questionable.

Communication with Mr. De Wee from the Town Council indicated that the disposal of meat and oil from current seal processing activities will be stopped and not allowed. The same will therefore be true for future similar developments.

6. PROPOSED WASTE AND EFFLUENT HANDLING

This section describes the Effluent handling process proposed by the Proponent.

Domestic Sewage: Domestic sewage from toilets and washrooms will go directly to the Municipality sewage system.

Plant Clean Up: Water used for clean-up will go to a water separator tank equipped with screen to remove solids, tissue particles, and hair. Those will be removed and go to a landfill.

Process Effluent: Water coming from the process effluent will go to the same flow as the water from plant clean up. The total quantity used per day should be maximum for the clean-up plant and process 10,000 litres.

Waste Sawdust: Sawdust used to clean and dry the pelts could either be burnt in the boiler or go to the landfill.

Packing Waste: Cardboard, empty salt and sawdust bags, etc. will be recycled if possible, or go to a landfill. Plastic barrels and containers will be recycled.

7. ASSESSMENT OF IMPACTS

The purpose of this section is to assess and identify the most pertinent environmental impacts and provides possible mitigation measures that are expected from the construction, operational and decommissioning activities of the facility.

The following assessment methodology (Table 1) will be used to examine each impact identified.

Table 1. Criteria for Impact Evaluation (Directorate of Environmental Affairs, 2008)

Risk Event	**Description of the risk that may lead to an impact.**
Nature of Impact	Reviews the type of effect that The Development have on the relevant component of the environment and includes "**what is affected and how?**"
Status (+ or -)	**Positive** - environment overall will benefit from the impact **Negative** - environment overall will be adversely affected by the impact **Neutral** - environment overall will not be affected
Extent	**Site specific** **Local** (limited to within 15km of the area) **Regional** (limited to ~100km radius) **National** (limited to within the borders of Namibia) **International** (extending beyond Namibia's borders)
Duration	**Very Short** (days, <3 days) **Short** (days, 3 days – 1 year) **Medium** (months, 1 - 5 year) **Long** (years, 5 - 20 years) **Permanent** (>20 years – life of The Development)
Intensity	**No lasting effect** (No environmental functions and processes are affected) **Minor effects** (The environment functions, but in a modified manner) **Moderate effects** (Environmental functions and processes are altered to such extent that they temporarily cease) **Serious effects** (where environmental functions and processes are altered such that they permanently cease and/or exceed legal standards/requirements)
Probability	Refers to the probability that a specific impact will happen following a risk event. **Improbable** (low likelihood) **Probable** (distinct possibility) **Highly probable** (most likely)

	Definite (impact will occur regardless of prevention measures)
Prevention	Measures to reduce the probability of an impact occurring.
Significance (no mitigation)	**None** (A concern or potential impact that, upon evaluation, is found to have no significant impact at all.) **Low** (Any magnitude, impacts will be localised and temporary. Accordingly the impact is not expected to require amendment to the project design.) **Medium** (Impacts of moderate magnitude locally to regionally in the short term. Accordingly the impact is expected to require modification of the project design or alternative mitigation.) **High** (Impacts of high magnitude locally and in the long term and/or regionally and beyond. Accordingly the impact could have a 'no go' implication for the project unless mitigation or re-design is practically achievable.)
Mitigation	Description of possible mitigation measures
Significance (with mitigation)	**None** (A concern or potential impact that, upon evaluation, is found to have no significant impact at all.) **Low** (Any magnitude, impacts will be localised and temporary. Accordingly the impact is not expected to require amendment to the project design.) **Medium** (Impacts of moderate magnitude locally to regionally in the short term. Accordingly the impact is expected to require modification of the project design or alternative mitigation.) **High** (Impacts of high magnitude locally and in the long term and/or regionally and beyond. Accordingly the impact could have a 'no go' implication for the project unless mitigation or re-design is practically achievable.)
Confidence Level	The degree of confidence in the predictions, based on the availability of information and specialist knowledge. **Low** (based on the availability of specialist knowledge and other information) **Medium** (based on the availability of specialist knowledge and other information) **High** (based on the availability of specialist knowledge and other information)

The assumed process is depicted in Figure 1, while more detail is given for the tanning process in Figure 2.

Input	Process	Product	Effluent/Waste
Harvested Seals →	Preparing animal in building B		
Wash Water	→ Meat	Processed: Human consumption & animal consumption (feed)	Blood, Oil & fat, Wash water
Wash Water	→ Organs	Processed: Human consumption & animal consumption (feed)	Blood, Stomach content, Urine, Oil & fat, Wash water
Wash Water	→ Blubber	Blubber processed into oil for food use and industrial use	Blood, Hair, Oil & fat, Wash water
Wash Water	→ Skin	Skin, flesh, wash, clean and grade	Rejected skins, Hair, Blood, Soil, Wash water
Wash Water & Tannery Cemicals	→ Tannery	Tanned Skin	Rejected skins soluble proteins, hair, fats oils, dye, pigments & salts, trimmings, wash water.

Figure 1. Assumed process with effluent & waste

Input	Process	Product	Effluent/Waste
Raw hides	Pretanning		
Salt, sulphuric acid	Pickling		Brine and acid dilution waters, H_2S, NH_3
Bacteria, soda ash, water	Soaking		Dirt-laden saline liquors, fleshings
Lime, sodium sulphide, water	Unhairing & Liming		Hydrogen sulphide, alkaline waste waters
	Trimming, fleshing, batling		Trimmings & fleshings
Lactic acid, bate. Ammonium chloride, water trimming	Deliming and bating		Ammonia, Alkaline waste-waters
	Main Tanning		
Chromic sulphate, salt syntan, sodium formate, soda ash, bactericide	Chrome Tannings		Acidic wastewaters containing Cr^3, syntan, salts
	Pressing		Press liquors
	Sammying , Splitting & Shaving		BOD, COD, Cr^3, dyes & fat
	Wet Finishing		
Tanning extracts, syntan, dyes, calcium formate, flour, glue, titanium dioxide, oil, water	Neutralisation, Secondary tanning, dyeing and sorting		Acidic wastewater containing Cr^3, tanning extracts, syntan, dyes & fats
	Drying, trimming and sorting		BOD, COD, Cr^3, dyes & fat, Trimmings contain Cr^3
	Finishing Operations		
Surface coatings	Conditioning		Solid Residues
	Batling & Trimming		Liquid residues
	Finishing		Solvent Vapours
		Leather Product	

Figure 2. Assumed tanning process with effluent & waste

7.1 Effluent Disposal

Domestic effluent may be disposed of directly into the municipal sewer system, provided that it comply with the relevant regulations. Effluent from the rest of the facility (Non-Domestic

Effluent) can also be disposed of into the municipal sewer system, provided that it comply with the relevant regulations.

Considering the high protein and suspended solids content of Non-Domestic Effluent it is advisable not to dispose of the effluent into the municipal sewer system. Various treatment methods like evaporation ponds or protein recovery plants do exist and it is recommended that such plants be evaluated for suitable effluent handling.

The impact from Non-Domestic Effluent disposal into the municipal sewer system is that it can overload the treatment works with effluent with BOD and COD and other constituents having high levels/concentrations. This can cause partial treated effluent to pass through the treatment plant. Also, effluent from the tanning process normally has a high total dissolved chemical content, is high in chromium (if chromium tanning is applied), high in sulphide, BOD and COD. Pesticides may also be present if hides were previously preserved.

The Environmental Investment Fund of Namibia as well as other organizations are funding the development of a 10 hectares irrigated fodder crop production area utilising sub-surface drip irrigation technology. Water will be sourced from the semi purified water from the sewage works of Lüderitz. The fodder harvested will be processed into animal feed that will be utilised as inputs into downstream value-adding agricultural production components such as a small dairy, a feedlot, piggery or poultry production unit or a combination of the above.

Table 2. Impact on Towns Sewage System

Nature of impact	**Impact on towns sewage system**
Status of impact	**Negative**
Extent	**Local** (limited to within 15 km of the area)
Duration	**Permanent**
Intensity	**Serious effects**
Probability	**Highly probable** (most likely)
Degree of Confidence in Predictions	**High** (based on the availability of specialist knowledge and other information)
Significance (without mitigation)	**High**
Mitigation/ Enhancement	Pre-treat effluent to acceptable standards before disposal or use separate treatment facility.
Significance (with mitigation)	**Low**

Table 3. Impact on Sewage Semi Purified Water Users

Nature of impact	**Impact on Sewage Semi Purified Water Users.** Chemicals in effluent makes water not usable for irrigation purposes, specifically crop cultivation as chemicals may accumulate in crops.
Status of impact	**Negative**
Extent	**Local** (limited to within 15 km of the area)
Duration	**Permanent**
Intensity	**Serious effects**
Probability	**Highly probable**
Degree of Confidence in Predictions	**High**
Significance (without mitigation)	**High**
Mitigation/ Enhancement	Pre-treat effluent to acceptable standards before disposal or use separate treatment facility.
Significance (with mitigation)	**Low**

7.2 Waste Disposal

Rotting meat attract flies and others pests, including jackal, hyena and other scavengers, potentially putting these scavengers in conflict with people visiting the waste disposal facility. Hair may be distributed off site by strong winds. Rotting meat can cause bad odours. Chemicals in tannery waste my be hazardous and should thus be disposed of in a suitable certified hazardous waste disposal facility. This is currently not available in Lüderitz.

Table 4. Impact on Waste Disposal Facility.

Nature of impact	**Biowaste disposal causes impact on the waste disposal facility.** This includes attraction of scavengers, increased fly and other pests, bad smells. Wind transported hair. Chemicals in the tannery waste may cause pollution of the soil and groundwater in the area.
Status of impact	**Negative**
Extent	**Local** (limited to within 15 km of the area)
Duration	**Permanent**
Intensity	**Serious effects**
Probability	**Highly probable** (most likely)
Degree of Confidence in Predictions	**High** (based on the availability of specialist knowledge and other information)
Significance (without mitigation)	**High**
Mitigation/ Enhancement	Reduce waste production. Classify waste and ship hazardous material to a suitable disposal facility. Bury biowaste in a suitably fenced off area, directly after disposal. Scavengers must not be able to enter the facility
Significance (with mitigation)	**Medium**

8. CONCLUSIONS

Very little information was provided regarding the chemicals used in the facility, especially related to the tannery. This makes an evaluation of the effluent streams a speculation at the best. No volumes were given on the relevant effluent production, making load estimates impossible. It is therefore recommended that chemicals of concern be evaluated once the chemicals to be used are known so that disposal guidelines can be set for this facility. This is especially important for chemicals not contained in the rather generic effluent guideline values. Effluent volumes must also be determined and characterised to determine if the town's treatment facility has the capacity and capability to handle the proposed effluent.

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09 December 2013

9. REFERENCES

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