
Status: Revision 1

# Water Resource Management Plan

Document No. xxx

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# Contents

## Abbreviations

| | |
|---|---|
| AfDB | African Development Bank |
| ATL | Aldwych Turkana Ltd. (Employer's Representative) |
| BH | Borehole |
| BOD | Biological Oxygen Demand |
| CESMP | Contractor Environmental and Social Management Plan |
| COD | Chemical Oxygen Demand |
| EC | Electrical Conductivity |
| EHS | Environment, Health and Safety |
| EIB | European Investment Bank |
| EMCA | Environmental Management and Coordination Act |
| ESHS | Environmental, Social Health and Safety |
| ESIA | Environmental and Social Impact Assessment, also referred to as EIA |
| ESMP | Environmental and Social Management Plan |
| ESMS | Environment and Social Management System |
| FNTP | Full Notice to Proceed |
| IFC | International Finance Corporation |
| KEBS | Kenya Bureau of Standards |
| KPI | Key Performance Indicator |
| L | litre(s) |
| LTWP | Lake Turkana Wind Power Ltd. |
| m | metre(s) |
| mg/l | milligram(s) per litre |
| ml | millilitre(s) |
| NEMA | National Environment Management Authority |
| NGO | Non-Governmental Organisation |
| OPIC | Overseas Private Investment Corporation |
| RO | Reverse Osmosis |
| TDS | Total Dissolved Solids |
| VIP | Ventilated Improved Pit-Latrine |
| WASREB | Water Services Regulatory Board |
| WHO | World Health Organisation |
| WRMA | Water Resources Management Authority |
| WRMP | Water Resources Management Plan |

# 1. Introduction and Background

## 1.1 Introduction

This Water Resource Management Plan (WRMP) is designed to ensure the protection of water resources in the wind farm area and, where appropriate, along the road rehabilitation corridor. Although it is considered that the wind farm development will not be a significant consumer of water, Lake Turkana Wind Power Ltd. (LTWP) shall adopt practical measures to avoid or reduce water usage and therefore prevent any significant adverse impacts on other users. The Plan sets out such measures that will be used to prevent and mitigate adverse impacts and the monitoring activities needed to determine the effectiveness of planned mitigation measures in terms of water abstraction, use / consumption and wastewater treatment and disposal.

Sustainable water usage is important to LTWP which has developed suitable mitigation measures to:

- Limit and manage potential impacts on the environment within its area of operations and control;
- Minimise any negative impacts on communities and the surrounding; and
- Control potential pollution hazards and minimise incidents associated with Project-related activities.

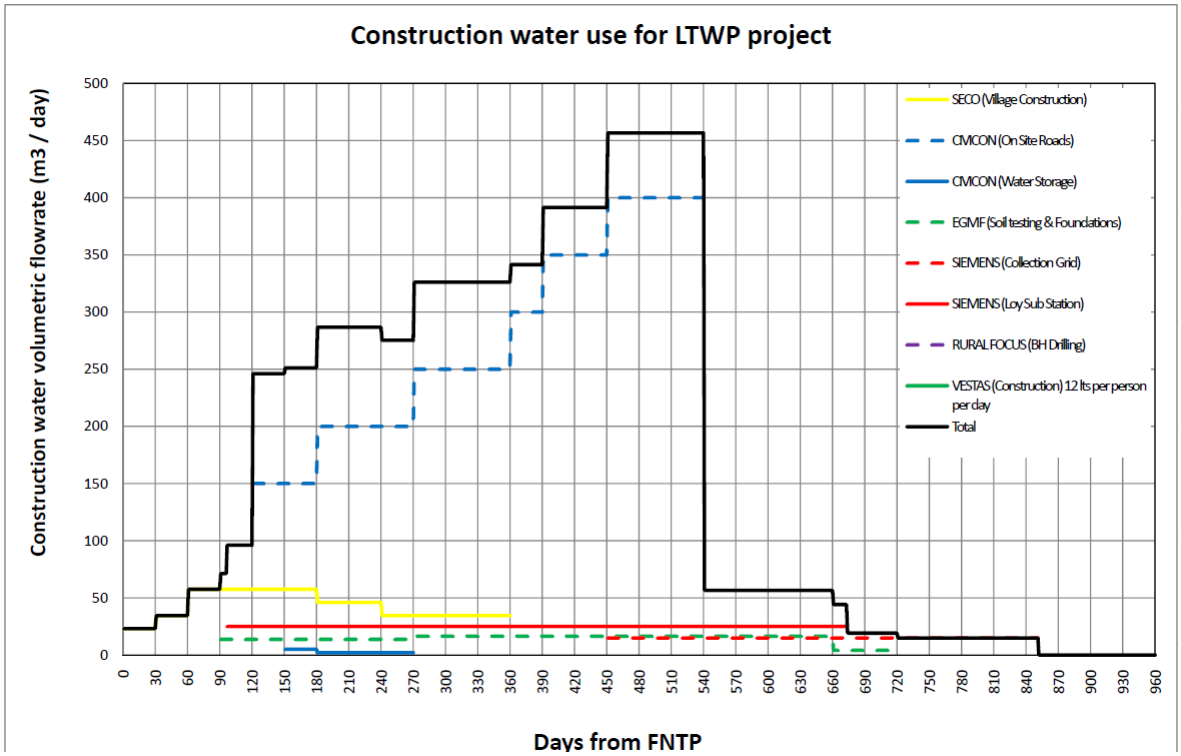
## 1.2 Background

The hydrology of the Project area is extremely variable with surface water only featuring after occasional heavy rains. Shallow pools and seasonal water courses are available for only a few weeks of the year during the long and short rain seasons. The dry riverbeds ('laggas') are only replenished on average once in every five to ten years.

Despite the general scarcity of water, there are several potential sources in the area, including waterholes dug in the laggas, surface water on the top of Mount Kulal and the spring at Loiyangalani. These resources were assessed by LTWP and it was concluded that they were impractical due to a variety of factors (including distance, costs, quality, available volume and the needs of existing users and/or livestock / wildlife). Hydrological studies were undertaken and concluded the general suitability of the groundwater aquifer in the wind farm area.

Consequently, LTWP has applied for and obtained the required permits for drilling construction phase boreholes and is currently in the process of installing the remaining water management infrastructure prior to seeking official consent to abstract groundwater for industrial and domestic use by the Project. Parallel Reverse Osmosis (RO) systems are being installed to ensure attainment of water quality standards at the LTWP Village; the Sirima settlement has been provided with a borehole (in 2012) at their new location, which includes solar pump, tank storage/ float switch and livestock trough receptacle. Outside of the wind farm area, the road upgrade contractor, Civicon, is responsible for directly organising its water requirements, including permitting, and will be subject to LTWP oversight.

Water requirements will reduce following completion of the construction phase, when manpower numbers will fall to the operational establishment level and water-intensive activities like cement batching and dust suppression mitigation will terminate. Figure 1.1 includes plots which show the estimated water consumption during the construction phase:



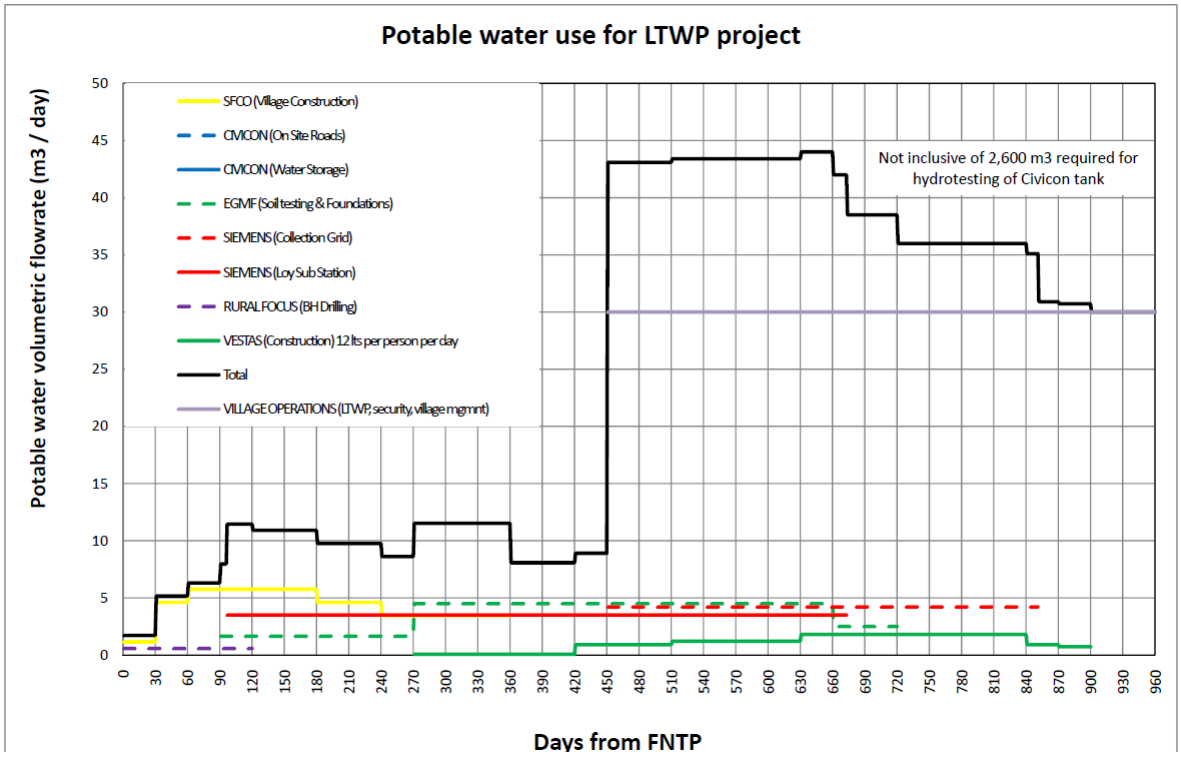




*Figure 1.1 – Estimated construction water consumption (construction use and potable) from full notice to proceed (FNTP)*

Managing water resources within the area of influence is important to LTWP, which is committed to the following measures as per LTWP's water resource management policy and strategy:

- To ensure compliance with relevant legislation, Environmental Social Impact Assessment (ESIA) recommendations, abstraction licence conditions, and the overarching project requirements of the Project namely International Finance Corporation (IFC) Performance Standards and in respect to this Plan;
- To comply with water quality and effluent standards;
- To minimise any adverse impacts on local / regional water users;
- To avoid any over–abstraction;
- To conserve resources through efficient use and minimisation of consumption where possible;
- To maintain a water balance inventory; and
- To make water balance and quality survey information available to key Project stakeholders.

The various water resource management procedures and processes set out in this Plan shall be implemented by all parties, whether directly employed by LTWP or subcontracted, and will apply to all construction and operational activities related to the wind farm development. The implementation of this plan shall be monitored by LTWP's Employer's Representative, Aldwych Turkana Limited's (ATL) Environmental, Social, Health and Safety (ESHS) team to ensure consistency and compliance with Kenyan legislative and regulatory requirements, Project policies, and international standards such as those specified in the IFC General EHS Guidelines.

In addition to routine monitoring water abstraction and quality in the installed boreholes at the wind farm location, further water quality monitoring will be undertaken in regards to the spring at Loiyangalani and Lake Turkana waters, which according to the ESIA[1], comprise the water sources likely to be affected by the operations of the proposed Project.

[1] Wind farm ESIA, section 3.3 Plant Identification and Water Analysis

# 2. Objectives, Scope and Approach

## 2.1 Objectives

The objectives of this Plan are to:

- To define management procedures for all water-related functions, including defining roles and responsibilities and training requirements;
- To ensure compliance with applicable Kenyan regulatory requirements, LTWP policy requirements and international lender obligations;
- To ensure that applicable potential environmental and social impacts are understood and addressed in order to minimise impacts to surface and/or ground water quality and availability;
- To ensure continuity of supply for the Project and to ensure that other water users are not adversely impacted;
- To ensure that all treated waters are safe;
- Define monitoring and reporting procedures; and
- To ensure effective implementation of water conservation, including recycling initiatives.

## 2.2 Scope

This WRMP is designed to cover all aspects in regard to water resource management for the wind farm and road upgrade activities; it is applicable to the construction activities and will be amended and updated for the operational phase of the wind farm. It is not however applicable to the associated Ketraco transmission line construction (see the **Transmission Line Oversight Management Plan**).

This Plan describes the proposed measures to address potential water resource-related social, health and environmental impacts from Project-related activities only. The Plan mainly applies to the Project's area of influence; however, any water resource management plans for the wider water catchment area outside of the impacted subdivision in Marsabit County will also be given appropriate consideration (e.g. in relation to the management of the cumulative water balance for the Project area).

LTWP is committed to comply with various environmental standards which are described in Section 3 below. This Plan covers all Project contractors and their storage, handling and use of water resources during the construction phase and will be amended and updated for LTWP's use and management of water resources during operational phase.

This Plan is part of the suite of Management Plans. The Plan covers all aspects of water management including:

- The development and utilisation of temporary water abstraction wells required to provide water for the Project during construction (depending upon final production rates this could include up to eight wells that have been partially developed within the wind farm area and any temporary off-site wells required during road upgrade works). Currently there is more water available from these wells than initially anticipated;
- Water usage during construction;
- Drinking water supply and treatment;
- Sewage/sanitary wastewater treatment; and
- Water resource and quality monitoring.

This Plan is designed to be a 'live' document that will be reviewed on a periodic basis and amended as necessary based on changes identified through monitoring, community consultation, and the grievance mechanism. The Plan will be updated based upon decisions taken by LTWP, taking account of stakeholder views, and its requirements communicated as appropriate to Project personnel and contractors.

Associated management system documentation, which either refers or incorporates water resource management requirements, include inter alia: LTWP's **Environmental and Social Management System**

(ESMS) Policy Manual, Framework Environmental and Social Management Plan (ESMP), the Construction Oversight Management Plan, Stakeholder Engagement Plan / Grievance Mechanism, and the Community Health and Safety Management Plan.

## 2.3 Approach

### 2.3.1 General Approach

This WRMP focuses on moderating the abstraction of water resource availability and mitigating direct, indirect and cumulative potential adverse impacts of the LTWP wind farm construction and future operation activities on surface and ground water quality within the Project area of influence. Some of the measures mitigating potential impacts are reflected in the ESIAs that informed the Project and Management Plans developed for the Project. Where applicable, those documents are directly referred to in this Plan; however, this document collates all the measures associated with water resource management in order to ensure a consistent and effective approach.

LTWP recognises its obligation to engage with the various authorities to deal with any grievances raised by local communities and stakeholders by actual or perceived water resource management impacts (direct or indirect) associated with the Project activities.

LTWP is unable to assume responsibility for any water resource management relating to the construction of Ketraco's associated transmission line, although it will seek to influence and – should circumstances demand - use its 'best efforts' to advise Ketraco and its contractors on the potential risks, impacts and mitigation strategies.

### 2.3.2 Roles and Responsibilities

Throughout the Project, LTWP will retain overall responsibility for the management of water resources, including abstraction, treatment and effluent disposal; although each contracted party remains directly responsible in relation to water management issues, including respect for any Water Resources Management Authority (WRMA) / National Environment Management Authority (NEMA) licensing conditions.

ATL's ESHS team will be supported by the water development contractor, Rural Focus. Together they will retain an oversight role in regard to water resource management, working as necessary (e.g. maintaining an effective water balance), monitoring water abstraction rates in boreholes (BHs) and groundwater, drinking water and wastewater quality, and reviewing performance via routine meetings and report submissions.

#### 2.3.2.1 ATL ESHS Manager

The ATL ESHS Manager's water resources management role focuses upon the need to:

- Monitor Project compliance with the requirements of LTWP's water resource policy and strategy through establishing a baseline for the Project, an effective working relationship with Rural Focus, other contracted water system operators, accredited laboratories and the various regulators;
- Screen and approve contractors' water management plans to ensure they comply with this WRMP and the requirements of its abstraction and effluent disposal licence;
- Oversee the road upgrade contractor's water management activities and arrangements during the rehabilitation and strengthening works for the C77 and D371 roads;
- Oversee the monitoring regime and reporting schedule to ensure on-going Project compliance with abstraction requirements and applicable water quality standards as further detailed in this WRMP; and
- Monitor water resource management through continuous related community liaison activities and any grievances received from workers or third parties.

#### 2.3.2.2 Construction Contractors

Each contractor is responsible for:

- Developing its own water strategy for the responsible use of water;
- Obtaining and complying with any water drilling, abstraction and/ or effluent disposal licenses it requires to complement the measures being provided by LTWP (e.g. road upgrade works, cement batching and effluent disposal);
- Keeping accurate records of abstracted, uses and disposed volumes; and
- Cooperating with ATL's ESHS team to ensure high standards of water resource management are maintained.

# 3. Project Standards / Legal and Institutional Framework

## 3.1 Kenyan Legislation

The Constitution of Kenya (2012) lays the foundation for many laws and, although not specific in regard to water management, it gives all Kenyans a right of access to water and a clean and healthy environment.

Underneath the Constitution, there are other Government of Kenya laws, regulations and orders that can have a bearing on water management for the Project. These include the:

- Water Act, 2002 (note that the draft Water Bill, 2012 may change requirements when enacted);
- Water Resources Management Rules, 2006, which set out the protocols for any utility, agricultural or industrial use of a surface water or groundwater resource, including abstraction, obstruction, diversion, effluent discharge, etc. This now falls under the remit of the WRMA which is responsible for permitting boreholes and abstraction;
- Environmental Management and Coordination Act (EMCA) deals with impact assessment and mitigation oversight by NEMA;
- EMCA (Water Quality) Regulations, 2006, sets out the NEMA effluent discharge consenting system and specifies standards for sources of domestic water, effluent discharge into the environment and into sewers; and
- Drinking Water Quality and Effluent Monitoring Guideline, which has been developed by the Water Services Regulatory Board (WASREB) and which sets out standards and sampling requirements that apply to water utility supplies.

The Ministry of Water and Irrigation is in charge of policies for water supply and has articulated its Strategic Plan 2012-2017. The Ministry of Public Health and Sanitation is in charge of policies for sanitation. The 2002 Water Act created WASREB, which undertakes performance benchmarking of water utility service providers and manages water abstraction permitting. NEMA manages the impact assessment process (a certified EIA is needed to support all water permit applications) and effluent discharge permitting.

Independent monitoring of drinking water quality can be undertaken by WASREB, the Ministry of Water and Irrigation, Kenya Bureau of Standards (KEBS), Ministry of Health and NEMA.

All relevant permits and licenses will be obtained and maintained by LTWP and the road upgrade contractor for water abstraction and waste water disposal. The following permits are required for both LTWP's water supply infrastructure and the separate arrangements being made by the road upgrade contractor (Civicon):

- WRMA Boreholes;
- WRMA Water abstraction;
- Drinking quality water supply; and
- NEMA wastewater effluent discharge.

## 3.2 LTWP's Water Resource Management Policy

LTWP has defined its environmental and social policies for the wind farm (see **ESMS Policy Manual**). The policies' objective #2 commits LTWP to managing "the associated environmental and social risks and impacts in accordance with the principles of sustainable development, applicable legal requirements, relevant international standards and recognised good industry practice" and includes a specific commitment to "*ensure the sustainable use of water resources….*"

The aims of LTWP's water resource management policy and strategy are to:

- Minimise any adverse impacts on local / regional water users;
- Avoid any over–abstraction;
- Conserve resources through efficient use and minimisation of consumption where possible;
- Comply with water quality and effluent standards; and
- Maintain a water balance inventory.

Furthermore, LTWP has adopted the IFC Performance Standards and supporting World Bank Group Environmental, Health and Safety (EHS) Guidelines to guide it towards achievement of appropriately high levels of environmental and social performance throughout the Project's life cycle.

The 2012 versions of the IFC Performance Standards set out a range of requirements with regard to managing social and environmental impacts, including those potentially associated with water resource management. The Performance Standards that are applicable to this Plan include:

- Performance Standard 1: Assessment and Management of Social and Environmental Risks and Impacts; and
- Performance Standard 3: Resource Efficiency and Pollution Prevention.

Performance Standard 3 aims at ensuring that projects do not cause or contribute to unacceptable water stress on third parties such as local communities. Although it is considered that the wind farm development will not be a potentially significant consumer of water, LTWP shall adopt practical measures to avoid or reduce water usage and therefore prevent any significant adverse impacts on other users. *In that regard, the Project is committed to avoiding the use of bottled water throughout its life cycle as far as reasonably practicable (i.e. except as a last resort)*.

It is also acknowledged that in regards to water, only the General EHS Guidelines contain the requirements that are potentially relevant to the Project (in sections 1.3 Wastewater and Ambient Water Quality and 1.4 Water Conservation). Note that the EHS Guidelines for Wind Energy do *not* include any water resource management standards or criteria in regards to on-shore developments.

The Project has set numeric standards for the following waters, taking account of the IFC's criteria for water–related issues:

- Groundwater quality (pre-use):
- Potable water; and
- Effluent wastewaters.

The specific numeric values for the above are presented in Appendix A, together with a comparison with applicable national and international standards. Appendix A presents the full list of substances controlled under Kenyan regulations; LTWP will not undertake analysis against all listed parameters unless the local situation warrants this and it is directed by NEMA or other Kenyan water or health authority.

In addition, it is also noted that drinking water should:

- Be visually clear and colourless (i.e. low turbidity);
- Not be saline;
- Contain no chemical substances that have the potential for adverse or long term effects on human health;
- Be free from pathogenic organisms that cause disease;
- Contain no compounds that cause an offensive taste or smell; and
- Not result in any accumulation of deposits or scaling that might affect water treatment, storage or distribution systems.

## 3.3 Lenders' Standards

In addition to the IFC Performance Standards, LTWP has accepted and will adhere to the requirements of specific lenders standards. Where differing levels of performance are detailed between the various standards, the most stringent requirement will be applied. LTWP will adopt the requirements defined in the respective standards of:

- African Development Bank (AfDB)
- European Investment Bank (EIB)

- Overseas Private Investment Corporation (OPIC)

A process of review of the various standards has been undertaken and requirements have been adopted and incorporated within the **Framework ESMP** and various Management Plans.

It is noted that the 2014 EIB Standards only reference 'water resources' in the definitions section of Standard 9: Occupational and Public Health, Safety and Security, although it is included in Volume 2 of its Environmental and Social Handbook – e.g. in the list of High Priority Areas for Environmental Protection (for promotion of efficient and sustainable natural resource management), in Strategic Environmental Assessments (under sectoral investment programmes), and as a consideration in regard to the potential effects of climate change.

Nevertheless, Standard 3: Pollution Prevention and Abatement sets out a number of relevant requirements in regard to pollution prevention and monitoring emissions to water (e.g. see paragraph #12[2]); however, these are considered to be broadly consistent with the IFC requirements which have been taken into account in the articulation of LTWP's Water Resource Strategy and this Management Plan.

[2] "*Over the lifetime of the project, the promoter must consider avoiding the deterioration of the quality of soil and groundwater. Therefore s/he should put in place adequate measures to prevent emissions to soil and groundwater and regularly monitor these measures so as to avoid leaks, spills, incidents or accidents occurring during the use or storage of different equipment and/or materials." (EIB Standard 3, para 12)*

# 4. Water Resource Management Stakeholders

## 4.1 Government

The Ministries of Environment, Water and Natural Resources, Public Health and Sanitation, and Water and Irrigation have varying degrees of responsibility for water management, although in practice responsibility is delegated to agencies and institutions. The WRMA is the lead agency in water resources management in the country as per Water Act 2002 sec 8(1).The WRMA functions have largely been devolved to the County Governments and regional WRMA offices.

## 4.2 Marsabit County

At the County level, water availability and management issues fall under the County Water, Environment and Natural Resources Department, Water and Irrigation Department (implemented by County Water Officers) Water Service Board, WASREB and regional WRMA offices[3], each of which may need to be engaged by LTWP from time to time.

## 4.3 National and International NGOs

In addition to local tribal trusts and community based organisations/ pastoral development projects, a wide range of national and international non-governmental organisations (NGOs) and academic organisations may wish to be engaged on various issues and/or request information on the Project's water resource management performance. Potential stakeholders may include *inter alia*:

- UNESCO
- Oxfam
- Kenyan Water and Health Organisation
- Water Resource Users Associations.

LTWP in accordance with its **Stakeholder Engagement Plan** will consult with the above parties in respect to this WRMP annually and update this plan accordingly with any appropriate recommendations or findings.

[3] The Project Area spans two WRMA regional areas, the Rift Valley and Ewaso Ngiro North.

# 5. Water Resource Management Strategy

In addition to the broad aims outlined in section 3.2 above, LTWP's Water Resource Management Strategy commits the Project to the following objectives, which shall be used to inform the development of Contractor Environmental and Social Management Plans (CESMPs), including specific WRMPs:

## 5.1 Groundwater Abstraction Objectives:

- Determine drawdown and other impacts upon the aquifer;
- Apply good industry practice during drilling processes;
- Test pumping prior to use and ensure efficient pumping and distribution;
- Monitor borehole and any nearby public well water depth and quality; and
- Deepen boreholes / lower pumps to new level as appropriate should drawdown lower water levels in boreholes.

## 5.2 Surface Water and Storm Run-off Objectives:

- Flash-flood risk assessment to be undertaken regularly (to consider all permanent and temporary Project components located less than 50m from existing laggas);
- Minimise impacts from any groundwater or surface water pollution incidents;
- Develop pollution prevention and contingency response measures (see Emergency Preparedness and Response Plans):
    - Prevent clean runoff water from entering chemical or fuel storage facilities;
    - Contain any potentially contaminated storm run-off or spills; and
    - Run-off diversion into rainwater harvesting tanks / ponds.

## 5.3 Water Treatment / Reverse Osmosis Plant Objectives:

- Design criteria to cover attainment of:
    - Domestic quality standards of water used without RO treatment (i.e. WASREB Drinking Water Quality and Effluent Monitoring Guideline[4]); and
    - Post RO treatment drinking water quality standards (i.e. as defined in any required WASREB licence and Service Provision Agreement, or alternatively in the World Health Organization (WHO), Guidelines for Drinking-water Quality[5]).
- Apply good construction management techniques during installation;
- Strict adherence to design criteria and manufacturer's instructions for operation and maintenance as appropriate (e.g. management of treatment chemicals, follow manufactures maintenance programme, timely repair of any leaks or burst pipes);
- Restrict access to RO Plant through designation of approved personnel and fencing where appropriate;
- Monitor water quality and quantity, including Project water balance, through mixture of sampling and testing by ATL's ESHS team and accredited laboratories as required;
- Analyse and report any water quality related health and safety risks;
- Diversion of brine or water of an unusable quality for dust suppression; and
- During eventual decommissioning, the RO Plant and associated infrastructure will be dismantled and removed. The site will be rehabilitated and all wastes removed and disposed of as per the decommissioning Waste Management Plan.

[4] NB: The IFC General EHS Guideline (section 3.1, Water Quality and Availability) states: "Where the project includes the delivery of water to the community or to users of facility infrastructure (such as hotel hosts and hospital patients), where water may be used for drinking, cooking, washing, and bathing, water quality should comply with national acceptability standards or in their absence the current edition of with WHO Drinking Water Guidelines."

[5] See http://www.who.int/water_sanitation_health/publications/2011/dwq_chapters/en/

## 5.4 Effluent treatment and Disposal Objectives:

- Design criteria to cover attainment of effluent quality standards (i.e. NEMA standards for Effluent Discharge into the Environment (Third Schedule of Water Quality Regulations) or IFC General EHS Guidelines - Indicative Values for Treated Sanitary Sewage Discharges, *whichever is more stringent*);
- Apply good construction management techniques during installation;
- Strict adherence to design criteria and manufacturer's instructions for operation and maintenance as appropriate, including management of treatment chemicals, waste filters, etc.);
- Restrict access to RO Plant through designation of approved personnel and fencing where appropriate;
- Monitor effluent quality and quantity, including Project water balance, through mixture of sampling and testing by ESHS team and accredited laboratories as required;
- Analyse and report any effluent related health and safety risks;
- Undertake periodic audits / inspections of construction, operational and maintenance controls;
- Diversion of any brine or water of an unusable quality for dust suppression; and
- Adhere to Waste Management Plan for the disposal of bio-solids, etc.

## 5.5 Construction Phase Water Management

### 5.5.1 Wind Farm Water Use and Reticulation System

All wind farm boreholes are already permitted and have been drilled; installation of the pumps, metering, generators/houses and elevated tanks is currently pending. Once the works are completed, the WRMA will verify that the work has been done as per specifications and will then issue the abstraction permits accordingly.

| Borehole | Pump Rate ($m^3$/hour) | Tank |
|---|---|---|
| Partukutukai | 11.1 | 12 $m^3$ |
| Partukutukai North | 4.86 | 12 $m^3$ |
| Loy SW Substation | 3.9 | 10 $m^3$ |
| Loy SW | Pending | - |
| Loy W | 1.38 | 10 $m^3$ |
| Loy NW | 7.92 | 12 $m^3$ |
| Sirima S / Village | 1.86 | 12 $m^3$ |
| Sirima Centre | 3.18 | 12 $m^3$ |
| Sirima Lagga | 3.12 | 10 $m^3$ |
| Sirima N | 2.76 | 10 $m^3$ |

*Figure 5.1 Wind Farm Borehole Details*

Following cessation of construction contractors' activities, their dedicated boreholes on the wind farm site will be withdrawn from use, blanked off/ sealed but retained for possible contingency back-up.

### 5.5.2 Borehole Design and Use

LTWP's borehole designs aim to be protective of the groundwater aquifers present in the wind farm area and adopt the key principle of preventing flows between hydraulically distinct shallow and deep aquifer. All water supply boreholes have been permitted by NEMA prior to drilling and installation.
Typical design considerations include:

- Surface seal around the BH to prevent any infiltration of soils / dusts / wastes from the surface;
- Solid casing will be installed from surface level down to the aquifer;
- Gravel / protective backfill around the casing; and
- Upper sections of the well bore will be sealed with impermeable grout (bentonite or similar).

### 5.5.3 Water Balance

- A water balance inventory will be developed and maintained. The water balance will be used to:
    - Undertake routine review of the effectiveness of water conservation measures; and

- Undertake routine review of water usage during construction. In the event that water usage significantly exceeds predicted levels the potential impacts of this will be assessed and any necessary additional mitigation measures will be identified.

- Water monitoring activities are described in section 5.2 above and in the procedure in Appendix B; and
- Results of all related water monitoring activities will be published in routine internal audit and other reports and in the required submissions to NEMA which will be made publicly available as part of LTWP's on-going stakeholder disclosure programme.

### 5.5.4 Wastewaters

#### 5.5.4.1 Hygiene and Sewage Effluents

Septic tanks will be appropriate where there are suitable locations for siting them (i.e. on level ground with enough separation between the drain field and the groundwater table, sufficient soil percolation for the design wastewater loading rate etc.) and availability of sufficient water for WC flushing. Ventilated improved pit (VIP) latrines with good quality concrete floor slabs will be provided at temporary construction camps. These will be designed and maintained to ensure adequate depth, cleanliness and without offensive odours and be free of insect / vermin nuisance.

Once construction of the on-site operations Village is completed, a sewage system and water treatment plant will be installed to serve accommodation, catering and recreational facilities, whereupon:

- All sewage and sanitary waters produced on the main Project location and at remote construction camps will be sent to the main waste water treatment plant (once commissioned) at the wind farm site or to wastewater treatment plants (e.g. road upgrade camps);
- Sewage effluent will not be discharged to any surface water body or soakaway, however it is a mandatory requirement that all sewage treatment plants meet applicable Kenyan / international discharge standards; and
- Wastewater generated from the sewage/ sanitary treatment plant will be reused where possible (e.g. for concrete production and road dust suppression) and, where not immediately possible, shall be placed in approved storage ponds pending reuse.

#### 5.5.4.2 Concrete Batching Effluent Disposal

- Any waste water generated from concrete batching will be adequately treated to deal with suspended solids and high alkalinity before discharge under effluent license conditions and methods as stipulated by NEMA.

## 5.6 Operations Phase Water Management

The water supply and hygiene and sewerage effluent systems developed for the Village will continue to operate throughout the operations phase. In addition, the following rules shall apply:

### Rainwater and Grey Water Harvesting and Re-use

- Grey water will be utilised for construction when the system is functional during latter part of construction. It is also intended to utilise a percentage of grey water on the proposed vegetable garden and for watering the landscaped areas within the LTWP Village once completed.
- No treated wastewater is to be directly discharged to laggas (local ephemeral watercourses) or permitted to infiltrate into the aquifers. Treated wastewater shall be reused for concrete road dust suppression and/or placed in approved grey water storage ponds pending reuse (e.g. in Village grounds maintenance activities).

# 6. Monitoring/ Evaluation

## 6.1 Key Performance Indicators

LTWP shall monitor key water resource management issues throughout the life of the Project, using the following Key Performance Indicators (KPIs) to benchmark the Project's water management:

| Proposed KPI | Target / Threshold | Monitoring measure |
|---|---|---|
| **Non-compliances: Number of reported non-compliances with the mitigation measures identified in this Management Plan** | Target: Minimisation and continued improvement in number of reported non-compliances | Water level/ quality monitoring, inspections and audits of water resource management activities |
| **Water use reduction during operational phase: Village water consumption / usage rates** | Target: 100 litres/person/day<br><br>(Threshold estimate = 150 l per day) | Water balance (flow meter readings as reported in routine site water usage reports) |
| **Water re-use: Percentage of treated wastewater that is re-used** | Target : 100%<br><br>(Threshold 40%) | Water balance (usage monitoring and reporting in routine site water usage reports.) |
| **Workforce complaints about drinking water quality / availability** | Target = zero<br><br>Threshold 1, with agreed mitigation | Worker grievance analysis |
| **Sirima settlement / other pastoralist well impacts: Number of instances where a sustained drop in water levels below (seasonally adjusted) baseline levels occurs** | Target= zero<br><br>Threshold 1, with agreed mitigation | Water balance (flow meter readings as reported in routine site water usage reports) |
| **Community/Livestock Well Complaints: Number of substantiated instances of complaints that wells/springs have been impacted** | Target = zero<br><br>Threshold 1, with agreed mitigation | Community Grievances (see Stakeholder Engagement Plan) |

## 6.2 Monitoring Performance

In general, ATL's ESHS team and water development contractor, Rural Focus, will have responsibility for water quality monitoring although the RO system supplier has a role in monitoring attainment of post treatment drinking water quality. In addition to automatic water system metering and monitoring, the following monitoring measures will be implemented to ensure compliance with the Project's Water Resource Strategy and water quality standards:

- **GROUNDWATER LEVELS:** All groundwater monitoring wells included in the baseline monitoring programme will be subject to field measurements and observations as per the procedure (see Appendix B). This includes any community / pastoralist wells or springs downstream (i.e. laggas) of the wind farm site. Water levels will be regularly monitored to determine changes against baseline values. Any sustained drop in water level greater than the seasonally-adjusted norm, and/or sufficient to affect pastoralist and/or livestock supplies, will trigger an investigation and development of appropriate remedial actions to ensure that the affected resources are brought back into full operational use and/or replaced with a suitable alternative;

- **GROUNDWATER QUALITY:**
    - All groundwater monitoring wells included in the baseline monitoring programme and water entering the RO system will be subject to field measurements (portable metering of level, pH, electrical conductivity (EC), total dissolved solids (TDS) and temperature) as per the procedure (see Appendix B);

- If / when required by WRMA, NEMA, other regulatory agency and/or the ATL ESHS Manager (e.g. following a potential aquifer pollution incident or marked deterioration in water quality), groundwater samples will be taken and sent to an accredited laboratory for analysis against Project or legal standards and/or for specific characteristics; and
- Changes in groundwater quality will be assessed to identify any statistically significant variations or long term trends. Any well exhibiting these features will be subject to further detailed assessment and, where this was considered likely to be due to Project activities this would trigger remedial actions to rectify the water quality as far as reasonably practicable.

- **LOIYANGALANI SPRING & LAKE TURKANA WATER QUALITY**: Water quality samples will be collected from both Loiyangalani Spring (both tap and spring water) and the shores of Lake Turkana on a 6-monthly basis during construction and sent to an accredited laboratory for analysis. Given the elapsed time since the original ESIA analysis[6], it is recommended that new reference samples are collected and analysed as soon as possible in order to determine whether there have been any significant changes in any of the water quality characteristics. The results will be compared against both the original analysis and the more recent reference analysis and any significant variances in values will be investigated by the ATL ESHS Manager to determine whether they are Project-related or due to other circumstances beyond LTWP's control.

- **WATER USAGE / WATER BALANCE:** LTWP will monitor the Project's total water use (including volumes recycled and reused), calculated on the basis of abstraction and flow metering results and taking account of any bulk tank storage measurements.

- **DRINKING WATER QUALITY:**
  - ***As far as reasonably practicable (i.e. except as a last resort), the Project shall avoid the use of bottled water throughout its life cycle and will rely upon abstracted groundwater for drinking and other uses;***
  - In addition to routine RO system monitoring of water quality standards, LTWP will send samples of drinking water - from both the LTWP Village RO system output and the Sirima settlement borehole - to an accredited laboratory for analysis against the Project's potable water quality standards (i.e. WASREB Drinking Water Quality and Effluent Monitoring Guideline). Sampling and analysis will be undertaken on a quarterly basis or as otherwise specified by the regulatory authorities and/or ATL ESHS Manager to ensure quality standards are consistently met; and
  - Any changes or non-compliance in drinking water quality will be assessed to identify any statistically significant variations or long term trends. As necessary, further tests may be commissioned and, in the event of any potential effects upon health, LTWP will consider appropriate contingency plans to rectify the water quality as far as reasonably practicable and/or make alternative supply arrangements;

- **WASTEWATER QUALITY:**
  - Wastewaters will be subject to field measurements (portable metering of level, pH, electrical conductivity, TDS and temperature) as per the procedure (see Appendix A);
  - In addition to any automatic system monitoring of effluents, LTWP will send wastewater samples to an accredited laboratory in accordance with the frequency and suite of analyses specified in the discharge permits (i.e. NEMA standards for Effluent Discharge into the Environment (Third Schedule of Water Quality Regulations) and, if more stringent, IFC General EHS Guidelines - Indicative Values for Treated Sanitary Sewage Discharges); and
  - Any non-compliant results will be assessed to identify any statistically significant variations or long term trends and investigated to determine potential causes and consequent corrective actions. As necessary, further tests may be commissioned and will consider any

[6] This was undertaken by the Chemical & Industrial Consultancy Unit (CICU) of the University of Nairobi, Chemistry Department, Chiromo Campus, a NEMA-recognised laboratory. Results of the chemical analysis of water are presented in the ESIA Annex 3a: Analysis of Waters from Loiyangalani Springs and Lake Turkana.

modifications or improvements to the wastewater treatment system to return effluents to acceptable quality levels.

- **POST INCIDENT SAMPLING (only if needed):**
  - Following any significant fuel or chemical spill or leakage to ground, the ATL ESHS Manager will decide if any sampling and analysis of potential contamination is needed. Where required, appropriate samples (at varying distances from the release and at varying depths in the ground) will be sent for analysis (e.g. presence of hydrocarbons). Currently, no routine sampling is anticipated in regard to any surface run-off from Project chemical / fuel storage areas.

## 6.3 Community Liaison

LTWP shall liaise with local authorities, communities and contractors in regards to water resource management. The contractors will ensure that ATL are advised in advance of near term activities where water resource use or construction activities have the potential to directly or indirectly impact local water users.

The ATL ESHS/Community Liaison team will provide communities with sufficient information on the Project's proposed water resource usage prior to construction and continue to provide an appropriate Grievance Mechanism (see the **Stakeholder Engagement Plan**).

# References

**LTWP documents:**

To be updated by construction team, as required.

**External documents:**

- Strategic Plan 2012-2017, Ministry of Water
- Water Resources Management Rules, 2006
- Drinking Water Quality and Effluent Monitoring Guideline, WASREB
- Guidelines for Drinking-water Quality, World Health Organization

# Appendices

# APPENDIX A: Project Water Quality Standards

## A.1 Quality Standards for Domestic Water[7]

| Parameter | Guide Value (max allowable) | WHO Guidelines* |
|---|---|---|
| pH | 6.6 – 8.5 | N/A |
| Suspended solids | 30 mg/l | N/A |
| Nitrate – $NO_3$ | 10 mg/l | 50 mg/l |
| Ammonia – $NH_3$ | 0.5 mg/l | N/A |
| Nitrite – $NO_2$ | 3 mg/l | 3 mg/l |
| Total Dissolved Solids | 1200 mg/l | N/A |
| E coli | Nil / 100 ml | N/A |
| Fluoride | 1,5 mg/l | 1.5 mg/l |
| Phenols | Nil mg/l | (no) presence |
| Arsenic | 0.01 mg/l | 0.01 mg/l |
| Cadmium | 0.01 mg/l | 0.003 mg/l |
| Lead | 0.05 mg/l | 0.01 mg/l |
| Selenium | 0.01 mg/l | 0.04 mg /l |
| Copper | 0.05 mg/l | 2.0 mg/l |
| Zinc | 1,5 mg/l | N/A |
| Alkyl benzyl sulphonates | 0.5 mg/l | N/A |
| Permanganate value (PV) | 1.0 mg/l | N/A |

Nil means less than the limit of detection using prescribed sampling and analytical methods and equipment as determined by the Authority.

***And any other parameters as may be prescribed by the Authority from time to time.***

* Guidelines for Drinking-water Quality, FOURTH EDITION, World Health Organisation, 2011

[7] Project water quality standards are extracted from the First Schedule of the *Water Quality Regulations 2006* available at: http://www.nema.go.ke/images/documents/water_quality_regulations.pdf. Domestic water is defined as "water used by communities or workforce for drinking, cooking, washing, and bathing".

## A.2 Effluent Discharge Standards

| PARAMETER | Water Quality Regulations 2006[8] (max. permissible levels) | | IFC Indicative Values for Treated Sanitary Sewage Discharge[9]s |
|---|---|---|---|
| | Discharge to the environment (Third Schedule) | Discharge to the Public Sewer (Firth Schedule) | |
| Suspended solids (mg/L) | 30 | 250 | 50 |
| Total dissolved solids (mg/L) | 1200 | 2000 | - |
| Total coliform bacteria (Most Probable Number / L) | 300 | - | 400 |
| Temperature °C | ±3°C based on ambient | 20 – 35 | - |
| pH | 6.5 - 8.5 | 6 – 9 | 6-9 |
| Oil and Grease (mg/L) - where conventional treatment shall be used | Nil | 10 | 10 |
| Oil and Grease (mg/L) - where ponds is a final treatment method | Nil | 5 | - |
| Total Phosphorous (mg/L) | 1 | - | 2 |
| Total Nitrogen (mg/L) | 2 | - | 10 |
| Ammonia Nitrogen (mg/L) | - | 20 | - |
| Substances with an obnoxious smell | - | Shall not be discharged into the sewers | - |
| Biological Oxygen Demand BOD days at 20°C (mg/L) | 30 | 500 | 30 |
| Chemical Oxygen Demand COD (mg/L) | 50 | 1000 | 125 |
| Arsenic (mg/L) | 0.02 | 0.02 | - |
| Mercury (mg/L) | 0.005 | 0.05 | - |
| Lead (mg/L) | 0.01 | 1.0 | - |
| Cadmium (mg/L) | 0.01 | 0.5 | - |
| Chromium VI (mg/L) | 0.05 | 0.05 | - |
| Chromium (Total) (mg/L) | 2.0 | 2.0 | - |
| Copper (mg/L) | 1.0 | 1.0 | - |
| Zinc (mg/L) | 0.5 | 5.0 | - |
| Selenium (mg/L) | 0.1 | 0.2 | - |
| Nickel (mg/L) | 0.3 | 3.0 | - |
| Nitrates (mg/L) | | 20 | - |
| Phosphates (mg/L) | 1.0 | 30 | - |
| Cyanide Total (mg/L) | Not Detectable | 2 | - |
| Sulphide (mg/L) | 0.1 | 2 | - |
| Phenols (mg/L) | 0.001 | 10 | - |
| Detergents (mg/L) | Nil | 15 | - |
| Colour | Less than 15 Hazen units | Less than 40 Hazen units | - |
| Alkyl Mercury | Not Detectable | Not Detectable | - |
| Free and saline Ammonia as N (mg/L) | - | 4.0 | - |
| Calcium Carbide | - | Nil | - |
| Chloroform | - | Nil | - |
| Inflammable solvents | - | Nil | - |
| Radioactive residues | - | Nil | - |
| Degreasing solvents of mono-di-trichloroethylene type | 0.3 | Nil | - |

[8] From Water Quality Regulations 2006, available from NEMA at http://www.nema.go.ke/images/documents/water_quality_regulations.pdf

[9] From IFC EHS General Guidelines, Table 1.3.1

# APPENDIX B: Groundwater Monitoring and Sampling Procedure

## 1. Purpose

The aim of this procedure is to monitor the level and chemical compound of all drilled boreholes and any existing local community water wells within the wind farm catchment area in order to monitor trends in the water balance and/or water quality.

## 2. Regulations and Standards

Water quality monitoring aims to demonstrate compliance with the following specified requirements:

- **Groundwater quality**: NEMA/WRMA Standards for Sources of Domestic Water (First Schedule of Water Quality Regulations);
- **Drinking water quality:** WASREB Drinking Water Quality and Effluent Monitoring Guideline or WHO Guidelines for Drinking-Water Quality, *whichever is more stringent*; and
- **Effluent quality:** NEMA/EMCA standards for Effluent Discharge into the Environment (Third Schedule of Water Quality Regulations) or IFC General EHS Guidelines - Indicative Values for Treated Sanitary Sewage Discharges, *whichever is more stringent.*

## 3. Required equipment

The following equipment is needed for groundwater monitoring and observation:

- Standard Water Level Dipmeter - Model: TBA (ATEX or equivalent).
- Waterproof pH, EC, TDS Meter - Model: TBA.
- GPS camera - Model: TBA.
- Sampling equipment: 500 ml plastic bottles (NB: accredited laboratory to advise specification, including sterilisation and labelling requirements).

## 4. BH Water Level Measurements

Water level is measured by standard dipmeter in accordance with manufacturer's instructions and occupational health and safety risk assessment. The water level of LTWP boreholes is measured from the upper side of the steel BH cover. Measure and record the calibration check height (e.g. an elevated part of the BH structure from the surface of the ground); if the measurement does not tally with the previous reading, re-calibrate / re-measure and enter both data into the Record Sheet (TBA). Connect the rope between the installed comparison signs on both sides of the well. The line of the rope is the reference point and the BH water level is measured by the dipmeter from the rope to the water surface and the reading recorded on the Record Sheet. If there are no installed comparison signs on opposite sides of the well, the level of the opening into the well shall be used as the reference point.

## 5. Groundwater Quality Monitoring

### 5.1 Proposed Method During Construction:

Water quality monitoring is undertaken in first 10 days of each month continually during the year. Water level observation of all active boreholes is undertaken once every three months (e.g. March, June, September and December). Water level observations of all boreholes and community wells / springs within the wind farm area monthly, while water quality monitoring is undertaken on trimonthly basis. In addition,

water quality monitoring will also involve taking a sample from the access point prior to the RO treatment plant.

Photographic monitoring of any open water wells or springs is undertaken monthly and the water quality monitoring is undertaken once in every three month around the wind farm.
Water samples will be taken from all points included in the water monitoring programme annually and chemically analysed by an accredited laboratory.

### 5.2 Measuring and observation (handheld meter):

- Print sample label (chain of custody);
- Prepare and check the equipment; if necessary, clean equipment and recharge / change the battery;
- Measure off at each point and record details on the sampling form; and
- The following water indices will be checked at all Project BHs and any local community wells:
  - pH;
  - Electrical Conductivity (EC);
  - TDS;
  - Temperature; and
  - Water level.

When checking drinking water quality, note any observations regarding colour and odour.

## 6. Water Sampling (for laboratory analysis as/when required)

### 6.1 Sampling:

- Prepare / sterilise the sampling equipment and containers prior to each round of sampling;
- Print the chain of custody labels and attach;
- Check the equipment;
- Go to the designated sampling points;
- Sampling:
  - Samples are to be taken from all Project boreholes (including the relocated Sirima settlement and any other nearby community wells / springs if specified by the ATL ESHS Manager), i.e. only at the points identified in the detailed;
  - Samples are only to be taken using the sterilised containers (500ml) and not less than 1lt total is to be collected for each sampling point;
  - Fill the containers with water and close the container tightly; and
  - Write the number of the sample, sampling date, the number and the name of the sampling point on the label of each sample. Attach labels carefully.
- Clean and dispose of any wastes if the area surrounding sampling points is polluted or littered with wastes; and
- Take a photographic record if required.

### 6.2 Laboratory procedure:

Prepare the samples for laboratory analysis:

- Record sample details on the chain of custody;
- Code the name of the samples;
- ESHS team to record the list of codes matching the name of the sample batch;
- Despatch the samples and list the required analysis indices for the testing to the Laboratory;
- Progress chase if necessary;

- Review and validate the laboratory results and transpose into the Water Quality Database; and
- Raise any queried values with the ESHS Manager and/or laboratory as appropriate.

## 7. Update Water Database

- The results of the laboratory's chemical analysis and all other monitoring data will be recorded in the Water Quality Database (i.e. water levels; pH value; EC; TDS; temperature; and chemical/metallic elements as appropriate); and
- In addition a copy of chain of custody label and the result of the laboratory's analysis report will be retained in the archives.